Journal of Theoretical and Applied Information Technology
31st July 2018. Vol.96. No 14
© 2005 – ongoing JATIT & LLS
ISSN: 1992-8645 www.jatit.org E-ISSN: 1817-3195

IMPROVING QUALITY OF SMES INFORMATION SYSTEM SOLUTION WITH ISO 9126

[1] JOHANES FERNANDES ANDRY, [2]JAROT S. SUROSO, [3]DEVI YURISCA BERNANDA

[1]Information Systems, Bunda Mulia University, Faculty of Technology and Design, Indonesia
[2,3]Information Systems Management Department,
BINUS Graduate Program-Master of Information Systems Management,
Bina Nusantara University, Indonesia

E-mail: [1] jandry@bundamulia.ac.id, [2] jsembodo@binus.edu, [3]devi.bernanda@binus.ac.id,

ABSTRACT

Oil distribution company in Jakarta, which requires an Order Fulfillment Systems Information, expected from the implementation of this software can achieve several objectives desired by user requirement. The company is SMEs to assist system to be more effective and efficient, provide convenience in terms of process data and information. With the use of applications compared to the manual process of recording which facilitates decision-makers to be able to monitor transactions and report in a short time. To design and implementation of applications that are reliable and avoid the bug or error, required evaluated quality of order fulfillment software used ISO 9126. Problems is implementation and evaluating quality of OFIS based on ISO 9126 standard in terms of functionality, efficiency, portability, usability, maintainability, and reliability, this paper is only on attribute functionality and sub characteristic. Perspectives of user and developer must satisfaction as product quality definitions, base on six high-level and other sub-qualities. The overall attribute describes the behaviour of the system, depending on the specific needs required by the firm.

Keywords: *Order Fulfillment Systems Information, ISO 9126, Attribute, Functionality, SMEs*

1. INTRODUCTION

This guide order fulfillment is a key process in managing the supply chain management [1]. Order fulfillment is in the very general sense the complete process from point of sales inquiry to delivery of a product to the customer. Sometimes order fulfillment is used to describe the narrower act of distribution or the logistics function, however, in the broader sense it refers to the way firms respond to customer orders [2], [3]. Development win order fulfillment and customer service capabilities, to get measurement right. Measurement provides the road map for helping you to go from your "as-is" capabilities to your desired "to-be" capabilities [4]. So that the company is expected to be able to fulfill the order with a stand on the slogan delivery it to the right place, at the right time for the right price [5],[6].

The company has implementations of software order fulfillment, then term of order fulfillment information systems will be shortened to OFIS. Information System (IS) or software is basically concerned with data processing into some information. IS works in every system, which provides information for the managerial activities in an organization. A system to convert data from internal and external sources into information and communicate that information in an appropriate form, to managers at all levels in all functions to enable them to make timely and effective decisions for planning, directing and controlling the activities for which they are responsible. Others, however, give it more limited scope. They see it as a system collecting and analysing data and producing reports. Its purpose is to help managers and managements solve structured problems [3], [7], [8]. OFIS are large and complex with maintenance problems, while users expect high quality [9]. However, it is hard to assess and assure quality.

To ensure quality in IS requires not only monitoring and management, but also adherence to strict standards. It is through measurement and metrics that software systems industry will ensure that the products and services meet the requirements [10], [11]. The International Organization for Standardization/International Electronic Commission or called ISO/IEC 9126

ISSN: 1992-8645 www.jatit.org E-ISSN: 1817-3195

standard has been developed to address software quality issues [12]. It specifies software product quality characteristics and sub-characteristics and proposes metrics for their evaluation. It is generic, and can be applied to any type of software product by being tailored to a specific purpose [13].

ISO 9126 was originally developed in 1991 to provide a framework for evaluating software quality and then refined over a further ten years period [14]. Many studies criticise ISO 9126 for not prescribing specific quality requirements, but instead defining a general framework for the evaluation of software quality [15].

