Project Management Approach on the Adaptive Enterprise Resource Planning

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Abstract—Enterprise Resource Planning (ERP) implementation is one of key success factors for business organization's to endorse their business strategy and goal alignment with information technology recent. In spite of its benefits, yet there are many failures in ERP implementation, whereas between 50% to 75% is categorized has failed due to lack of top level management awareness, change of business processes in project implementation, unsuitable architecture, design, and technological infrastructure. The study proposes an Adaptive ERP system that coverage both management and technology areas with the main characteristic are in visibility, flexibility, and agility. The Adaptive ERP is expected becoming as alternative approach to overcome failures in ERP implementation. The Adaptive ERP has standardized business process transitioning from Project Management (PM) into Operational Management (OM) that generally as baseline for conventional ERP. An addition, Adaptive ERP has standardized Service Oriented Architecture (SOA) in order to manage interoperability of the application services.

Keywords— Adaptive Enterprise Resource Planning, Project Management, Operational Management, Service Oriented Architecture.

I. INTRODUCTION

As one of the enterprise information system product that has become most important in business practice today, ERP is required by almost enterprise and small medium enterprises (SMEs) business organizations [1] to manage their resources (financial, material, manufacture, human, etc.) and stakeholders (director, customer, vendor, etc.) to achieve their business strategies and objectives. ERP has been designed to improve the competitiveness, flexibility, productivity and responsiveness to the organization and market growth in the dynamically global economy [2].

Various benefits have been achieved by business organization that has successed to implement ERP within integration business environment, standardized business process procedure, and availibity of business transaction in real time so have , impact for organization development[3].

There are facts that many organizations are failed in optimizing ERP implementation, where between 50% to 75% is categorized failure due to lack of top level management awareness, change of business processes in project implementation, unsuitable architecture, technical implementation, and technological infrastructure choices [2][3].

Even in the many case studies, many large companies have invested in large portion for IT technology, resources, and yet they have failed in the ERP implementation [4]. The failure of the ERP implementation is not only caused financial loss of investment, but also has impact in disordering and halting business processing.

Other many failures of ERP implementation, founded in Indonesia country, in investigation many big companies including State Owned Enterprises such as Semen Indonesia and PERTAMINA as the two largest companies in Indonesia that have been expensively invested by used branded products have been categorized failed in the ERP implementation.

Therefore, it is required to review ERP business process strategy that adopted effectively management principal which have ability to improve overall stakeholders participation especially top management awareness to direct operational management, and also radically changes of business processes.

The Adaptive ERP is intended as an alternative solution for those entire requirements. The Adaptive ERP has adopted Project Management as a standardization business process without leaving management business process that was covered by operational management. This study proposes transitioning project management approach to ERP operational management, in order to improve business process visibility and flexibility.

This innovation might differ from conventional ERP approach, and there has been no research founded on the field of the ERP studies have discussed about ERP with based on the project management process groups and activities. In generally ERP modules, the project management is only being a sub module of ERP.

Operational management in many enterprise corporates that are using *make to order* manufacture supply with production system classified by *Job-Shop* or *Batch* production type [5] that produces highly variety of product, use general purpose machine and facilities, use highly operators skill, use many outsources machines and operators, and do detailed activity planning for sequencing production jobs has operational characteristic as well as project management.

On the other side, SOA is intended to support Adaptive ERP architecture, design and technology. SOA as a principal paradigm, oriented in middle layer service of application software and works in middleware infrastructure has more adapted to dynamically business process improvement that can be managed and maintained easily when distributed in many organization's divisions accordingly depending upon company's development.

With implement PM and SOA principal, adaptive ERP frameworks fulfilled three principal characteristic there are: Availability, Flexibility, and Agility, which addressed to overcome failures in ERP implementation.
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II. LITERATURE REVIEW

The ERP is an Enterprise Information System as tool and strategy of enterprise organization to achieve their objectives and goal [6], with standardized in many software modules (finance, manufacture, inventory, human resource, etc.) which have standardized business process to managing overall organization's activities and stakeholders (customer, supplier)[7] in order to balance their demand and supply [8].

