

Inventory Reduction Strategy System (IRSS) for Material Management

By

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Dissertation submitted in partial fulfilment of
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CERTIFICATION OF APPROVAL

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A project dissertation submitted to the
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Universiti Teknologi PETRONAS
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Approved by,

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UNIVERSITI TEKNOLOGI PETRONAS
TRONOH, PERAK
MAY 2012

CERTIFICATION OF ORIGINALITY

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

HAMIDAH BINTI MOKHTAR

SID : 11933

BUSINESS INFORMATION SYSTEM

TERMINOLOGIES

Liquidity

Easily convert into cash

Inventory

Items held in stock which contain economic value. (Waters, 1992) Inventory is the largest single asset that most companies have which consumes spaces, required maintenance and sometimes becomes

Inventory Reduction

Activity to minimize the cash investment in inventory while studying the availability of inventory management as spare parts to avoid production lost.

Cost savings

Amount of money that the company could save from the result of inventory reduction strategies.

Obsolescence cost

Add to the user cost of capital, which have a negative effect on research efforts;

Turnaround

Plant maintaining project where all the production will be stops to allow the experts to inspect and repairs all the operation equipment. Therefore, it requires a lot of spares part items.

Group of SCM

One stop center for all SCM departments in PETRONAS subsidiaries.

ABSTRACT

Materials are the largest inventories in Oil and Gas industries. Keeping this type of inventory are very important to make sure the production line would not be interrupted. However, inventories are the largest single asset on the balance sheet (PROACTION CEO, 2006). The values hold by inventory basically in form of physical items causing reduction on amount of cash in hands. According to the finance theory of Time Value of Money (TVM), *a dollar that we have today worth more than a dollar in the future* (Time Value of Money). Those money which hardly liquidities cannot be spend, invest and use for any other projects. Holding these inventories is important and keeping it could cause lost, thus, the best things to do is to optimize the inventory.

Inventory reduction strategies are commonly used in Supply Chain Management department in any business. This strategies focusly to optimize the inventory of a company. From author's survey, most of companies are using System Application Programming (SAP) to manage their inventory. However, SAP Material Management (MM) modules in SAP cover the inventory management part only and it lacks at optimizing current inventories. Companies are usually used Microsoft Excel to further analyze the inventories and from the author's research and survey, there are no system proposed exists yet in Malaysia.

Thus, this report will explain on the limitation of the current tools used and description on the system proposed by the author which is Inventory Reduction Strategies System (IRSS) as a decision support system that could solve the problem arises above. The literature review in this report will focus more on the technical flow of the current tools. Methods used in this project are SDLC and a survey has been done to analyze the relevancy of the system. Last but not least, result and discussion will explain the outcome of the projects.

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ABBREVIATIONS AND NOMENCLATURES

IRSS Inventory Reduction Strategies System

SAP System Application System

SDLC System Development Life Cycle

CHAPTER 1

INTRODUCTION

1.1 Background of study

In managing the inventory, Supply Chain Management (SCM) department or inventory department of the company are the one who conducts roles to make sure the inventories optimize and available when required. As inventories are the largest single asset on the balance sheet (PROACTION CEO, 2006); therefore finance department also involve in solving the inventory issues as it relates with company's financial decision. Therefore, this report will explain the issues arises regarding inventory management and how it could affect the company's financial performance.

In Oil and Gas industries, large companies like Malaysia Liquefied Natural Gas Sdn. Bhd. (MLNG); one of PETRONAS subsidiaries usually make a huge value of transaction every day to purchase materials to make sure continuity of production. The companies realize the important of executing inventory reduction strategies to optimize inventory and increase cost savings which will be explain in the problem statement after this. Figure 1.1 shows SCM department expecting RM 36.9 million reductions in their financial performance last year and inventory section (SCM/4) is contributing the highest which is RM17.7 million. From the previous year analysis, since inventory section of SCM department responsible to monitor the overall inventories in warehouses; therefore, SCM department expects RM17.7 million cost savingsⁱ from inventory control exercises. Moreover, a bar graph beside the figure shows RM 29.1 million inventories also targeted to contribute to the inventory reduction at that point of time. Further explanation regarding inventory reduction strategies and steps involve in managing inventories had been elaborated in this literature review.

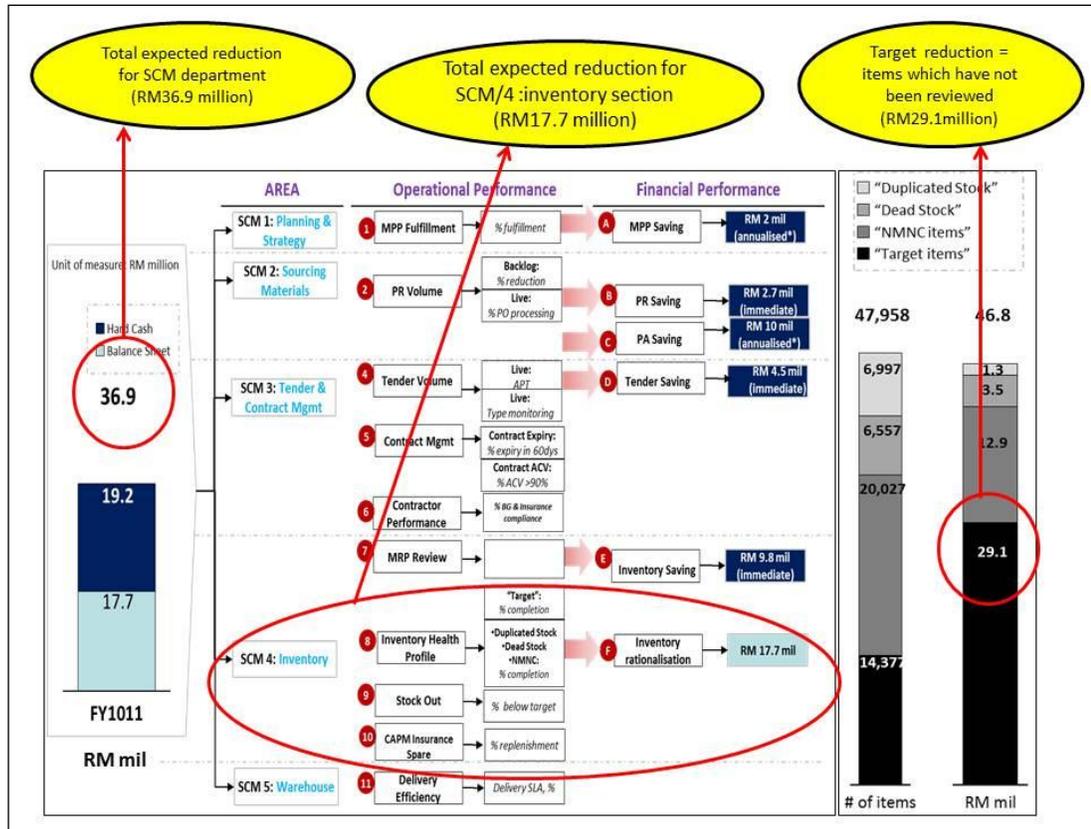


Figure 1.1 Financial Performance for Financial Year 2010/11 SCM Department of MLNG

1.2 Problem statement

There are two main problems statement leads to development of IRSS which are inventory hidden cost and limitation on the current tools.

(i) Inventory hidden cost

People always use Iceberg Theory to describe success, health, management and etc. Now, author will use the same theory to give a clear overview of the inventory management problems. Figure 1.1 illustrates the traditional inventory cost measures. Everyone knows the structure of iceberg that floats in the sea where small part of it are visible to everyone but beneath of it actually is having the largest part of the iceberg.(Rauch, 2005) The visible part of the iceberg describes how people measure the value of inventory. People always assume that the inventory value is small by looking only at the inventory prices.

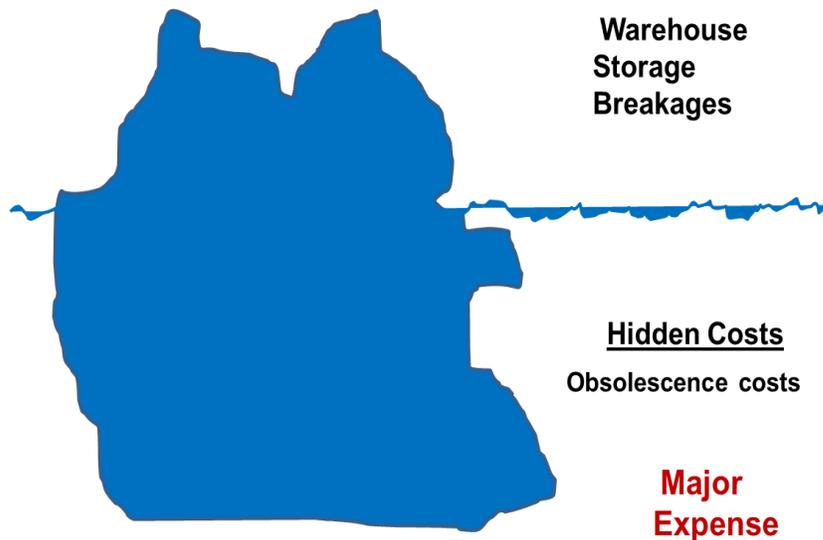


Figure 1.2(1) Author's describe inventory management problem using Iceberg's Theory

However, real inventory value shown by the bottom part of the iceberg model which represents all the hidden costs of the inventory itself. These obsolescence costⁱⁱ which cannot be seen physically and usually misjudge on the inventory's section account.

Thus, author manages to identify four hidden cost if inventories were kept in a long period of times which are:

a) Payment on taxes

Research also have been done at all manufacturing companies that inventory can account for up to 50% (or more) of the current asset of the business and all the assets can only be liquiditiesⁱⁱⁱ (converted to cash) in the next 12 months because it is tied up in inventory. (Slater, 2006) Apart from the asset are hardly turn into cash, this annual carrying cost recorded in the balance sheet as asset and based on Real Property Gains Tax also known as RPGT, any real property like fixed asset, 5% taxes will be charged on company's asset. (Real Property Gains Tax (2011), 2011) Therefore, the more inventory kept in the warehouses, the higher the annual tax that should be paid every year.

b) Maintenance cost

Inventory might be loss, damage, theft or spoilage. This is where maintenance cost comes across especially large and expensive items by carrying costs in other areas such as security, air conditioning, better control systems, recruiting policies and etc.

c) Warehouse rent expenses

MLNG Sdn Bhd has to rent supplier's warehouse last year due to limited storage spaces to keep the turnaround^{iv} materials. However, during the investigation with MLNG staffs last year, we have found large numbers of obsolete material that have not been move from the warehouses. So, extra money have outflow to pay the warehouse's rent. Thus, running inventory reduction strategies frequently will help the companies to avoid the need to move to large facilities and cutback existing facilities.

(ii) Limitation on the current tools

In dealing with the complexity and changeability in markets that organization operate, modern business organization become more and more dependent on their information system. (Welcome to the IS group, 2012) In order to avoid human errors and one of the way to increase the effectiveness and efficiency of a business proses, System Application Programming (SAP) which is an Entrepise Resource Planning (ERP) system are world-widely used to handle material management. Moreover, SAP Material Management (MM) is a module of SAP ERP that is used to handle procurement and inventory management. (Malik, 2011) However, it only covers the tracking part of the inventory in the warehouses but lacks in further analysis in using inventory reduction strategies to optimize the company's inventories holding.

Currently, MLNG is using trackers design using Microsoft Excel to analyze the inventory list generated from SAP system. This trackers cannot be categorize as an information system as it only helps in tracking which data have been reviewed and all the process details still have to go manually by the inventory staffs. The author will describe further on the current tools used with the help of some info-graphic below. In the current process, material list extracted from SAP are divided by each category involves. Each reduction strategies have its own tracker and folders containing linked files for other department involve in certain reduction strategies. For example, Figure 1.2(2) shows folder of Material Inspection Tracker which is one of inventory reduction strategy containing files that are linked to a master data file as describes below.