Research and practical work shows that the assessment of the quality of a software component is in general a very broad and ambitious goal[15]. Recent research also shows that these characteristics and sub-characteristics covers a wide spectrum of system features and represent a detailed model for evaluating any software system [16]. Figure 1 ISO/IEC 9126 standards to explain attributes and sub attributes. Problems is implementation and evaluating quality of OFIS based on ISO 9126 standard in terms of functionality, efficiency, portability, usability, maintainability, and reliability?

Table 1 to show OFIS of the oil distributor company, characteristic and sub-characteristic with description. This study aimed at identifying deficiencies that could contribute to the failure of software systems by asking a series of questions, including: can the OFIS perform the required functions? Are the results of OFIS as anticipated? (see table 1).

Table 1 : Order Fulfillment Information Systems of The Oil Distributor Company [17], [18], [19], [20].

Characteristic	Sub-characteristic	Description
Functionality	Suitability (F1)	Can the OFIS perform the required functions?
	Accurateness (F2)	Are the results of OFIS as anticipated?
	Interoperability (F3)	Can the OFIS interact with other systems?
	Security (F4)	Can the OFIS prevent unauthorized access?
Reliability	Maturity (R1)	Have the faults in the OFIS and hardware devices been eliminated over time?
	Fault tolerance (R2)	Is the OFIS capable of handling errors?
	Recoverability (R3)	Can the OFIS resume working and recover affected data in case of a failure?
	Reliability compliance (R4)	Does the OFIS adhere to the existing reliability standards?
Usability	Understandability (U1)	Does the OFIS user recognize how to use the system easily?
	Learnability (U2)	Can the OFIS be learnt easily?
	Operability (U3)	Can the OFIS work with a minimal effort?
	Attractiveness (U4)	Does the OFIS interface Look good?
	Usability Compliance (U5)	Does the OFIS meet the existing usability standards?
Efficiency	Time behavior (E1)	How quickly does the OFIS respond?
	Resource utilization (E2)	Does the OFIS utilize resources efficiently?
	Efficiency compliance (E3)	Does the OFIS adhere to the existing efficiently standards?
Maintainability	Analyzability (M1)	Can faults be easily diagnosed?
	Changeability (M2)	Can the OFIS be easily modified?
	Stability (M3)	Can the OFIS continue functioning if changes are made?
	Testability (M4)	Can the OFIS be tested easily?
Portability	Adaptability (P1)	Can the OFIS be moved to other environments?
	Installability (P2)	Can the OFIS be installed easily?
	Portability compliance (P3)	Does the OFIS comply with portability standards?
	Replaceability (P4)	Can the OFIS easily replace other software?

2. THEORETICAL BACKGROUD

2.1 Order Fulfillment

According Hay (1990) states that a profit organization attempts to maximize profits, whereas a non-profit organization considers monetary returns of less importance [17], [18]. Their major objectives may include improved literacy rate, better quality of life, equal opportunities for all genders or races, etc. The revenues gained by a non-profit organization would be used primarily to balance the expenditure of the organization. Due to conflicting objectives, managing a successful profit organization may be drastically different from a nonprofit organization [18], [19], [20] .

Based on the problems then authors with software house to provide solutions from the oil

ISSN: 1992-8645 www.jatit.org E-ISSN: 1817-3195

distribution company. An application that is able to integrate multiple processes into several modules: the sales module, the purchase module, the finished goods warehouse module, the raw material and auxiliary modules, the debt module, the receivable module, the financial module.

The unbalanced and unstable integration of manufacturing and transport systems weaken the competitiveness of supply chains. Especially in dynamic situations and environments, production and transport systems must be properly integrated so that efficiency, responsiveness, and flexibility can be achieved and sustained [21], [22]

2.2 QUALITY SOFTWARE

Software testing is a process of verifying and validating that a software application or program meets the business and technical requirements that guided its design and development and works as expected and also identifies important errors or flaws categorized as per the severity level in the application that must be fixed [22], [23].

The quality of the software can be viewed through a certain size and size, as well as software. One of the software quality benchmarks is ISO 9126.

ISO/IEC 9126 is an international standardization that is made by ISO/IEC used to evaluate software product. This standard has been greatly used in the research that is conducted to evaluate quality of a system [24], [25], [26], [27].