Functional modules that are generally included within ERP software such as: Product Forecasting, Production Scheduling, Materials Management, Inventory Management, Purchasing and Receiving, Sales Operations, Distribution and Logistics, Accounts Payable, Accounts Receivable, Fixed Asset, General Ledger, Product Marketing, Strategic Marketing, technical support, and also management support Cash Bank and Human Resource Management [9].

Evolution occurs in ERP, adapted to industry globalization and dinamically stakeholder's expectation. ERP I have been created with addition Customer Relationship Management (CRM) to support relation link to customer, and Supply Chain Management (SCM) to support relation link to supplier [9]. Then ERP II integrated with Business Intelligent to support organization ability to evaluate and improve business strategy in upgrading the quality of products [10], services, and management as response to predictive analysis in future. The ERP evolution is shown in Figure 1.
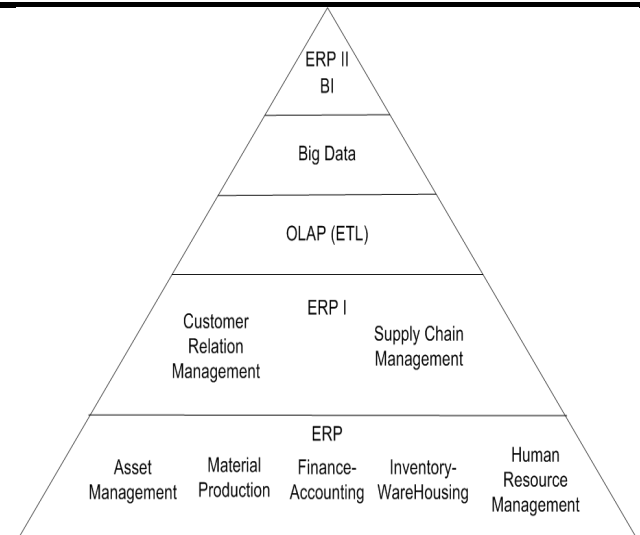

Fig.1: ERP modules and evolution (Source: Author's compilation, 2016).

1. Project Management

Project is temporary endeavor to create unique product, service or result. Project management concerns on the application of knowledge, skills, tools and techniques to project activities to meet project requirements, where the project management has process groups of initiating, planning, executing, monitoring and controlling, and closing [11].

Within fulfillment of project management business processes, there are many knowledge areas are existing and supporting many activities to achieve overall strategy and objectives, they are: integration, scope, time, cost, quality, human resource, communication, risk, procurement management and as addition asset management [11].

In applications, Project management generally used to create a new product or service, implementation a new business process or organization's structure, change organization's structure or strategy.

Different with project management applications, conventional ERP based on Material Resource Planning and in generally has adopted operational management. Characteristic differences between project management and production management are shown in Table 1.

Table.1: Comparison between Project Management vs. Operational Management (Source: Author's Compilation, 2016).

Concerns	Project Management	Operational Management
Start-End Point	Clean State, Specified Start to End	Existing, No real Start to End
Outcome	Unique	Repetitive

Live Cycle	Temporary	Long Time
Frequency Of Change	Short	Long
Managerial Structure	Simple	Complex
Operational	Complex	Moderate
Risk Coverage	High	Moderate
Resource	Dynamic	Static
Activity Oriented	Human	Manufacture
Base of Works	Workbase Structure	Daily operations

According to its characteristics, project management more adaptive than operational management, therefore the project management process groups and activities can be considered to adopt as Adaptive ERP baseline, because the Adaptive ERP has higher control to adapt various uncertainty conditions and variable resources that are running dynamically.

2. Service Oriented Architecture

SOA is a design paradigm in software engineering which introduces as a concept of services that can be represented as functionalities of an application [12]. It's addressed in order to help reducing complexities in software development, where this paradigm should be flexible in adapting within a heterogeneous and decentralized information system [12]. Furthermore, SOA can help to bridge business process requirements and IT component services.

As an extension of design paradigm of SOA, Service Resource Oriented Architecture (SROA) as alternative best practice solution framework for agile model driven design include strategy to composition and decomposition webservice for REST and SOAP, distribution and integration software component and service, and also webservice orchestras within Business Process Model Notation (BPMN) inside Business Process Management Suite (BPMS) infrastructure technology [14].