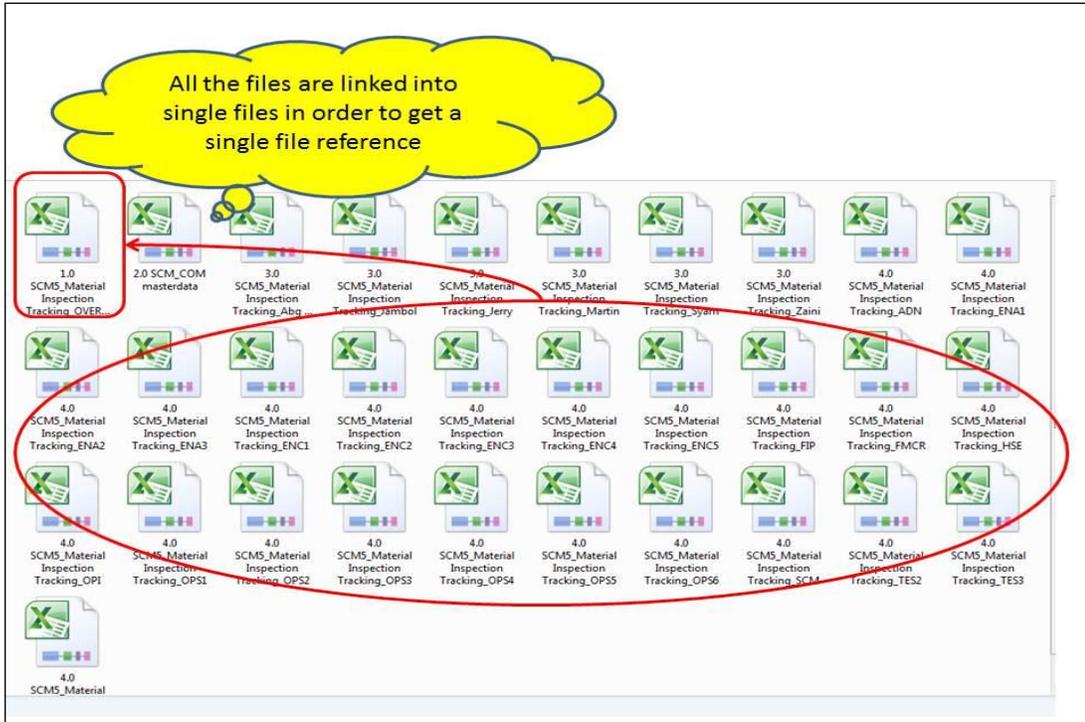


Figure 1.2(2) Linked files in Material Inspection Tracker's folder

Each of the files own by specific department who involves in the reduction strategies. . The idea is to allow many users to open files in the folders at one time and master data with linked files is to collect all the data into single files to ease the Inventory Executives from open the files repeatedly in order to get the updates from other departments. These linked files sometimes corrupted and disturbed the Inventory Executive's schedules in reporting. Figure 1.2(3) shows current file used which contain a lot of links from other files and corrupted (REF! symbols).

PETRONAS		SCM EXECUTIVE SUMMARY											
		Weekly Area Performance											
KEY RESULT AREAS	Week Ending	18/3/11	25/3/11	1/4/11	8/4/11	15/4/11	22/4/11	29/4/11	6/5/11	13/5/11	20/5/11		
	Project Week #	40	41	42	43	44	45	46	47	48	49		
KRA: Material Receiving Performance (George+Tracy)													
	Total PO Line Items Actual This Week Based on PO-	#REF!	#REF!	11									
	Total Overdue PO Line Items Delivered This Week	#REF!	338	0	#REF!								
	Total PO Line Items Early Arrival This Week	60	153	0									
	Total PO Line Items Arrival Last Week without GRN103/5N	15	6										
	Total PO Line Items Arrival This Week without GRN103/5N	6	5										
	Total PO Line Items Without GRN 103/5N	21	11										
	Total PO-GRN 103 Line Items Last week	180	115	#REF!	#REF!	#REF!	#REF!	#REF!	#REF!	#REF!	#REF!		
	Total PO-GRN 103 Line Items This Week	115	85										
	Total PO-GRN 103 Line Items To-date	235	200										
	Total Outstanding DO-GRN 103 Line Items To-date	N/A	N/A										
	Total GRN103 Target This Week	103.5	76.5										
	Total GRN 103 Actual This Week	115	85										
	% of GRN 103 Performance	111%	111%										
KRA: Material Inspection Performance (George+Zaini)													
	Total Outstanding Material for Inspection Last Week	171	4	95									
	Total Outstanding Material for Inspection This Week	4	95										
	Total Outstanding Material for Inspection: 7 days	139	73										
	Total Outstanding Material for Inspection: 7 - <30 days	17	22										
	Total Outstanding Material for Inspection >30 <60 days	0	0										
	Total GRN 104 Material Pending for Clarification Last Week	86	8	25									
	Total GRN 104 Material Pending for Clarification This Week	8	25										
	Total Material Rejected Last Week (GRN 124 - COM)	6	1	9									
	Total Material Rejected This Week (GRN 124 - COM)	1	9										
	Grand Total Material Rejected To-Date (GRN 124 - COM)	7	10										
	Total Material COM Closed This Week	0	0										
	Total Outstanding COM This Week	7	10										
	Total Material Inspection Target This Week	153.9	23.75										
	Total Material Inspection Actual This Week	167	-91	95									
	% of Material Inspection Performance	108.5%	-383.2%										
KRA: Material Issuing Performance (Ramle+ Tracy)													
	Total # Issuance Last Week	263	165	241	250								
	Total # Issuance This Week	165	241	250									
	Total # Frustrated Order Recorded at Counter This Week	3	10	2									
	Total # Frustrated Order Recorded at Counter To-Date	13	23	25									

Figure 1.2(3): Current Reporting document

Moreover, since reviewing the items are also falls under engineer’s KPI, there is always an issue when the numbers of items reviewed by the engineers are not up-to-date in Inventory Executive’s reports because of last minute changes in the documents. Lastly, an analysis report will be generated from the master data to see the performance of the inventory reduction strategy.

Another problem of the current tools is even a single item might falls under more than one category such as under ‘Non-Moving and Non-Critical (NMNC) stock’ and it is also will falls under ‘dead stock’ categories. All of the inventory reduction strategies are operated individually in different Microsoft Excel documents. Thus, as shown in Figure 1.2(4) where inventory executive have to filter it manually when it have been merge down to avoid redundancy of calculation to be included in the inventory performance report. Integrating all the strategies analysis into a single system would help to avoid

redundancy of data analysis and a report can be prompt out to see the of the overall inventory performance in the companies. Therefore, Inventory Reduction Strategy System (IRSS) for material management comes into the pictures to centralize all the strategies in an integrated system to help the Inventory Executives and managers in making decision to optimize inventories in the companies as well as increase the cost saving for the companies.

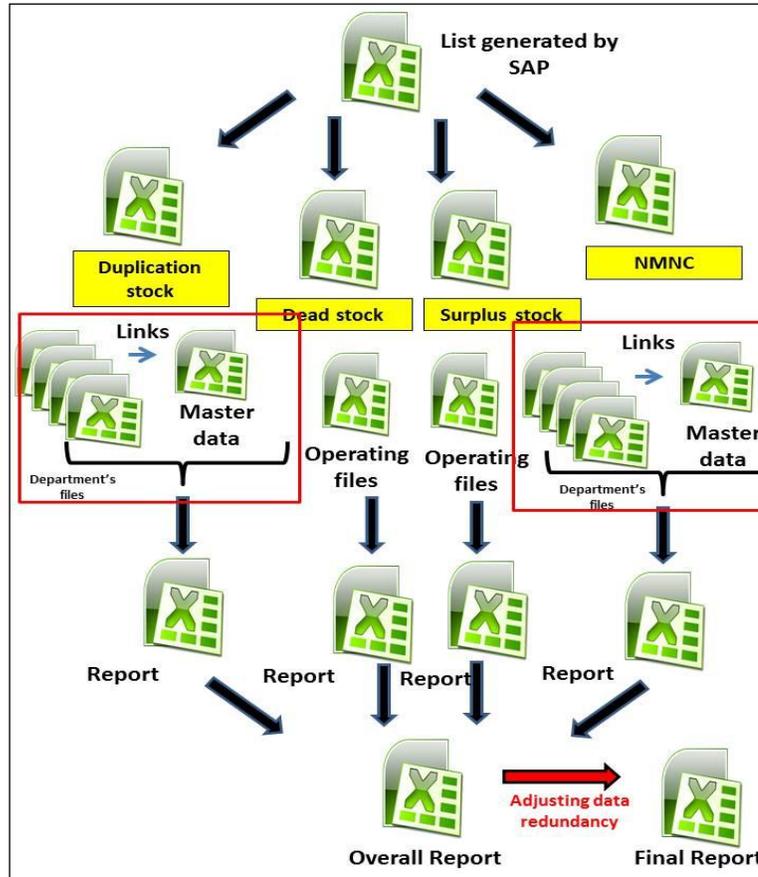


Figure 1.2(4) Excel files used in operating current inventory induction strategies

1.3 Aims and Objectives

The objectives for implementation of the Inventory Reduction Strategy System (IRSS) for Material Management are:

- a) To increase cost savings of inventory section in SCM department.
- b) To avoid report with redundancy of data (inventory reduction strategy's result) by prioritize the end-result.
- c) To provide a decision support system and clear overview (report generator) on the current Inventory Holding in order to help Inventory Executives to make decision and justify them at the board of director.
- d) To allow several parties that involves in the inventory reduction strategies (Inventory Executives, Subject Matter Expert (SME), Finance staffs and other MLNG staffs) to complete their review task online.

1.4 Scope of studies

In order to develop and complete this IRSS, several fields and items that needs to be researched and revised:

- Research on inventory management and inventory reduction strategies
- Research on the current tools use in MLNG
- Research on PETRONAS inventory reporting system
- Research on APPSERV server and PHP language

1.5 Limitation

The challenge of this project:

- Required interaction with MLNG staffs especially Inventory Executives in order to make sure the system developed tally with their requirement.
- A little bit hard to test the system with the end-user as the company are located at Bintulu, Sarawak.

1.6 Feasibility Study

In order to check on the feasibility of inventory reduction initiative chosen, below analysis objective had been underlined and the result were to be reviewed;

- Technical Analysis

In this aspect the ability of building the system is examine. In this project the main key is to check on how inventory reduction strategies could be used to support corporate sustainability.

- Economic Feasibility

This feasibility test is to examine either the system develop will bring any value to the business. Corporate sustainability is defined as an approach to meet the shareholder expectation. Conducting this project will resulting in producing a system that could meet the shareholder expectation.

- Organizational Feasibility

This test is to evaluate on the importance of the system develop and will it be used after it is develop.

CHAPTER 2

LITERATURE REVIEW

2.1 Definition of inventory

In education level, inventory management is widely perceived to be one of the most boring management topics. However, in industries, inventory is one of the most important disciplines in almost every company. Research have been done at all manufacturing companies that inventory can account for up to 50% (or more) of the current asset of the business and all the assets can only be liquidities (convert to cash) in the next 12 months because it is tied up in inventory. Unlike cash, the money tied up in inventory is not available for any other use. (Slater, 2006). These shows that the important of inventory management in business world.

By definition, inventory is a list of items held in stock (Waters, 1992) that contain economic value. (Inventory Management) The 'economic value' determine the success of the companies in handling their financial management because value of the inventory will relates to the large portion of money invested in the company. This is where the financial management concept of '*Time value of money*' is important. The theory describe that, a dollar that we have today worth more than a dollar in the future.(Time Value of Money) Therefore, high value of inventory will give a benefits depends on the purposes of the inventory which are as a spare parts for major projects, ensure manufacturing efficiencies and enable supply in a timely manner. However does the inventory left in the warehouse have the same purposes or there is a failuer in inventory team which does not really look into the usage of inventory for certain period of times. All this things are related to inventory management.

2.2 Inventory Management versus Inventory Reduction

One of the more important aspects of process control education is inventory or material management. An engineer with some experience can usually immediately say if a proposed inventory management system is workable. However, for a student or newcomer to the field, it is not obvious, and even for an experienced engineer there may be cases where experience and intuition are not sufficient. (Skogestad, 2009)

Inventory management is the activity to ensure the availability of inventory items in order to be able to service customers. Inventory management involves the coordination of purchasing, manufacturing and demand to ensure the required availability. (Slater, 2006) Primary focus of inventory management is to avoid stock out (material are not available) from happen because the impact of stock out could stop the whole production line. Therefore, any stock out triggers an action, not only to restock but also to typically overstock, in order to avoid future stock out and the negative consequences the result.

Inventory reduction is the activity to minimize the cash investment in inventory while maintaining the availability promise of inventory management. (Slater, 2006) It focuses is more on identify the opportunities to reduce cash investment by eliminating unnecessary investment in inventory with no change in inventory risk profile. For example, reviewing excess stock that can be remove from the warehouses by referring to demand and supply characteristics and also criticality of the materials. Then, the works is to reduce cash investment in the items.

Eventually, **inventory management** must lead to over investment of cash in inventory as people seek to eliminate stock our, whereas **inventory reduction** results in a minimized investment of cash while maintaining availability of the materials for projects or spare parts.

Therefore, this paper will focus on inventory reduction in order to solve the problem statement as stated above.

2.3 Inventory Reduction Strategies and current tools

Table 1.1 below shows list of indicator for inventory reduction strategies and its major impact.

NO.	Indicator	IMPACT
1.	Remove obsolete stock	<ul style="list-style-type: none"> • Scrapping stock will provide a tax benefit in most countries. • Sale of items will provide an inflow of cash (and may produce a profit!)
2.	Reduce reorder quantity	<ul style="list-style-type: none"> • Delay in spending cash retains cash in the business. • Lower reorder quantities reduce the stock held value and associated holding cost.
3.	Reduce maximum holdings	<ul style="list-style-type: none"> • Reduce stock held value and associated holding costs.
1.	Remove over stock items	<ul style="list-style-type: none"> • If removed by natural attrition, the impact is to lower the stock held value and associated holding costs. • If written off, the impact is the difference between held value and revenue if sold.
2.	Reduce quantity held	<ul style="list-style-type: none"> • In addition to the obvious reduction in inventory, the impact will be to reduce the cost of counting, maintaining, moving, storing, etc.