There are six quality characteristics in ISO/IEC 9126 standard i.e. functionality, reliability, usability, efficiency, maintainability, and portability [24].

ISO standards provide a very important basis for performing quality measurements indirectly and basically provide a perfect list for assessing the quality of a system / software.

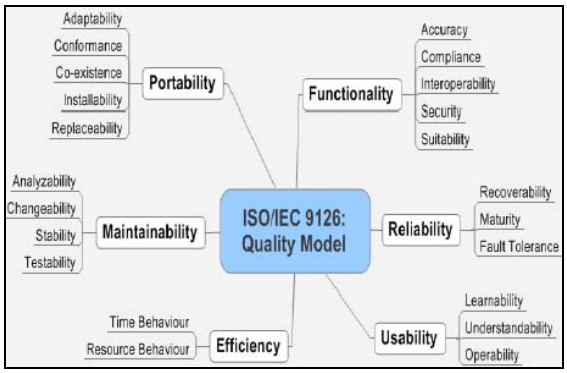

Figure 1 : ISO/IEC 9126 quality model - external and internal quality [28].

Testing process must balance the written requirements, real-world technical limitations and user expectations [23], [28]. The testing process and its results must be repeatable and independent of the tester, i.e., consistent and unbiased [28], [29]. Software can be tested at many different testing levels, for example at levels of units, components of integration and of the whole system [28], [30].

2.3 SME

Throughout the world the role of small and medium sized enterprises (SMEs) is becoming increasingly prominent [31], [32]. SMEs can be established in any locality for any kind of business activity in urban or rural area [31], [32], [33]. According to Reider [34], the two main primary reasons for the existence of small firms are: (1) to provide goods and services to satisfy customers' needs in a manner that they will continue to use and recommend the firms' goods and services, i.e. "customer service business" and (2) to create desired goods and services so that the investment in the firm is converted to cash as quickly as possible, i.e. "cash conversion business" [31], [35]. Small businesses are very important to the world economies [31], [36]. The most important and the large part of world economies are the small firms. That is why; more and more researchers are seeking and trying to understand about these firms.

3. RESEARCH METHODOLOGY

The methodology used in this research combined field work and User Acceptance Testing (UAT), as this allowed the views and opinions of study participants to be quantified and analyses. The standard of interest for this research is ISO 9126. Evaluating OFIS with UAT and coding phase defect, where the output of this stage is UAT and coding phase defect. Evaluated is done to identify and identify errors that may occur. Because of limited time and cost then research is only on aspect or attribute functionality. The researchers used the quality characteristics and sub-characteristics to evaluate the OFIS, only for attribute functionality and sub characteristics. Evaluating software is often associated with verification and validation (V & V). Where verification is a set of activities that ensure the software has performed certain functions correctly. While validation is a set of different activities from verification that ensures that the built software can be traced to customer needs / requests. Verification is "Are we building the product right?" and validation is "Are we building

ISSN: 1992-8645 www.jatit.org E-ISSN: 1817-3195

the right product?" [37]. Functionality is all the functions; attributes of the system to satisfy user requirements. It includes suitability (F1), accuracy (F2), Interoperability (F3) and security (F4). Some features such as the name of the OFIS running in desktop base, no loading time, this place make the first impression for users. The OFIS is the place where staff or employee can access in local area network at office of company. Evaluated functionality of OFIS by black box testing, done without detailed knowledge of the internal structure of the system or component tested. Base on functional evaluated; this is a software level testing from business and operational perspective. In today dynamic age, businesses change rapidly and act to competition, hence requirements tend to change within projects [38]. It is conducted on a complete, integrated system to evaluate the system's compliance with its specified requirements. Often called black box testing, this type of tests is generally performed by Quality Assurance (QA) analysts who are concerned about the predictability of the end-user experience. Also referred to as behavior testing, specification-based testing, input/output testing or functional testing. Black box testing focuses on the functional requirements of the software, based on the software requirements specification. With the existence of black box testing, software engineers can use a set of input conditions that can fully examine the overall functional requirements of a program. Black box testing is not an alternative technique than white box testing. Moreover, it is a complementary approach in covering errors with different classes of white box testing methods. Categories of errors that will be known through black box testing: Functions that is missing or incorrect: Error from interface, Error of data structure or external database access Error of performance or behaviour and Error of initialization and termination. Black box testing is used in the final stages and focuses on the information domain. The test is designed to answer the following questions: How validate the function will be tested? How are system behavior and performance tested? What good input categories are used for test cases? Are some systems sensitive to a particular input value? How is an input category defined? System has tolerance level and volume of any data? What are the consequences of certain combinations of data that will occur in system operation?