3. Adaptive ERP

The basic principle of Adaptive is learning by doing, where not only give attention to how uncertainty behavior of working on the ecosystem but also how to manage uncertainty in the best manner to achieve progress and improvement [15].

Similarly, the Adaptive ERP is able to improve business strategy and technology with the variety of changes both in the internal environment of the organization and with the external environment, but while maintaining performance in visibility and flexibility [16].

On the side of the business strategy and objectives, business process becomes the most important factor. The

Adaptive ERP should be able to maintain the visibility of business processes in the overall organization divisions in order to integrate across divisions, and having the flexibility to adapt with improvement of business processes.

Comparison Visibility and Flexibility in Adaptive ERP can be illustrated in Figure 2, the steady state system not yet to adopt operational management based on ERP where Visibility and Flexibility on business processes in lowest level because business process management and transaction data are managed within traditionally management, so has impact it too hard to managed and maintained.

While in the Centralized Enterprise, that used centralized and monolithic ERP has highest visibility level in the integration of business process management and data transaction in the large organizations with the same business transaction location and system, despite of the flexibility is low for many divisions which have different business processes and locations.

In contrast to the decentralized where each division works separately with the specification of business processes and transaction data independently has highest flexibility, but has low visibility to integrate.

By the using of Adaptive ERP, it has ability to get a good flexibility because the system is running in the distributed system, and also still maintaining visibility remains high with their synchronization and integration of business processes through support of agility of SOA technology in middleware infrastructure (i.e.: BPMS, ESB) and middle layer software (WSDL, BPEL).

SOA is managed by adaptive workflow, refers to the ability of the workflow management system to dynamically adapted with the model (such as: BPMN) to manage activity as service during runtime that is intended to income flexibility in distributed system [17].

For those reasons, the adaptive ERP is intended to be able to adapt to perform a unique and dynamically business environment includes management and technology strategy, to get the best solutions on the improvement organization ecosystems with efficient in cost and time. Three characteristics of the Adaptive ERP: Visibility, Flexibility and Agility must be present as the most important keys to build adaptive ERP.
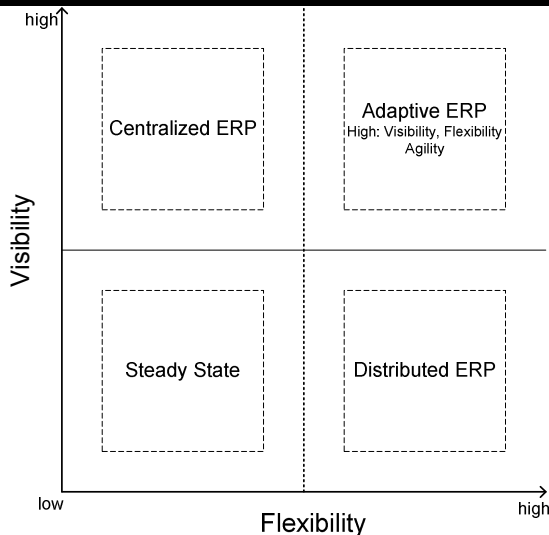
Fig.2: Comparison between ERP systems in visibility and flexibility [16].

4.   Related Works and Contributions

In the previous study has been described ERP and Operational Management are linked conceptually. Based on the identified effects of ERP, describes predictive analysis on the managerial tasks of the production and operations manager in an ERP environment have potential relevance to future research [18]. In change Strategy describes the main factors affecting Information and Communication Technology (ICT) adoption and process redesign within organizations, with the objective to define a systematization framework and a set of methods and tools useful for scholars and practitioners that is included strategy, people, process, and enablers [19]. This study has novelty as future research for transitioning project management within ERP operational management and detailing strategy, people and process to improve business processes within The Adaptive ERP to overcome failures in the conventional ERP implementation.