Table 2.3 : List of indicator for inventory reduction strategies and its impact

There are two key reasons of inventory reduction approach fails which are the focus is more open on high priced items as they are seen as providing the greatest impact and

secondly, the focus is on high turnover items as any change in this area is likely to be realized more quickly (due to high turnover). (Slater, 2006)

On the first approach, inventory teams are too focus on high priced items as they are seen as providing the greatest impact. However, they neglects total investment as it gives the total value invested (quantity x item's cost). The total value invested is much more important not how much the items cost because it represents how much cash tied up to the inventory.

Secondly, by neglecting slow move items and often results in imbalance of inventory. Famous question, how often has your business faced having plenty of inventories but none of the right items in stock? The process has to be change to aim at the cash investment rather than juts the inventory activity.

To see the overall inventory holding, managers and inventory team have to come out with the inventory reporting to view the trend of the inventory monthly or yearly basis. The system proposes will helps in generating inventory reports based on the inventory reduction strategies.

To get a clear overview, authors present the process flow of some of the inventory reduction strategies used in MLNG in Figure 2.3. However, there are a lot more inventory reduction strategies but author's only shows four of it to give a rough view of the inventory reduction strategies.

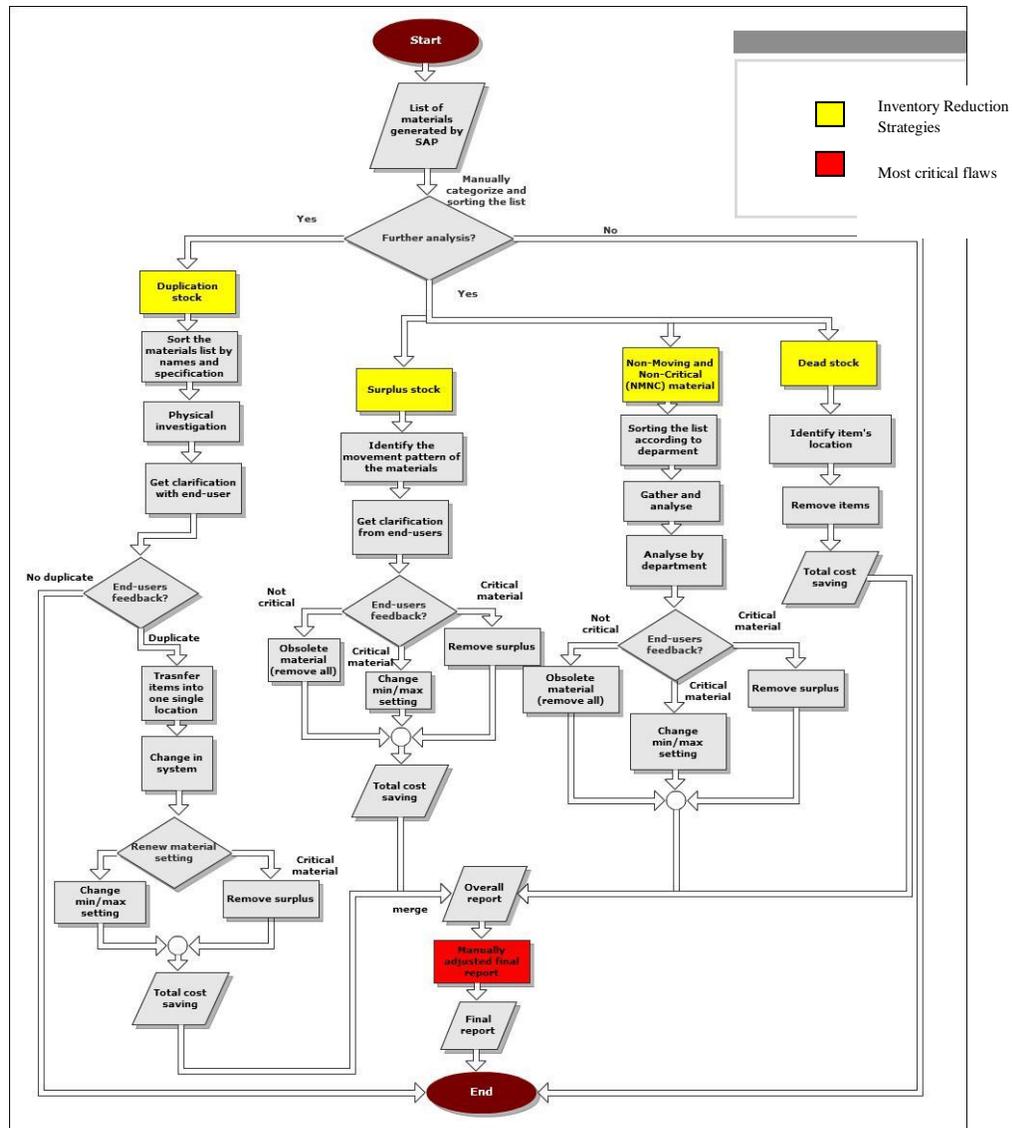


Figure 2.3 : Flow chart of current inventory reduction strategies processes

2.4 Inventory Reporting

Inventory reporting is a report that shows the current inventory holding condition of the company. For example, large companies like PETRONAS state certain aims for its subsidiaries to provide in their inventory reporting such as:

- Support key decision making towards running PTERONAS as high-performing business. (GSCM, 2009)

- b) Monitor and gain through understanding of the Plant’s performance, identify performance gaps and improvement opportunities, and track effectiveness of corrective actions. (GSCM, 2009)
- c) Achieve standardized KPI reports and reporting structure that allow for cross-OPU performance comparison. (GSCM, 2009)
- d) Ensure consistent understanding in terms of the definition and calculation of the KPI’s, to ensure reporting consistency for Groupwide Assessment and Performance Benchmarking (GSCM, 2009)
- e) Allow for faster access to information and reduce manual effort to support fast and effective reporting process. (GSCM, 2009)

Flow of inventory reporting

Figure 2.4(1) below shows how SCM department undergoes its inventory reporting process starting from within the SCM department itself with updates from IWP(Inventory, Warehouse and Purchasing) section’s scorecard until presentation to Group of SCM^v.

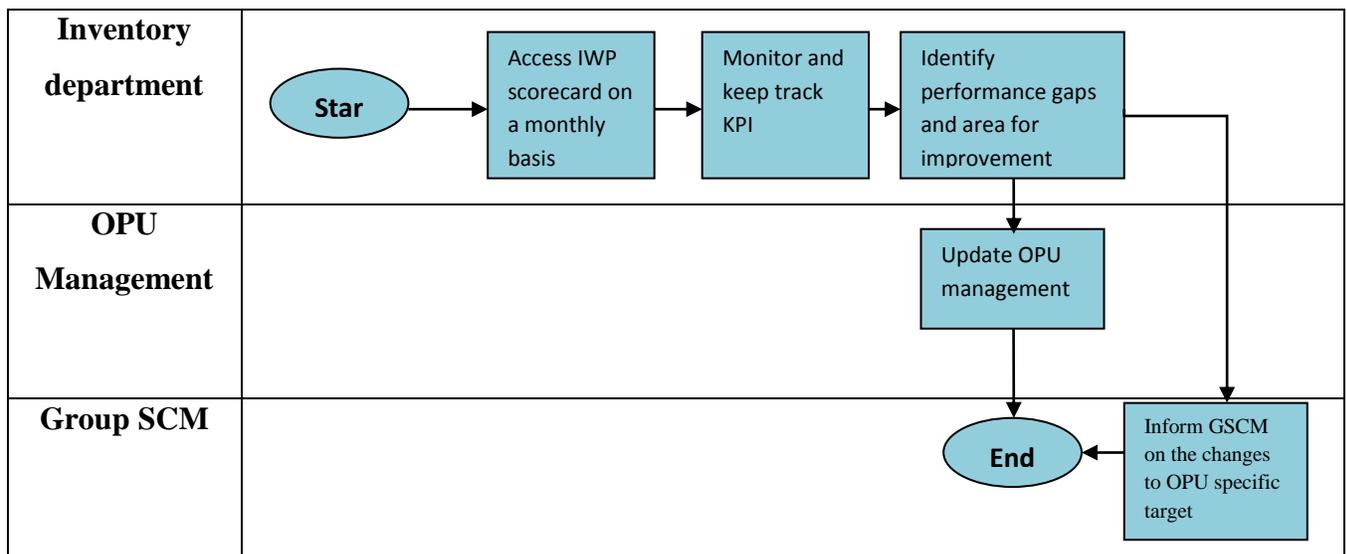


Figure 2.4(1) : Flow of Inventory Reporting

Table 2.4 shows indicator that PETRONAS state to see the overview of their inventory holdings.

NO.	INDICATOR	PURPOSE	REMARKS
1.	Inventory Holding	To report the total inventory value and line items	Inventory holding will decrease with <ul style="list-style-type: none"> f) Rate of issuance > Rate of replenishment g) Adjusting the stock replenishment and re-ordering level to reflect actual usage h) Reduction of excess stock and disposal of non-moving items.
2.	Inventory optimization	To indicate proper utilization of funds on inventory	Calculate Current Plant Replacement Value (CPRV) to insure value of the plant.
3.	Non-moving stock	To measure value and volume of non-moving stocks for spares and consumable categorized by criticality level	Impact of high non-moving stocks : <ul style="list-style-type: none"> i) High invested capital tied-up j) Poor space utilization and necessary preservation effort k) High inventory turnover

4.	Fast- Moving stock	To measure value and volume of Fast Moving Stock for spare and consumbales	
5.	Slow- Moving stock	To measure value and volume of Slow Moving Stock for spare and consumbales	Required MRP parameter setting and procurement strategy review
6.	Surplus stock	To determine number of surplus stocks in order to minimize surplus stock.	Surplus = Excess stock + Obsolete stock

Table 2.4 : Indicator of PETRONAS Inventory Report

Therefore, Inventory Reduction Strategies System (IRSS) for Material Management will provide an inventory report by referring to the goals and indicator by the PETRONAS too.

Lastly, Figure 2.4(2) shows current file used which contain a lot of links from other files and corrupted (REF! symbols).

PETRONAS		SCM EXECUTIVE SUMMARY												
		Weekly Area Performance												
KEY RESULT AREAS		Week Ending	18/3/11	25/3/11	1/4/11	8/4/11	15/4/11	22/4/11	29/4/11	6/5/11	13/5/11	20/5/11		
		Project Week #	40	41	42	43	44	45	46	47	48	49		
KRA: Material Receiving Performance (George+Tracy)														
OVERALL MATERIAL RECEIVING	Total PO Line Items Actual This Week (Based on PO)	#REF!	#REF!		11									
	Total Overdue PO Line Items Delivered This Week	#REF!			338	0	#REF!							
	Total PO Line Items Early Arrival This Week		60	153	0									
	Total PO Line Items Arrival Last Week without GRN103/5N		15	6										
	Total PO Line Items Arrival This Week without GRN103/5N		6	5										
	Total PO Line Items Without GRN 103/5N		21	11										
	Total PO -GRN 103 Line Item Last week		180	115	#REF!	#REF!	#REF!	#REF!	#REF!	#REF!	#REF!	#REF!	#REF!	#REF!
	Total PO -GRN 103 Line Items This Week		115	85										
	Total PO -GRN 103 Line Items To-date		235	200										
	Total Outstanding DO-GRN 103 Line Items To-date		181	181										
	Total GRN103 Target This Week		103.5	76.5										
	Total GRN 103 Actual This Week		115	85										
% of GRN 103 Performance		115%	111%											
KRA: Material Inspection Performance (George+Zaini)														
OVERALL MATERIAL INSPECTION	Total Outstanding Material for Inspection Last Week		171	4	95									
	Total Outstanding Material for Inspection This Week		4	95										
	Total Outstanding Material for Inspection: 7 days		139	73										
	Total Outstanding Material for Inspection: 7 - <30 days		77	22										
	Total Outstanding Material for Inspection >30 <60 days		0	0										
	Total GRN 104 Material Pending for Clarification Last Week		66	8	25									
	Total GRN 104 Material Pending for Clarification This Week		0	25										
	Total Material Rejected Last Week (GRN 124 - COM)		4	1	3									
	Total Material Rejected This Week (GRN 124 - COM)		1	3										
	Grand Total Material Rejected To-Date (GRN 124 - COM)		7	10										
	Total Material COM Closed This Week		0	0										
	Total Outstanding COM This Week		7	10										
Total Material Inspection Target This Week		153.9	23.75											
Total Material Inspection Actual This Week		167	-91	95										
% of Material Inspection Performance		108.5%	-383.2%											
KRA: Material Issuing Performance (Bamle+ Tracy)														
OVERALL MATERIAL ISSUING	Total # Issuance Last Week		263	165	247	250								
	Total # Issuance This Week		165	247	250									
	Total # Frustrated Order Recorded at Counter This Week		3	10	2									
	Total # Frustrated Order Recorded at Counter To-Date		13	23	25									

Figure 2.4(2) : Current Reporting document

2.5 Current tools

PETRONAS		SCM 5 Warehouse												
		Material Pending Inspection Tracking												
Monday, 04 July, 2011														
Daily Material Inspection Update														
Overall		6.85	Days	Note: GRN 103 - GRN 105										
#COMs				No. of Outstanding Material				Without GRN 103						
LAST WEEK		THIS WEEK	COM 104	COM 124	LAST WEEK		THIS WEEK	<7 days	<30 days	<60 days	>60 days	LAST WEEK		THIS WEEK
Abang Maulan	0	3	3	0	8.23	16.42	49	288	166	52	67	4	0	0
Jambol	1	2	2	0	4.77	4.28	11	143	128	24	1	0	1	0

Figure 2.4(3): Tracker for Material Pending Inspection

Material Inspection is also one of inventory reduction strategies and Figure 2.4(3) shows a tracker develop by Microsoft Excel where each cells contain formula. Thus, large

amount of formulas and link inside a single Microsoft Excel document have cause slow loading for the document and file corrupted. Figure 2.4(4) belows shows large volume of data and analysis in a sheet of Microsoft Excel documents.