4. RESULT AND DISCUSSION

General process consists of master data, customer, support process, supplier and production (see figure 2). Where master data is master data control include user, goods, currency, distributor and retail price, transaction type, exchange rate, supplier and customer. The main process of order fulfillment application is the recording of sales order data received from the customer and the return of goods sold by the customer to the company. The application also facilitates the procurement or purchase of production materials from the company to suppliers with a purchase order (PO) and facilitated also with the purchase return from the company to the supplier. Procurement of goods is also done by the application by providing work orders production on the production. Supporting processes include data control of accounts receivable, finance, accounting data recording and debt data control.

Journal of Theoretical and Applied Information Technology
31st July 2018. Vol.96. No 14
© 2005 – ongoing JATIT & LLS
ISSN: 1992-8645 www.jatit.org E-ISSN: 1817-3195

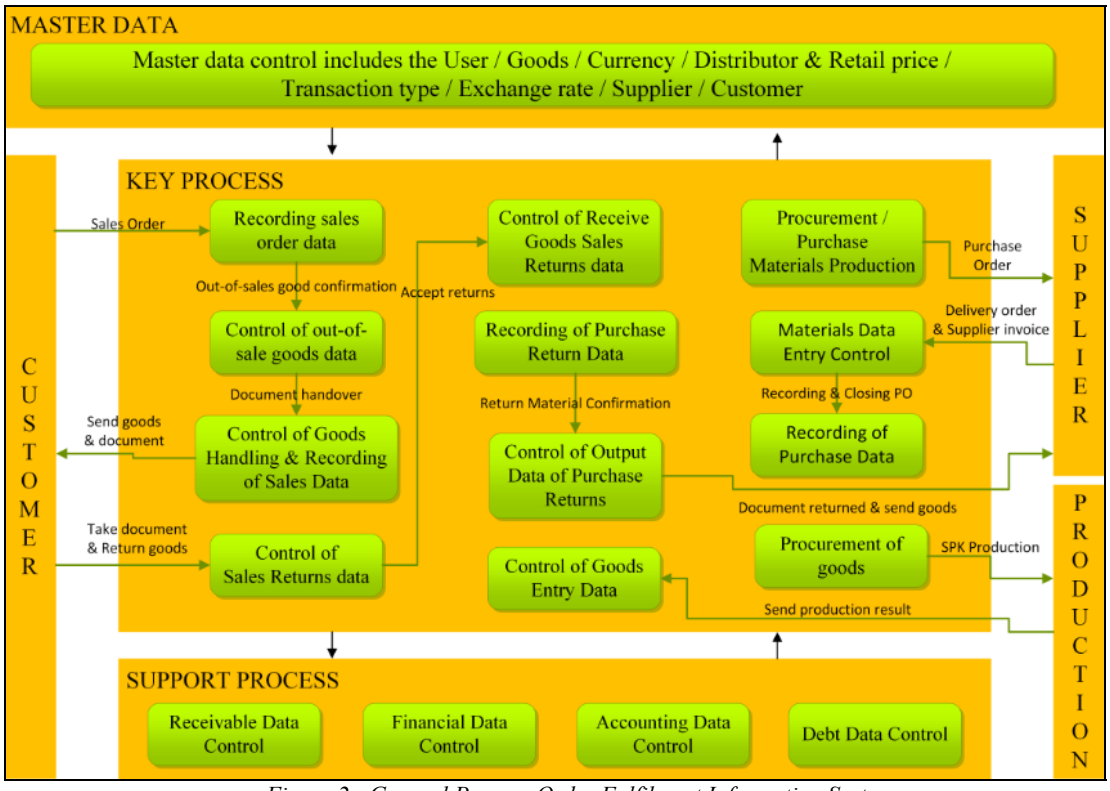

Figure 2 : General Process Order Fulfilment Information System

The admin section runs the activity of managing the master data and utilities of the application. The sales department runs the activity of organizing the sales order data, managing the sales invoice data and sales returns, arranging sales reports and returns from sales. The purchasing department runs an activity governing purchase order data and purchase returns and arranging PO or purchase report data. The warehouse runs the activity of organizing the finished goods data, arranging raw material data or auxiliary materials, arranging the finished goods report, arranging raw material reports and auxiliary reports. The part of the debt runs the activity of managing supplier invoice data, regulating the beginning balance data, debt repayment, closing debt and debt report. The part of accounts receivable runs the data of payment receipt, the balance of receivables, cover receivables and manage receivable reports. The financial section carries out the activity of organizing cash and bank transaction data, adjusting the beginning balance of finances and arranging the financial period. The accounting department runs the activities of managing accounting journals, cost of goods sold, managing financial statements and stock reports.

Based on the needs of the organization of the general process and use cases and activity diagrams that have been conveyed before in chapter 4, the application fulfillment order consists of module that are:

- Master Module
- Sales Module
- Purchase Module
- Warehouse Module So
- Raw Material and Materials Module
- Debt Module
- Receivable Module
- Financial Module