III.   METHODS AND DISCUSSION

In this study conducted the various literature and study in scope ERP implementation failures. Also analyze the causing linkages and founded the hypothesis. The different viewpoint from many earlier studies, this study not only put the project management as early in the project implementation, but addresses the project management be an alternative operational management in the Adaptive ERP. Then the researchers build model and software to implement these method and share it with company that have operations management compatibility to determine whether the method suitable to be adapted to the operational ERP and obtains benefit results. In this discuss only describe in the project management approach

within the Adaptive ERP conducted to the causing of ERP implementation failures. The SOA approach will discuss in the next our other paper.

3.1 Defines Key Factors of ERP Implementation Failures

To analyze the problems of three main factors of ERP implementation failure, necessary to determine the key factors related to the main problem.
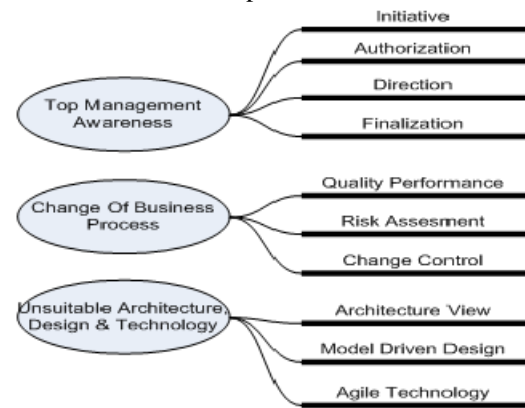

Fig.3: Comparison between ERP systems in visibility and flexibility (Source: Author's compilation, 2016)

- In the first problem, addressed to the top management awareness problem founded four key as the primary responsibility of the top management level they are: initiative, authorization, direction, and finalization. Top level management should be has the strongest initiative for the implementation and operation of ERP and then give authorization and direction for planning by the managerial, and then find out exactly progress and finalization.

- Next to the second problem, addressed to the business process improvement, three key that take effect, they are: Quality Performance, Risk Assessment and Controlling Change. Quality performance needed as a parameter objective, if those parameters are not fulfilled or failed, it would cause various impacts of risk. It needs quantification of the parameters of performance and risk. Change control required as authorization to improve quality performance and reduce the defect of the risk impact.

- While for the third problems, addressed to unsuitable Architecture, design, and technology 3 main keys should be solutions: compliance architecture view, fitness model driven design, and the agile technology. Multi perspective view architecture is used to provide an collaboration of brainware, software and hardware architecture that can be understood by all stakeholders [20], with the Business Architecture View as a priority. Suitability business architecture transformation into software

architecture can be achieved through the using of the model-driven design, SOA and agile support technology. Interoperability of software modules, the adaptation for improvement business processes and evolution of software in the future will be achieved.

3.2 Establishment of Keys Relation to Solution Hypothesis

For mapping the problem points with the hypothesis of solutions, it is necessary to conduct processes and tools, as shown in Table 2.

Table.2: Relation Between problem and solution keys (Source: Author's Compilation, 2016).

Key\Solution	Project Management	Service Oriented Architecture
Initiative	Initiating stage	
Authorization	Planning Stage	
Direction	Executing Stage	
Finalization	Closing Stage	
Quality Performance	Quality Plan, Quality Assurance, Quality Control	
Risk Assessment	Risk Plan, Risk Assessment, Risk Control	
Change Control	Integrated Change Control	Business Logic (WSDL, OWLS)
Business Architecture View		BPMN
Model Driven Design		BPMN to BPEL
Agile Technology		ESB, BPMS

3.3 Project Management as a Management Solution Approach

Top level management awareness problem can be solved by including them to ERP operational, whereas they have responsibilities to manage portfolio management in ERP operational for initiating, authorizing, directing, finalizing, and integrating on project to others, this has applied Top-Down and Bottom-Up policy in the project management stage.

While for the middle level managerial, has responsibility in program management for the planning, monitoring and controlling in the quality performance, risk analysis, and control changes in business strategy and operational implementation of ERP then for the works executing is performed by the low level operator.