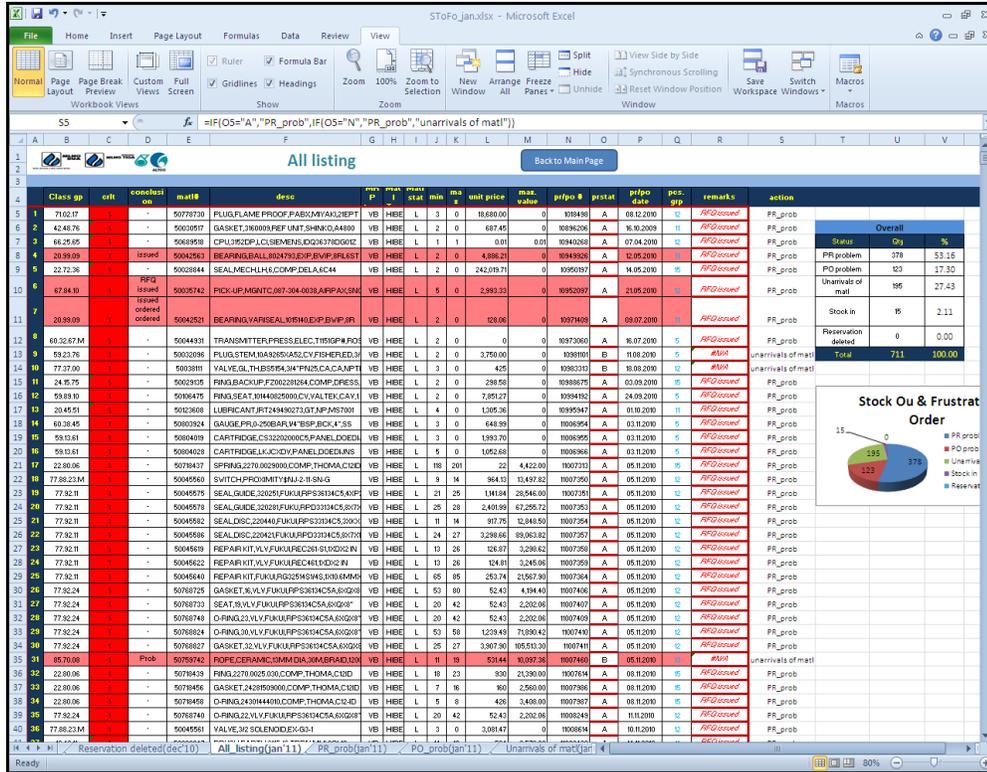


Figure 2.4(4): Material Listing in Microsoft excel

CHAPTER 3

RESEARCH METHODOLOGY

3.1 System Development Life Cycle

In order to complete the project, the details of methodology will be explained further in this chapter. The methodology of the project is established on four major steps using System development Life Cycle which are planning, analysis, design and implementation. Figure 1.1 below shows the flow of the system development.

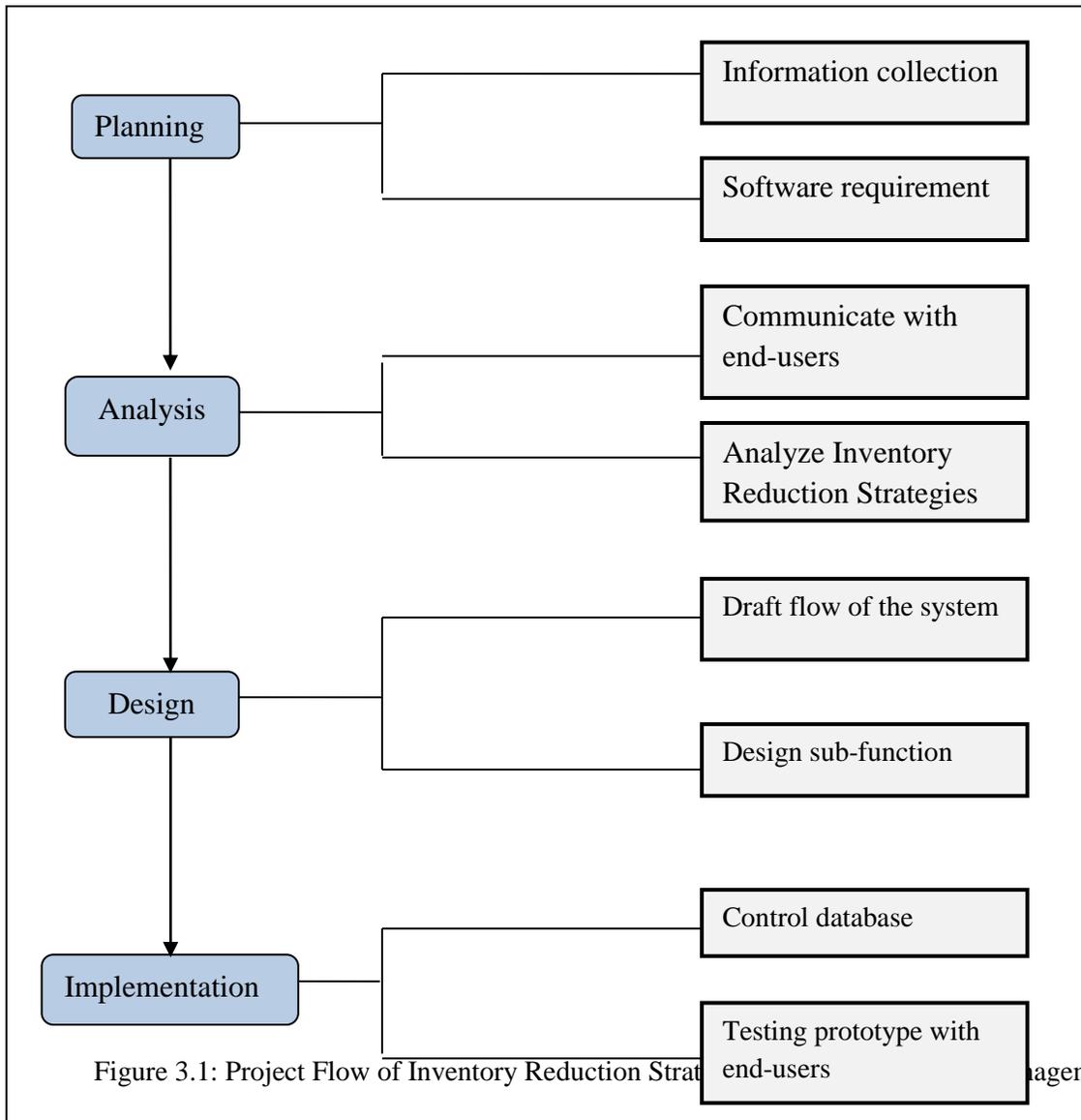


Figure 3.1: Project Flow of Inventory Reduction Strategies Management

Planning must be done in the proper manner to identify all the information and requirement such as software specifications. The planning phase has two main elements which are information collection and the requirements of software. Information is obtained from journal, text book and research paper. The information collected is then analyzed into credible, reliable and useful aid in implementation steps.

Further analysis with end-users and look into the most important inventory reduction strategies required and studied how the strategies determine. After that, draft of system sub-function will be design based on the inventory reduction strategies. At the last part of the design, a summary of all report generated from the system to show the condition of current inventory holding.

Testing part will be conducted with end-users using the latest inventory database of the company.

3.2 Project activities

Author has done some survey to 30 students in UTP which have experienced working at oil and gas business during internship. The main objective of the survey is to identify oil and gas companies that have used any software to optimize their inventory (based on internship experience). Next, feedback from the survey is positive as describe below.

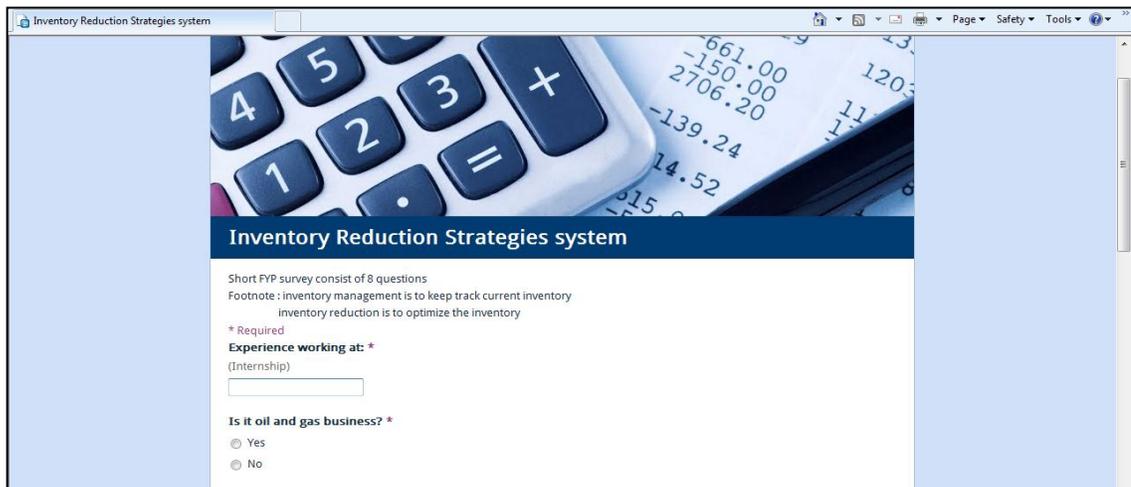
3.2.1 Survey Question and results

The survey questionnaire has been created by the author to trigger the knowledge on inventories department of the companies on the participants and at the same time get to know any tools has been used by other companies to optimize company's inventories.

List of survey questions as follow:

1. Experience working at:
2. Is it oil and gas business?

3. Did the company that you have/are working at have a department that manage company's inventory?
4. Do you know a little bit about the department's (in question 3) works?
5. Do you agree that optimizing inventory is important for a company?
6. How do the company (stated in question1) optimize their inventories?
7. Do the company have a system to analyse the current inventory? What type of system do they use?
8. Lastly, explain about the company's strategies on how they optimize their inventory.
9. Any explanation on the company's strategies on how to optimize their inventory?



The image shows a screenshot of a Google Form titled "Inventory Reduction Strategies system". The form is displayed in a browser window with a blue header. The background of the form features a calculator and a document with numbers. The form content includes:

- Short FYP survey consist of 8 questions
- Footnote : inventory management is to keep track current inventory
inventory reduction is to optimize the inventory
- * Required
- Experience working at: ***
(Internship)
- Is it oil and gas business? ***
 - Yes
 - No

Figure 3.2: Survey Question using Google form

Timestamp	Experience working at:	Is it oil and gas business?	Did the company that you have/are working at have a department that manage company's inventory?	Do you know a little bit about the department's (in question 3) works?	Do you agree that optimizing inventory is important for a company?	How do the company (stated in question1) optimize their inventories?	Do the company have a system to analyse the current inventory? What type of system do they use?	Lastly, explain about the company's strategies on how they optimize their inventory.	Any explanation on the company's strategies on how to optimize their inventory?
6/2/2012 10:28:26	General Electric	Yes	Yes	Yes	Yes	Run projects, Check at warehouse	System Application Programming (SAP)		
6/2/2012 10:28:56	Group Technical Solution	Yes	Yes	Yes	Yes	Run projects, Check at warehouse	System Application Programming (SAP), Microsoft, Excel/Access		
6/2/2012 10:32:05	PGB kerteh	Yes	Yes	Yes	Yes	Check at warehouse	System Application Programming (SAP)		
6/2/2012 10:38:13	8 months	Yes	Yes	Yes	Yes	Run projects, Check at warehouse	System Application Programming (SAP), Microsoft, Excel/Access	Basically the will use SAP a lot to communicate with each other. As for my department, SAP were utilize to send work order, purchase order, update work status etc.	
6/2/2012 10:42:59	company	No	Yes	Yes	Yes	Run projects	Their own system Microsoft, Excel/Access		
6/2/2012 11:13:30	8months	Yes	Yes	Yes	Yes	Check at warehouse	Excel/Access		
6/2/2012 11:22:48	kloc	Yes	No	Yes	Yes	Run projects	System Application Programming (SAP)		

Figure 3.3: Survey feedback's tables from Google spreadsheet



Figure 3.4: Portion of automatic survey's summary from Google spreadsheet

3.2.1 Others

Apart from that, flow of all other activities did during the projects development have been described in the Gantt chart.