Evaluating of OFIS from functionality aspect using test case instrument. Test case is a set of inputs to be tested, conditions to be executed and expected results. Test case in this study aims to check the needs of the system in this case the needs of system functionality. In addition the test case also aims to provide a mechanism that can help ensure the completeness of the test and provide the highest possible to reveal errors in the software. Evaluating is the process of running or executing a program with the main purpose to find errors. OFIS is software customized made by Kreavi Informatika Solusindo, a software house in Jakarta, implement and develop distributor oil. Writing from this paper is tailored to real applications OFIS, (see Figure 2 General Process Order Fulfillment Information

ISSN: 1992-8645 www.jatit.org E-ISSN: 1817-3195

System). Decomposition functions of OFIS are module: 1. Master, including: data of user, unit of goods, data of finished goods, currency, customer data, distributor & retail price, raw material data, data of auxiliary materials, transaction type, supplier data and tax rate. 2. Inventory, including: finished goods, raw materials, auxiliaries, & recalculate the stock of goods. 3. Sales order, including: sales invoices, sales returns and reports. 4. Account receivables, including: proof of payment of beginning balance of receivables, account receivable, aging schedule, receivable receipt report, recap out invoice, accounts payable, and accounts receivable has not been paid off. 5. Purchasing, including: Purchase order (PO), outstanding PO, delivery details, closing PO, Purchasing report, returns purchase statement and outstanding PO. 6. Account debt, including: supplier invoices, debt closing, invoice redemption, early debt balance set, debt posting, debt card, debt recap and monthly debt report. 7. Cash/Bank, including: replace cash / bank period, Journal proof number, cash / bank initial balance, cash / bank post, cash transaction and bank transactions. 8. Accounting, including: journal proof number, account master, accounting journal, cost of production, accounting post posting, monthly book closing, moving end of year balance, starting balance set, financial statement, stock report and transaction check. To show user interface module login OFIS, see Figure 3 and Figure 4 to display the main menu interface as well as for the whole of the OFIS. In this paper author only discuss sub module inventory, finished goods such as beginning of balance, beginning of balance delivery order (DO), sales returns, delivery orders, DO out for sale, stock cards, stock position, final balance, finished goods listings, DO stock card, stock position DO and final balance (see Figure 3 OFIS of Module Finished Goods Inventory).

Master or admin module is to manage the master data which includes user data, goods data, currency data, distributor price data and retail transaction type data, tax rate data, supplier data and customer data. User data will be created username, password and user permissions. The goods data consists of units of goods, finished goods, raw materials and auxiliary materials. Currency data will be displayed in the currency of the transaction. Data on distributor and retail prices will be displayed on distributor and retail goods prices. Transaction type data includes all types of transactions performed. The data of tax rate of will display the nominal of tax rate. Supplier data will display supplier profile. The customer data will display the customer profile and the discounted price. The entire process and the transaction will automatically enter into the database.

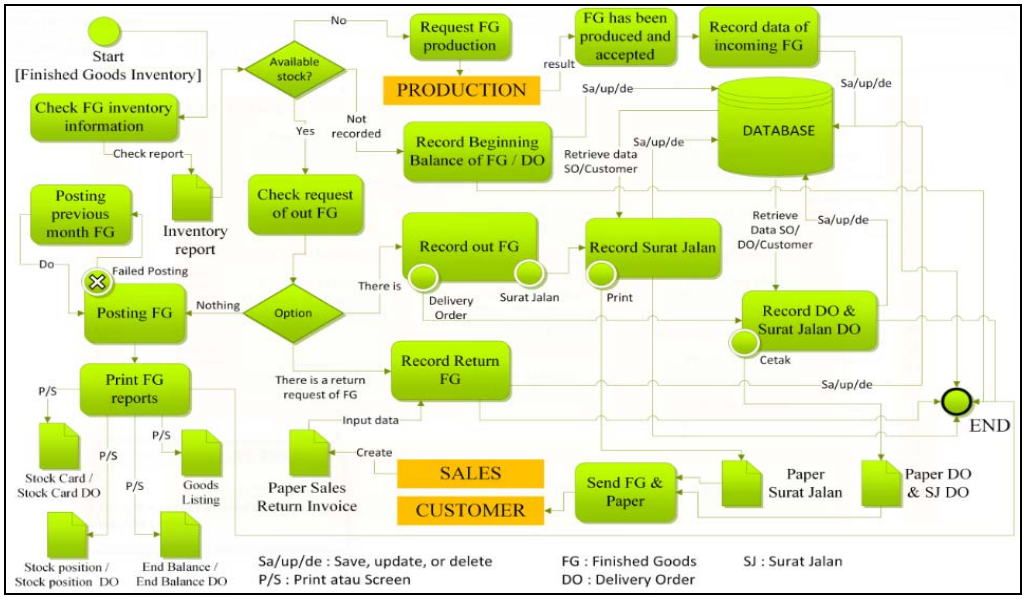

Figure 3: OFIS of Module Finished Goods Inventory

Sales module starts from sales staff, checks sales order information, if there is sales order, and then staff will record sales order data (SO). Next request letter data / delivery order (DO), disposition to the

Journal of Theoretical and Applied Information Technology
31st July 2018. Vol.96. No 14
© 2005 – ongoing JATIT & LLS
ISSN: 1992-8645 www.jatit.org E-ISSN: 1817-3195

warehouse, and the warehouse will send the following goods with invoices to the customer, and the customer will confirm the goods ordered and the system will record the sales invoice data, and will print invoice sales / invoice tax. If the goods do not match the order of the customer, then the goods will be returned, then the staff will record the return of sales data and print invoice sales returns.

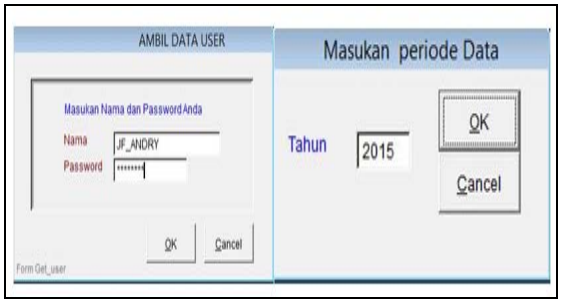

Figure 3 : User Interface Module Login OFIS

Figure 4: Main Menu Interface

The purchasing module starts from the purchasing staff checking the inventory information of the raw materials / supporting materials, the inventory report will be made, if the stock is minimal, it will record the purchase order (PO) data and will print PO. If the stock is not dismissed, it will print a purchase report. The warehouse will confirm the suitability of goods ordered by the purchasing department to the supplier, if appropriate received and recorded, otherwise it will be made a purchase return, then will print purchase invoice and mailing the way.