3.3 Key milestone

Basically for this project, author has been advice by her supervisor to focus only at 70% of the system. This is because inventory reduction strategies propose by the author is a

lot and it is complicated. Therefore, supervisor would like the end users to see the logic of the system before continue developing the complete system.

3.3 Gantt Chart

Gantt Chart (FYP1)																	
Month	January				February				March				April				May
Week		W1	W2	W3	W4	W5	W6	W7	W8	W9	W10	W11	W12	W13	W14	W15	W16
Planning																	
Finding the topic																	
Research																	
Preparing proposal																	
Preparing Gaant Chart																	
Analysis																	
Communicate with MLNG staff and consult lecturer																	
Preparing Extended Proposal																	
Survey																	
Design																	
Getting the software needed																	
GUI design																	
Physical basic design																	Exam week

Gantt Chart (FYP2)																		
Month	May				Jun				July				August				September	
Week		W1	W2	W3	W4	W5	W6	W7	W8	W9	W10	W11	W12	W13	W14	W15	W16	W17
Design																		
Physical basic design																		
Implementation																		
1st Prototype																		
Getting feedback from the expert																		
Ongoing prototype																		
Final Testing																		
Implementation																		
Presentation																		
Documentation																		

3.4 Tools Required

3.2.1 Software

Operating System	Window 7 Home Premium
Processor	Intel (R) Core (TM) 2 Duo CPU P8700 @2.35GHz
Memory	4.00 GB
Disk Space	300 GB

Table 3.2 Personal Computer Specifications

3.2.2 Software

- APPSERV
- Dreamweaver

CHAPTER 4

RESULT & DISCUSSION

In this chapter, author will discuss on some results and discussion on the progress of the system proposed. In describing the technical part of IRSS, author has used some infographic such as system flowchart, use-case diagram, entity-relationship diagram, UML class diagram and GUI design to ease the reader.

4.1 System Flowchart

To illustrate the system flow, author have design two flowcharts as shown below. Flowchart in figure 4.1 describes flow of system during login time. The main part in this flowchart is choosing type of user login because it will determine the user access level to the system.

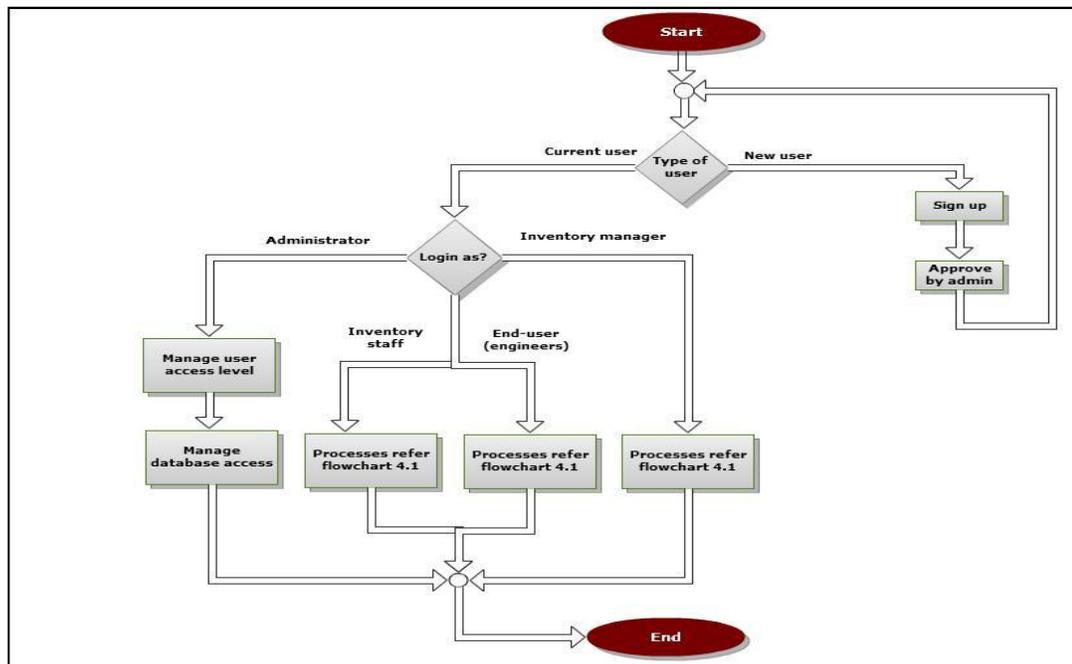


Figure 4.1 Login Flowchart

To describe type of users and access level of it in the system, refer table 4.1 below.

No.	User	Inventory Reduction Strategy						Summary	Report
		Manage user	Manage database access	NMNC	Duplication stock	Surplus stock	Dead stock		
1	Admin	X	X	-	-	-	-	-	-
2	Inventory staff	-	-	X	X	X	X	X	-
3	Inventory manager	-	-	X	X	X	X	X	X
4	Engineering staff (end-user)	-	-	X	X	-	-	-	-

Table 4.1 Type of user and access level

One of the main problem of the previous system is it have large numbers data duplicates with each other and have to split it manually. Venn diagram in figure 4.2 illustrates the duplication of the data.

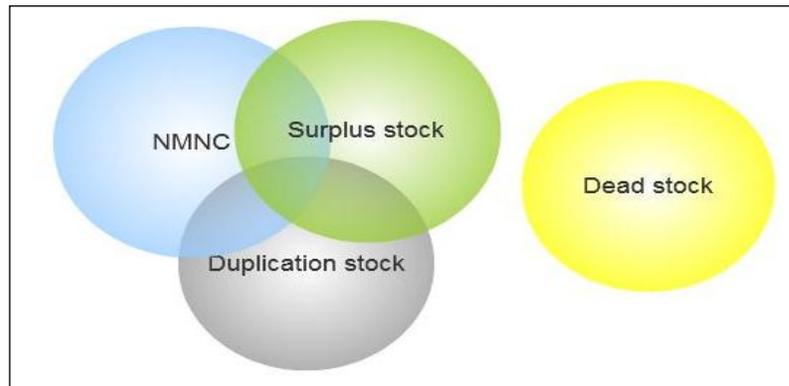
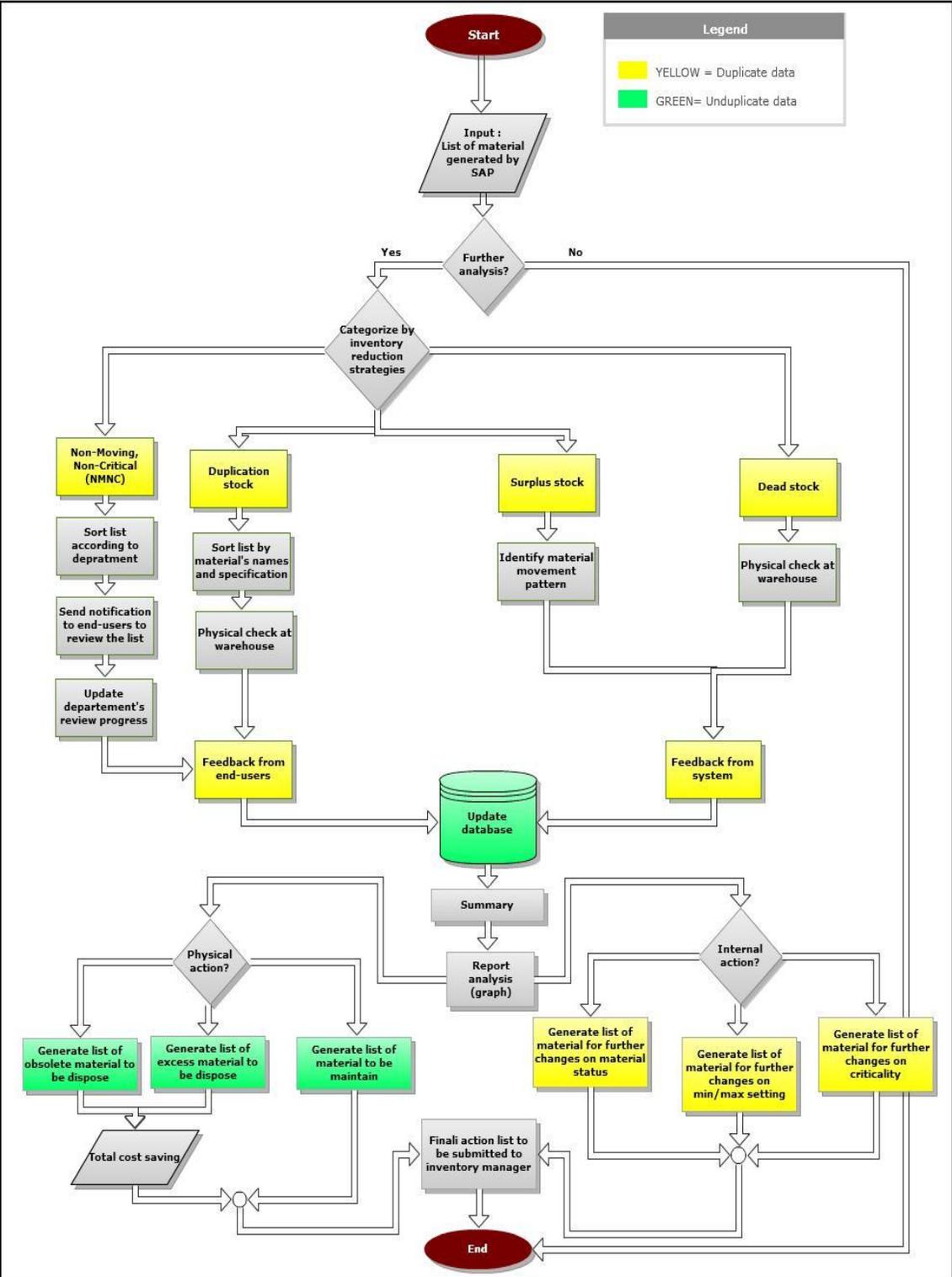


Figure 4.2 Venn diagram for redundancy of data in IRSS

Therefore, IRSS come into the picture to solve the problem by merging all the data at the end of the reduction strategies and update the result into a single database based on priority of the process. To understand further on the flow of the process, refer flowchart in figure 4.4. After the database update summary and report will be automatically generated by the system based on inventory manager requirement to be presented to Board of Director for approval.