Module of finished goods warehouse, starting from warehouse staff checking inventory information of finished goods, then make inventory report. If the stock is available it will check the request out of finished goods, otherwise it will request the production of finished goods. The production section will produce on demand from the warehouse. Done in production, the production staff will record the incoming data of finished goods to the database. Finished goods in the warehouse will be recorded out finished goods if there are demand sales from the sales.

The raw materials and supporting materials module, starting from the warehouse staff of raw materials / supporting material (BB / BP), will check the sales information BB / BP and will be made inventory report. Staff will see the stock is available or not, if the condition is no stock, then immediately inform the shortage of BB / BP gets the purchase, to be followed up with made PO. If staff see / to check stock available, it will check whether there is a request out BB / BP, if any then will be noted. If it does not exist then it will post BB / BP. And then will print the report BB / BP. Check also with stock card, stock position, final balance and incoming BB / BP report.

Debt module, or accounts payable (HD), the staff checks the demand for HD data creation, if there is a request to record supplier invoices, if there is unrecorded HD data, the staff will record the beginning balance of the debt, check also the HD repayment request, if yes, then will record the repayment of debt, print repayment HD / proved of repayment of HD. The finance department will receive documents for the HD repayment settlement and record the HD cover.

Module Receivables, staff will check the request making data receivable, if no, it will post data receivables the previous month and then will post receivables then will print the accounts receivable. If there is a receivable, it will be recorded on the TPB (receipt of payment) accompanied by TPB from the customer and record the beginning balance of receivables and will record the closing of receivables.

Financial Module, financial staff will arrange financial data, if there is no transaction it will post cash and bank of previous month and next will print cash / bank statement. If there is a transaction, it will record the financial transactions by recording receipts / exit bank transactions via cash. If any receivables are not recorded, it will print the beginning balance of cash / bank. For incoming cash / bank will change period by setting data period starting from arranging serial number of transaction. So the reports that enter into the database of cash book reports, bank statements, cash out reports, cash receipts, bank statements and bank receipts.

Because of the limitations of the page for the overall breakdown of the process from OFIS, then only show the Finished Goods Inventory module.

Table 2 : Evaluate Module Login.

Test Case	*Test steps*	*Expected Result*	*Actual Result*

ISSN: 1992-8645 www.jatit.org E-ISSN: 1817-3195

Login page has been displayed after the OFIS run	Input text to textbox Name: 1. 'abcde' or 'ABCDE' (without quote) 2. 0123456789 3. ~`!@#$%^&*()_+-={[}]\:;'"<,>.?/ (and space)	Succeed to show capital letter, number, and special character to textbox Name	User can input capital letter, number, and special character to textbox Name
Login page has been displayed after the OFIS run User Name 'JFA' and password 'JFA' Has been registered in the system	1. Input name 'JFA' to textbox Name 2. Blank input password to textbox Password 3. Click button 'Ok'	To show message password can't empty and systems, turn off automatically	Message success and systems, turn off automatically
Login page has been displayed after the OFIS run User Name 'JFA' and password 'JFA' Has been registered in the system Period time year '2017' registered in the system	1. Input name 'JFA' to textbox Name 2. Input password 'jfa' to textbox Password 3. Click button 'Ok' 4. input number '2016' to textbox 5. Click button 'Ok'	Show message is year period can't register	Show error success and systems, turn off automatically
User JFA exit from login page with click button 'Exit' and back to login page	1. Click button 'Cancel' to page Login	Success System shutdown	System shutdown

The ISO 9126 working group has come up with three new expressions which they introduced in ISO TR 25021, namely: quality measure element categories, quality measure elements and quality measures [39]. Quality measure elements are described as an input for the measurement of the software quality measures of external quality, internal quality and quality in use [39].

The allocation of resources for the testing project varies, depending on (1) whether the test cases exist and is designed to be ready for reuse, and (2) whether testing is automated. After doing the test planning, the next step is to implement it with a mechanism or process that has been established. Software testing process is one part of the software development process in outline.

Therefore, the discussion will start from the software development process to the software testing process. In this chapter is also inserted a glimpse of the knowledge of process development standards, which will show the difference between the application of process development standards. The following percentages assume that no automated test cases can be reused. If automated test cases can be reused, the total time will drop dramatically, especially in the effort required to re-execute the test cases and evaluate the results.

Test implementation activities, which aim to implement test procedures that have been made. There are three stages of activity, starting from test implementation activities by test designers, with test scripts, test cases, and revised test procedure documents as testing products, and based on inputs from components, test cases, workload analysis documents, Test models, and test procedure documents. After that proceed with the activities to create the design classes and test packages by the designer .

Table 4 : Evaluating Activity of Effort for Test

Phase	Activity	Per cent of effort for test
Test Planning	*Create all*	*5 %*
	Define Test case detail	*10 %*
	Prepare of environment test	*10 %*
	Total	*25 %*
Execution Test	*Set-up and initiation test*	*10 %*
	Executed Test	*30 %*
	Result Test	*10 %*
	Total	*50 %*
Evaluation Test	*Review Result Test*	*5 %*
	To communicated of Problem	*10%*
	To Follow up of Problem	*5 %*
	Documentation	*5 %*
	Total	*25 %*

As a testing product on these activities are the classes and the test packages themselves, which are based on inputs from the design models, test cases, and revised test procedure documents. Finally, processes with the implementation activities of the sub-system and component tests by the implementer. Sub systems and test components are product testing of this activity, which is generated based on inputs from packets and test classes, builds, and components. While the test execution activity in the integration test phase, which aims to ensure the components of the system collaboration and apply as desired, performed by the tester. The sting product of this activity is the test execution

ISSN: 1992-8645 www.jatit.org E-ISSN: 1817-3195

result, based on the inputs of test scripts, builds, and components. And the last activity is a system test execution, which aims to ensure the system as a whole works as expected. This activity is done by a tester with product testing is the result of test execution, which is based on the inputs of test scripts and build.

Testing Order Module Fulfillment will be done several stages namely:

a. Testing Module Login,
b. Testing Master Module, which consists of
- User Data Master Module
- Master Unit Module Module
- Currency Master Module
- Master Transaction Type Module
- Master Module of Tax Rate
- Master Raw Material Module
- Master Material Module Module
- Master Module of Goods
- Module Master Price Distributor and Retail
- Master Supplier Module
- Master Customer Module

c. Sales Module
d. Purchase Module
e. Warehouse Module Module
f. Module of Raw Material and auxiliary Material, consisting of
- Warehouse Module - Raw Material
- Warehouse Module - Auxiliary Material

g. Debt Module, which consists of
- Debt Module - Supplier Invoice
- Debt Module - Invoice Repayment
- Debt Module - Close Debt
- Debt Module - Initial Debt Balances
- Debt Module - Debt Report

h. Receivable Module
i. The Financial Module, which consists of
- Financial Module - Initial Balances of Bank Cash
- Financial Module - Cash Receipts
- Financial Module - Cash Expenditure
- Financial Module - Bank Reception
- Financial Module - Bank Expenditure
- Financial Module - Financial Statement

j. Accounting Module - Accounting Report

5. CONCLUSION

There are several factors that define different evaluation criteria for the success of the Order Fulfillment Information System (OFIS) of functionality aspect, but there are other important factors that are not specifically addressed. Additionally, they are inadequate to combine the developers' point of view for evaluation purposes. Focus on target groups of distributor's oil companies, functional requirements using ISO 9126 standards.

Perspectives of user and developer must satisfaction as product quality definitions, base on six high-level and other sub-qualities. The quality of OFIS is identified. The quality factor required to evaluate the OFIS based on user targets is arranged into a clear order of importance. The overall attribute describes the behaviour of the system, depending on the specific needs required by the firm.

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