4.3 Process flowchart

4.2 Use-case diagram

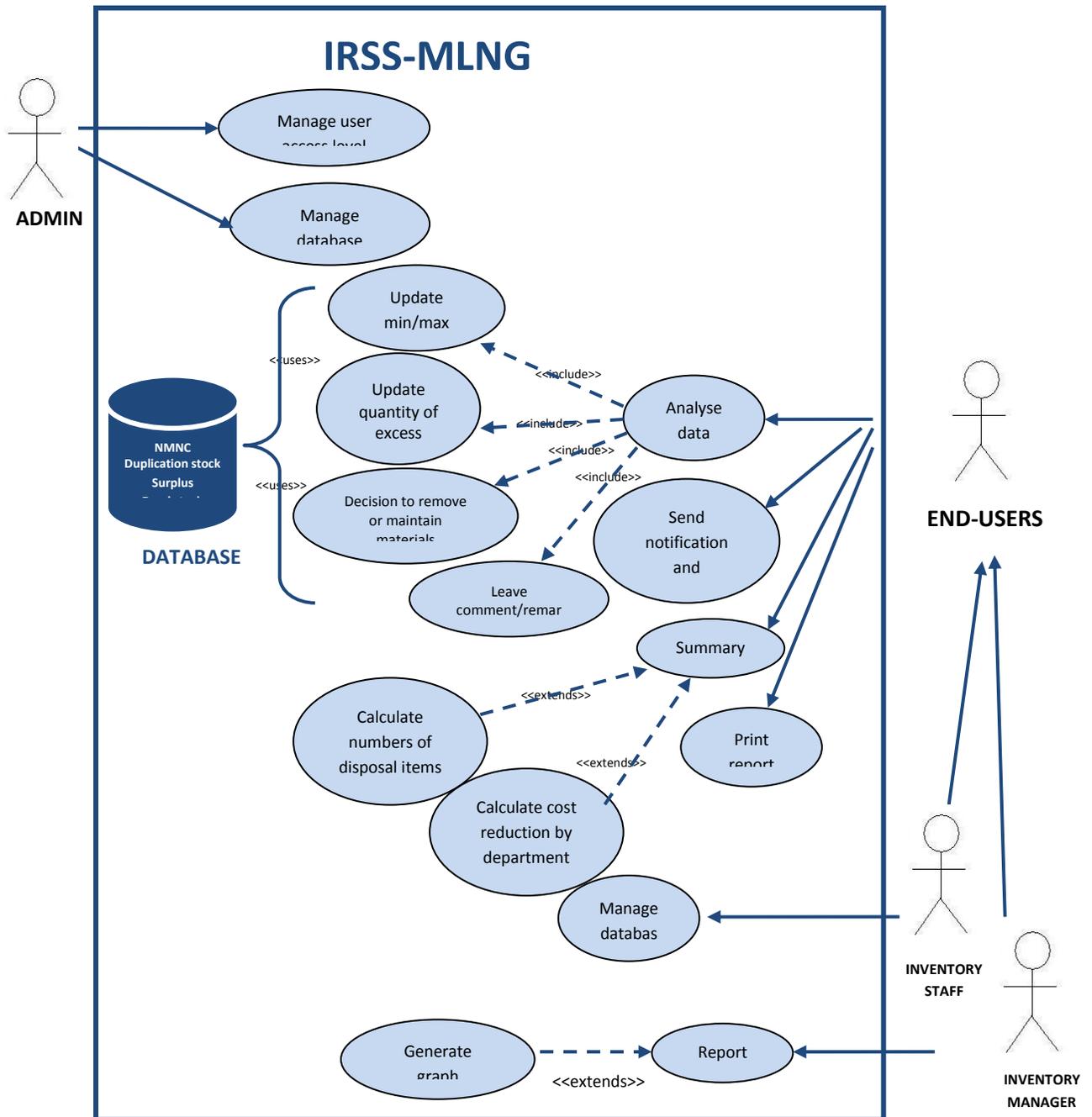


Figure 4.4 Use Case Diagram of IRSS

Author has use UML Use Case diagram to portray the different types of users of a system and the various ways that they interact with the system. Refer figure 4.4 above for more details.

4.3 Entity Relationship Diagram (ERD)

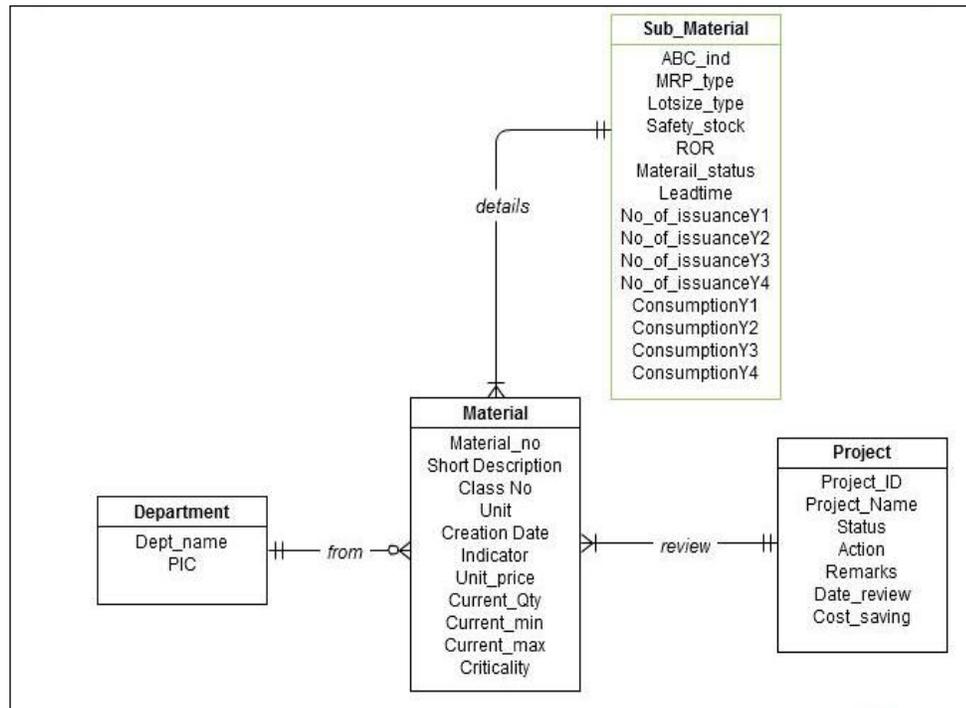


Figure 4.5 ER Diagram for database in IRSS

Entity relationship diagram (ERD) as shown above is one of the methods to describe the connection between variables in the database.

4.4 UML Class Diagram

UML class diagram in figure 4.6 below shows functions used at the back of the system. Currently, author is developing all the functions of the systems. All the function shown here are the basic functions in the system. Along the development phase, author will add on some more function that she thinks relevant for the system in the future.

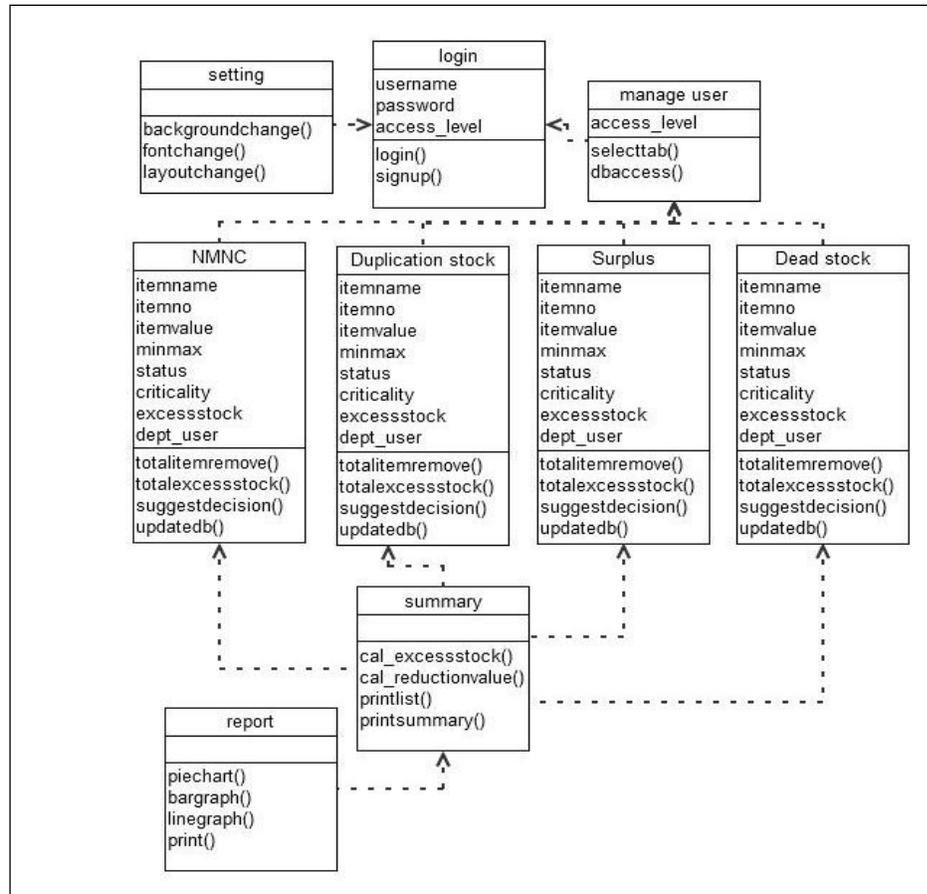


Figure 4.6 UML Class Diagram of IRSS

4.5 Draft Graphical User Interface (GUI) Design

Graphical user interface or well known as GUI design for IRSS will be shown according to the user access level.

4.5.1 System Login

Figure 4.7 shows GUI design for MLNG IRSS system login. This system will be design to have a four access levels which are administrator, inventory staff, engineering staff and manager in order to manage the accessibility of the database. All of the user's function will be describe in the next section. Apart from that, each system user will be provided with username and password to access the system.

MLNG_IRSS

[Sign up](#) [Help](#)

User: admin [v]
Username:
Password:
1 Log in

Sign Up

First Name:
Last Name:
Email Address:
Staff ID:
2 Sign up

1 User will choose their access level and log in
2 Insert data required to sign up and waiting approval from admin to get username

Figure 4.7 System Login

4.1.2 Admin Access Level

Admin also known as administrator for this website is the secretary of the Supply Chain Management (SCM) Department. Refer Figure 4.8 Admin will have 4 basic tabs which required in order to manage the website which are :

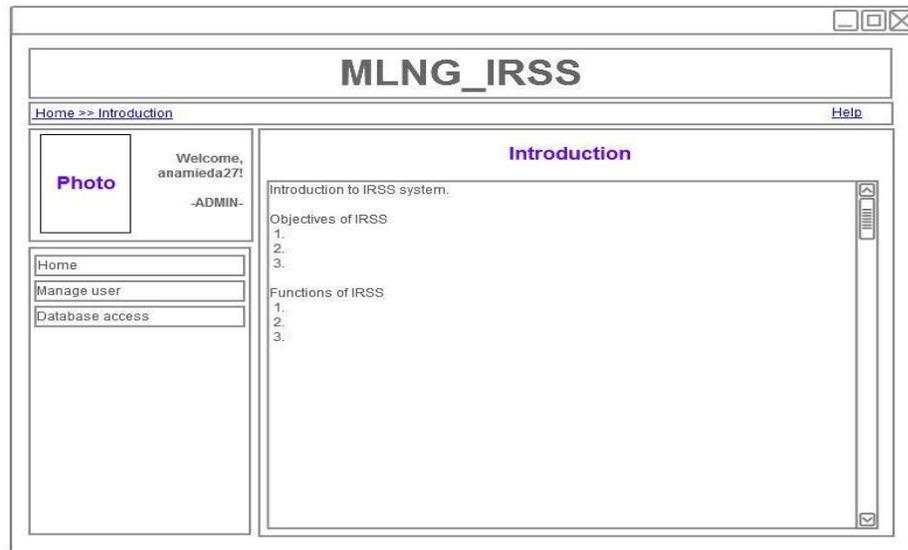


Figure 4.8 Administrator's function

- (a) **Home** : Home will describe briefly task for admin and general information regarding MLNG-IRSS.
- (b) **Manage user** : Admin will manage user to get type of access level.
- (c) **Database** : This tab will provides a system setting to allow certain user request on the database.

4.5.3 Inventory Staff Access Level

Inventory Staff refers to any staff in inventory which will help manager to complete the technical part of the data and brainstorm way forward in progress job. Refer Figure 4.9 to see how inventory staff access the system.

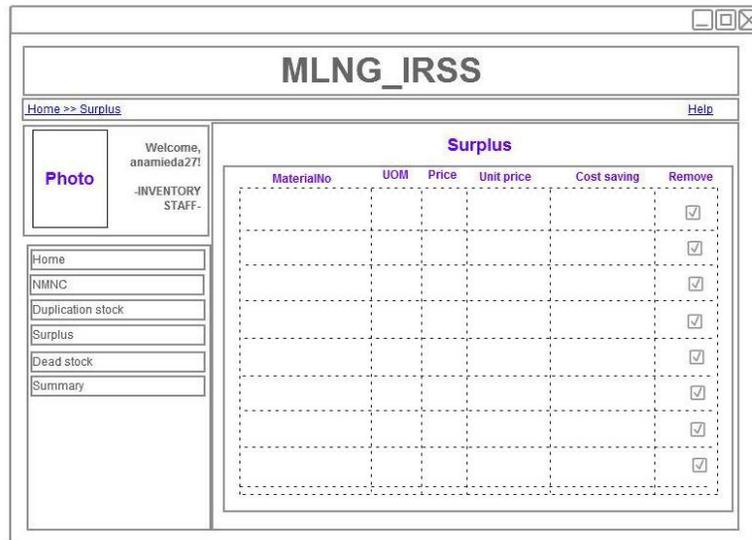


Figure 4.9 Inventory Staff's access level

There are 3 main tabs available for inventory staff which are :

- (a) **Home** : Provide general information on the system.
- (b) **Inventory Reduction Strategies (NMNC, Duplication stock, Surplus and Dead Stock)** : Allow user to access the database for each strategies and comment on the necessary field. Refer Figure 4.10 below to get a clear overview.

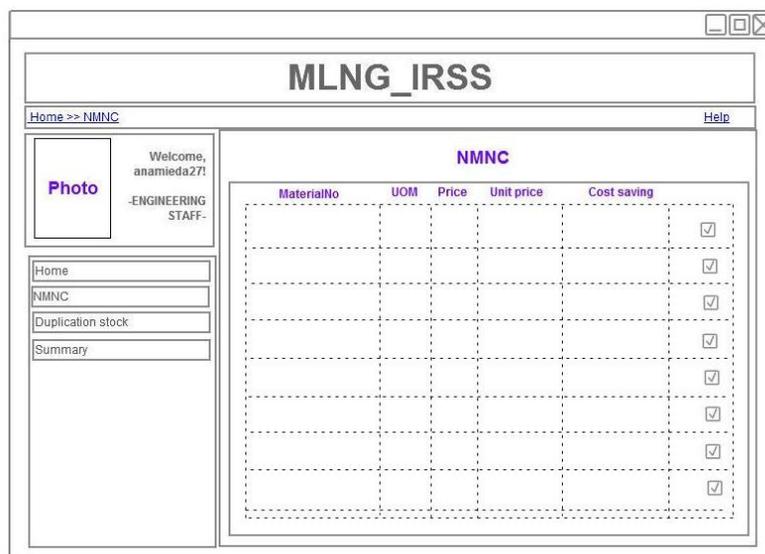


Figure 4.10 Inventory Reduction Strategies's tab

(c) **Summary** : Provides summary of data edited or available.

4.5.4 Manager Access Level

Figure 4.11 shows manger's access level, the different between manager and inventory staff is only at analysis part. Manager's will required further analysis to ease them in presenting the result to the Board of Director on the decision making made by the department.

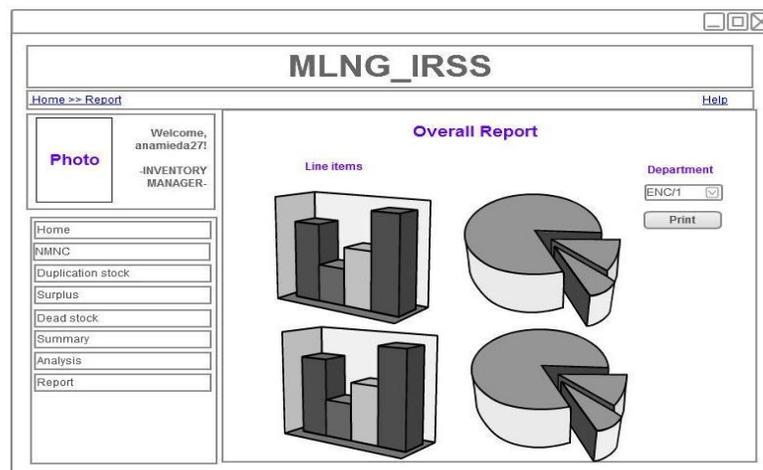


Figure 4.11 Manager access level

4.6 Real Interface Design

As the author have describe thoroughly in the GUI design above, therefore, author will only shows a few examples of interface of the system proposed as it is almost the same as the GUI that have been designed previously.

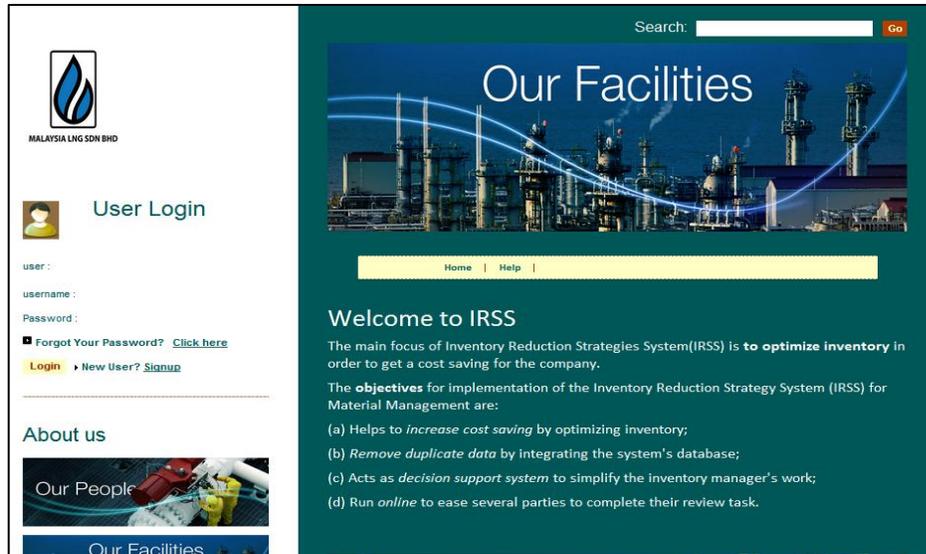


Figure 4.12 Home page

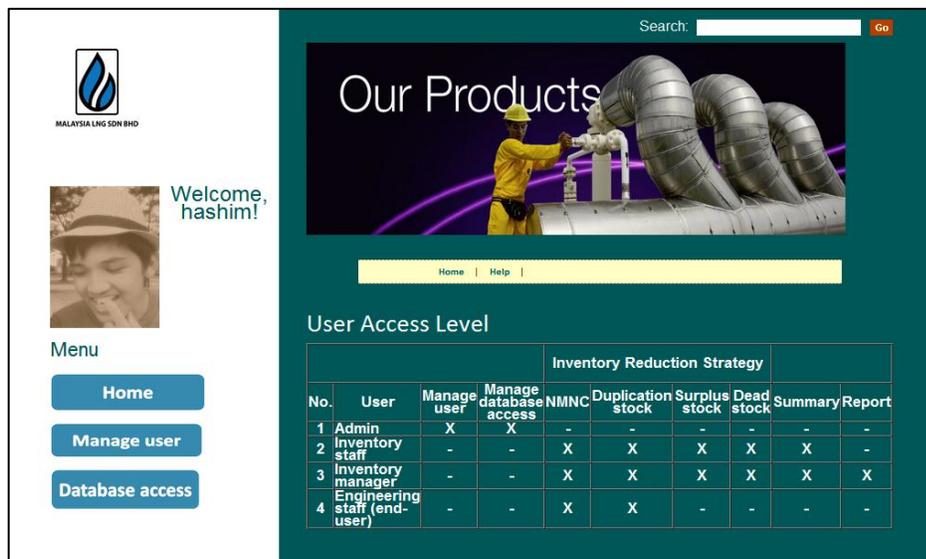


Figure 4.13 Admin page

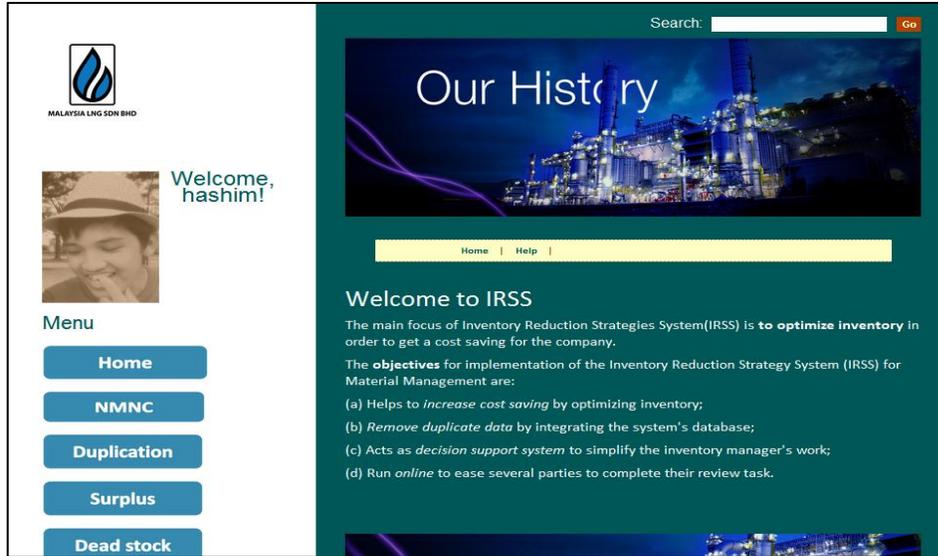


Figure 4.14 Inventory staff page

CHAPTER 5

CONCLUSION & RECOMMENDATIONS

5.1 Conclusion

As a conclusion, author has explained in details on the system proposed in previous chapters. The main aim of the project is to come out with an integrated system that merges all the inventory reduction strategies into a single system to get a more concrete summary of the inventory holding. Apart from that, Inventory Reduction Strategy System (IRSS) will provide a decision support to ease and simplify works of inventory managers from the entire technical task previously. The project will be carried out based on methodology suggested, starting with planning phase which consists of collecting information and identifying software compatibility with the inventory strategy suggested. The project will be tested phase by phase to avoid any syntax and other. It is hoped that the system developed would be beneficial to the company specifically in Oil and Gas Industries (one of the largest industries contribute for the country's financial) in managing their inventory more efficient and increase profits share for the beneficial of the citizens.

5.2 Recommendation

There are some recommendations suggested from the author which are;

- Get the certificate of approval from the MLNG/company

This is advise by the author's supervisor previously as the approval would motivate the developer to finish the end product as the product will confirm be used by the company. Apart from that, it will give the authority to the author to communicate with other inventory department in other PETRONAS's subsidiaries.

- Conduct survey directly on inventory department in any oil and gas industries;

The current survey was conducted to the ex-trainee of oil and gas companies which not all of them have experience working as inventory staff. Therefore, author suggests conducting survey directly to the inventory department in the company. Certificate of approval as describe above will help the author to complete the survey.

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APPENDICES



Inventory Reduction Strategies system

Short FYP survey consist of 8 questions
Footnote : inventory management is to keep track current inventory
inventory reduction is to optimize the inventory

*** Required**

Experience working at: *
(Internship)

Is it oil and gas business? *

Yes
 No

Did the company that you have/are working at have a department that manage company's inventory? *
(Supply Chaint/Inventory/SMSO/Mateial dept)

Yes
 No

Do you know a little bit about the department's (in question 3) works? *

Yes
 No

Do you agree that optimizing inventory is important for a company? *
benefit : avoid lost and save money

Yes
 No

How do the company (stated in question1) optimize their inventories? *

Run projects
 Check at warehouse
 Not sure

Do the company have a system to analyse the current inventory? What type of system do they use? *

System Aplication Programming (SAP)
 Microsoft Excel/Access
 Their own system
 No system
 Not sure

Lastly, explain about the company's strategies on how they optimize their inventory.
if you have experineced working with inventory department

Inventory Reduction Strategy System (IRSS) for Material Management

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Abstract— Materials are the largest inventories in Oil and Gas industries. Keeping this type of inventory are very important to make sure the production line would not be interrupted. However, inventories are the largest single asset on the balance sheet (PROACTION CEO, 2006). The values hold by inventory basically in form of physical items causing reduction on amount of cash in hands. According to the finance theory of Time Value of Money (TVM), a dollar that we have today worth more than a dollar in the future (Time Value of Money). Those money which hardly liquidities cannot be spend, invest and use for any other projects. Holding these inventories is important and keeping it could cause lost, thus, the best things to do is to optimize the inventory.

Inventory reduction strategies are commonly used in Supply Chain Management department in any business. This strategies focusly to optimize the inventory of a company. From author's survey, most of companies are using System Application Programming (SAP) to manage their inventory. However, SAP Material Management (MM) modules in SAP cover the inventory management part only and it lacks at optimizing current inventories. Companies are usually used Microsoft Excel to further analyze the inventories and from the author's research and survey, there are no system proposed exists yet in Malaysia.

Thus, this report will explain on the limitation of the current tools used and description on the system proposed by the author which is Inventory Reduction Strategies System (IRSS) as a decision support system that could solve the problem

arises above. The literature review in this report will focus more on the technical flow of the current tools. Methods used in this project are SDLC and a survey has been done to analyze the relevancy of the system. Last but not least, result and discussion will explain the outcome of the projects.

Keywords: Inventory Management; Inventory Reduction, IRSS.

I. INTRODUCTION

In managing the inventory, Supply Chain Management (SCM) department or inventory department of the company are the one who conducts roles to make sure the inventories optimize and available when required. As inventories are the largest single asset on the balance sheet (PROACTION CEO, 2006); therefore finance department also involve in solving the inventory issues as it relates with company's financial decision. Therefore, this report will explain the issues arises regarding inventory management and how it could affect the company's financial performance.

In Oil and Gas industries, large companies like Malaysia Liquefied Natural Gas Sdn. Bhd. (MLNG); one of PETRONAS subsidiaries usually make a huge value of transaction every day to purchase materials to make sure continuity of production. The companies realize the important of executing inventory reduction strategies to optimize inventory and increase cost savings which will be explain in the problem statement after this. SCM department expecting RM 36.9 million

reductions in their financial performance last year and inventory section (SCM/4) is contributing the highest which is RM17.7 million. From the previous year analysis, since inventory section of SCM department responsible to monitor the overall inventories in warehouses; therefore, SCM department expects RM17.7 million cost savings from inventory control exercises. Moreover, a bar graph beside the figure shows RM 29.1 million inventories also targeted to contribute to the inventory reduction at that point of time. Further explanation regarding inventory reduction strategies and steps involve in managing inventories had been elaborated in this literature review.

II. LITERATURE REVIEW

A. Definition of inventory

In education level, inventory management is widely perceived to be one of the most boring management topics. However, in industries, inventory is one of the most important disciplines in almost every company. Research have been done at all manufacturing companies that inventory can account for up to 50% (or more) of the current asset of the business and all the assets can only be liquidities (convert to cash) in the next 12 months because it is tied up in inventory. Unlike cash, the money tied up in inventory is not available for any other use. (Slater, 2006). These shows that the important of inventory management in business world.

By definition, inventory is a list of items held in stock (Waters, 1992) that contain economic value. (Inventory Management) The 'economic value' determine the success of the companies in handling their financial management because value of the inventory will relates to the large portion of money invested in the company. This is where the financial management concept of 'Time value of money' is important. The theory describe that, a dollar that we have today worth more than a dollar in the future.(Time Value of Money) Therefore, high value of inventory will give a benefits depends on the purposes of the inventory which are as a spare parts for major projects, ensure manufacturing efficiencies and enable supply in a timely manner. However does the inventory left in the warehouse have the same purposes or there is

a failuer in inventory team which does not really look into the usage of inventory for certain period of times. All this things are related to inventory management.

B. Inventory Management versus Inventory Reduction

One of the more important aspects of process control education is inventory or material management. An engineer with some experience can usually immediately say if a proposed inventory management system is workable. However, for a student or newcomer to the field, it is not obvious, and even for an experienced engineer there may be cases where experience and intuition are not sufficient. (Skogestad, 2009)

Inventory management is the activity to ensure the availability of inventory items in order to be able to service customers. Inventory management involves the coordination of purchasing, manufacturing and demand to ensure the required availability. (Slater, 2006) Primary focus of inventory management is to avoid stock out (material are not available) from happen because the impact of stock out could stop the whole production line. Therefore, any stock out triggers an action, not only to restock but also to typically overstock, in order to avoid future stock out and the negative consequences the result.

Inventory reduction is the activity to minimize the cash investment in inventory while maintaining the availability promise of inventory management. (Slater, 2006) It focuses is more on identify the opportunities to reduce cash investment by eliminating unnecessary investment in inventory with no change in inventory risk profile. For example, reviewing excess stock that can be remove from the warehouses by referring to demand and supply characteristics and also criticality of the materials. Then, the works is to reduce cash investment in the items.

Eventually, inventory management must lead to over investment of cash in inventory as people seek to eliminate stock our, whereas inventory reduction results in a minimized investment of cash while maintaining availability of the materials for projects or spare parts.

Therefore, this paper will focus on

inventory reduction in order to solve the problem statement as stated above.

C. Inventory Reduction Strategies and current tools

There are two key reasons of inventory reduction approach fails which are the focus is more open on high priced items as they are seen as providing the greatest impact and secondly, the focus is on high turnover items as any change in this area is likely to be realized more quickly (due to high turnover). (Slater, 2006)

On the first approach, inventory teams are too focus on high priced items as they are seen as providing the greatest impact. However, they neglects total investment as it gives the total value invested (quantity x item's cost). The total value invested is much more important not how much the items cost because it represents how much cash tied up to the inventory.

Secondly, by neglecting slow move items and often results in imbalance of inventory. Famous question, how often has your business faced having plenty of inventories but none of the right items in stock? The process has to be change to aim at the cash investment rather than juts the inventory activity.

To see the overall inventory holding, managers and inventory team have to come out with the inventory reporting to view the trend of the inventory monthly or yearly basis. The system proposes will helps in generating inventory reports based on the inventory reduction strategies.

To get a clear overview, authors present the process flow of some of the inventory reduction strategies used in MLNG in Figure 2.3. However, there are a lot more inventory reduction strategies but author's only shows four of it to give a rough view of the inventory reduction strategies.

D. Inventory Reporting

Inventory reporting is a report that shows the current inventory holding condition of the company. For example, large companies like PETRONAS state certain aims for its subsidiaries to provide in their inventory reporting such as:

a) Support key decision making towards running PTERONAS as high-performing business. (GSCM, 2009)

b) Monitor and gain through understanding of the Plant's performance, identify performance gaps and improvement opportunities, and track effectiveness of corrective actions. (GSCM, 2009)

c) Achieve standardized KPI reports and reporting structure that allow for cross-OPU performance comparison. (GSCM, 2009)

d) Ensure consistent understanding in terms of the definition and calculation of the KPI's, to ensure reporting consistency for Groupwide Assessment and Performance Benchmarking (GSCM, 2009)

e) Allow for faster access to information and reduce manual effort to support fast and effective reporting process. (GSCM, 2009)

Therefore, Inventory Reduction Strategies System (IRSS) for Material Management will provide an inventory report by referring to the goals and indicator by the PETRONAS too.

E. Current tools

In dealing with the complexity and changeability in markets that organization operate, modern business organization become more and more dependent on their information system. (Welcome to the IS group, 2012) In order to avoid human errors and one of the way to increase the effectiveness and efficiency of a business process, System Application Programming (SAP) which is an Enterprise Resource Planning (ERP) system are world-widely used to handle material management. Moreover, SAP Material Management (MM) is a module of SAP ERP that is used to handle procurement and inventory management. (Malik, 2011) However, it only covers the tracking part of the inventory in the warehouses but lacks in further analysis in using inventory reduction strategies to optimize the company's inventories holding.

Currently, MLNG is using trackers design using Microsoft Excel to analyze the inventory list generated from SAP system. This trackers cannot be categorize as an information system as it only helps in tracking which data have been reviewed and all the process details still have to go manually by the inventory staffs. The author will describe further on the current

tools used with the help of some info-graphic below. In the current process, material list extracted from SAP are divided by each category involves. Each reduction strategies have its own tracker and folders containing linked files for other department involve in certain reduction strategies. For example, Figure 1.2(2) shows folder of Material Inspection Tracker which is one of inventory reduction strategy containing files that are linked to a master data file as describes below.

Each of the files own by specific department who involves in the reduction strategies. . The idea is to allow many users to open files in the folders at one time and master data with linked files is to collect all the data into single files to ease the Inventory Executives from open the files repeatedly in order to get the updates from other departments. These linked files sometimes corrupted and disturbed the Inventory Executive’s schedules in reporting.

Moreover, since reviewing the items are also falls under engineer’s KPI, there is always an issue when the numbers of items reviewed by the engineers are not up-to-date in Inventory Executive’s reports because of last minute changes in the documents. Lastly, an analysis report will be generated from the master data to see the performance of the inventory reduction strategy.

Another problem of the current tools is even a single item might falls under more than one category such as under ‘Non-Moving and Non-Critical (NMNC) stock’ and it is also will falls under ‘dead stock’ categories. All of the inventory reduction strategies are operated individually in different Microsoft Excel documents. Thus, as shown in Figure 1, where inventory executive have to filter it manually when it have been merge down to avoid redundancy of calculation to be included in the inventory performance report. Integrating all the strategies analysis into a single system would help to avoid redundancy of data analysis and a report can be prompt out to see the of the overall inventory performance in the companies. Therefore, Inventory Reduction Strategy System (IRSS) for material management comes into the pictures to centralize all the strategies in an integrated system to help the Inventory Executives and managers in making decision to optimize inventories in the companies as well as increase

the cost saving for the companies.

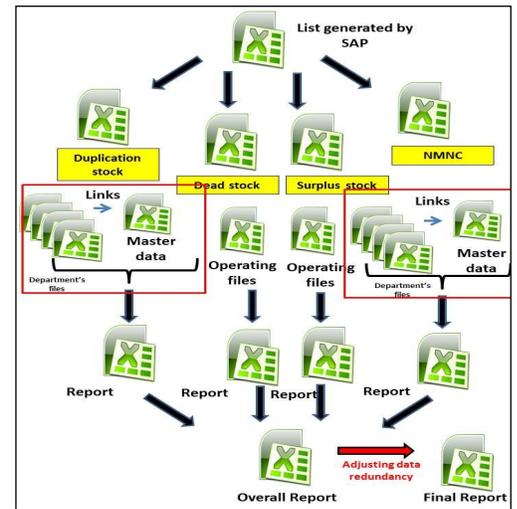


Figure 1 Excel files used in operating current inventory induction strategies

III. FINDINGS

A. System Flowchart

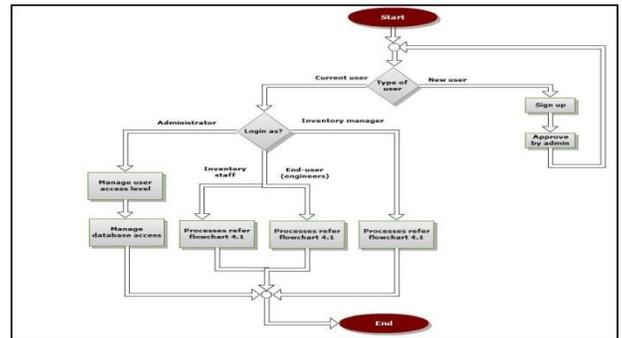


Figure 2. Login Flowchart

N. o.	User	Inventory Reduction Strategy						Summary	Report
		Manage user access level	Manage database access	NMNC	Duplication stock	Surplus stock	Dead stock		
1	Admin	X	X	-	-	-	-	-	-
2	Inventory staff	-	-	X	X	X	X	X	-
3	Inventory manager	-	-	X	X	X	X	X	X
4	Engineering staff (end-user)	-	-	X	X	-	-	-	-

Table 1 Type of user and access level

One of the main problem of the previous system

is it have large numbers data duplicates with each other and have to split it manually. Venn diagram in figure 3 illustrates the duplication of the data.

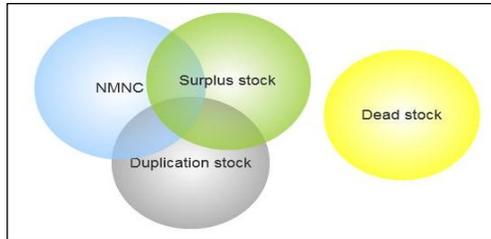


Figure 3 Venn diagram for redundancy of data in IRSS

Therefore, IRSS come into the picture to solve the problem by merging all the data at the end of the reduction strategies and update the result into a single database based on priority of the process. To understand further on the flow of the process, refer flowchart in figure 4. After the database update summary and report will be automatically generated by the system based on inventory manager requirement to be presented to Board of Director for approval.

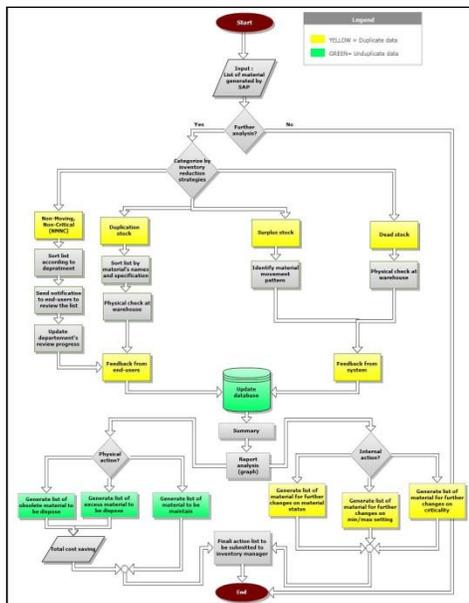


Figure 4 Process Flowchart

IV. CONCLUSION & RECOMMENDATION

A. Conclusion

As a conclusion, author has explained in details on the system proposed in previous chapters. The main aim of the project is to come out with an integrated system that merges all the inventory reduction strategies into a single system to get a more concrete summary of the inventory holding. Apart from that, Inventory Reduction Strategy System (IRSS) will provide a decision support to ease and simplify works of inventory managers from the entire technical task previously. The project will be carried out based on methodology suggested, starting with planning phase which consists of collecting information and identifying software compatibility with the inventory strategy suggested. The project will be tested phase by phase to avoid any syntax and other. It is hoped that the system developed would be beneficial to the company specifically in Oil and Gas Industries (one of the largest industries contribute for the country's financial) in managing their inventory more efficient and increase profits share for the beneficial of the citizens.

B. Recommendation

There are some recommendations suggested from the author which are;

- Get the certificate of approval from the MLNG/company

This is advise by the author's supervisor previously as the approval would motivate the developer to finish the end product as the product will confirm be used by the company. Apart from that, it will give the authority to the author to communicate with other inventory department in other PETRONAS's subsidiaries.

- Conduct survey directly on inventory department in any oil and gas industries;

The current survey was conducted to the ex-trainee of oil and gas companies which not all of them have experience working as inventory staff. Therefore, author suggests conducting survey directly to the inventory department in the company. Certificate of approval as describe above will help the author to complete the survey.

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TERMINOLOGIES

ⁱ **Cost savings** is amount of money that the company could save from the result of inventory reduction strategies.

ⁱⁱ **Obsolescence cost** add to the user cost of capital, which have a negative effect on research efforts;

ⁱⁱⁱ **Liquidity** is easily converted to cash

^{iv} **Turnaround** means plant maintaining project where all the production will be stops to allow the experts to inspect and repairs all the operation equipment. Therefore, it requires a lot of spares part items.

^v **Group of SCM** is a one stop center for all SCM departments in PETRONAS subsidiaries