To illustrate the ERP business process by adopting those policy given one example of its application within the Financial & Accounting domain as a domain that has the most critical and important activity in the ERP, as shown in Figure 4. Also we give definition on the Adaptive ERP live cycle process group in Table 2.
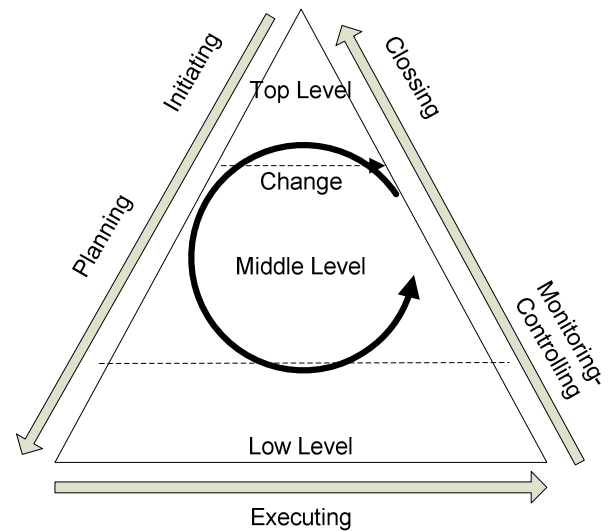

Fig.4: Process group cycle in Top Down – Bottom Up Policy (Source: Author's Compilation, 2016).

The main difference strategies between the Adaptive ERP based on project management and the conventional ERP based on operational management are within Initiating-Closing stages as start-to-end business processing, and Workbase Structure (WBS) as activities map.

Table.2: Definition of ERP live cycle process group (Source: Author's Compilation, 2016).

Initiating	The process stage consists of the initially activities that must be achieved as a authorization, foundation, stimulants, or prerequisite subsequent activities
Planning	The process stage consists of set of the planning activities as the strategy that is managed by middle managers in every business process, to achieve objectives of the business process.
Executing	The process stage consist of the work activities in executing set of activities that has been planned, to be done by the technically operator on the field
Monitoring &	The process stage consist of monitoring and controlling Activities in tracking

| Controlling | working activities, measuring quality performance, quantifying risk and request changes improvement to increase quality performance and reduce the risk impact. |
| Closing | The process stage consist of formalization activities that be sign of business process has completed |

Within the Initiating-Closing stage the adaptive ERP has advantages flexibility in managing the duration of management cycle, where companies can choose monthly, quarterly, semiannual or annual year dynamically on its cycle. For later in every cycle can be integrated without would have affected to transaction has been running during the previous cycle.

The addition of the WBS incoming operational management not based on daily operational to manage overall resources. WBS hierarchically structured to manages overall resources inherent within processes and activities. This approach is inherent with *Activity Base Cost* (ABC) [21], as shown in Figure 5. WBS as a basis of planning, executing, and monitoring-controlling in dynamically operational, and tracking both overall and detail financial transactions.

IV.   RESULTS

From one of implementation sharing result in PT. Iglas Indonesia as one of State Owned Corporate that is producing glass bottles to serve various demands of beverage and pharmaceutical industry with mass production and use *make to order* supply type, it was founded that the strategy of using project management to operational transactions in the Adaptive ERP system is more suitable compared with a previous information system.

By using this system, the organization's is easier to manage budget planning, calculating the unit cost of production, calculating variable costs, and incomes financial quality measurement and risk controlling for each production activity, and other various financial analysis.WBS Also dynamically applied in other operational domains , such as: Material Production, Inventory-Warehouse, Human Resource, Asset management, CRM, and SCM.

V.   CONCLUSION

This study concluded, The Adapted ERP that has supported by project management principal and knowledge's has visibility to fulfill standardization ERP operational management, and has flexibility for managing operational duration by using process groups and allocating details operational in activity base cost inside WBS.

VI.   FUTURE WORKS

On the future study will have been required to describe SOA pattern to support the Adaptive ERP development [22], and also Business Process Innovations (BPI) with process mining auditing [23] in overall ERP modules such as: Financial Accounting, Material Production, Inventory-Warehouse, Human Resource, Asset management, CRM, and SCM. Also to fulfill ERP-BI supporting can be used many key performance indicators [24] from extraction data in OLAP and big data as predictive analysis.
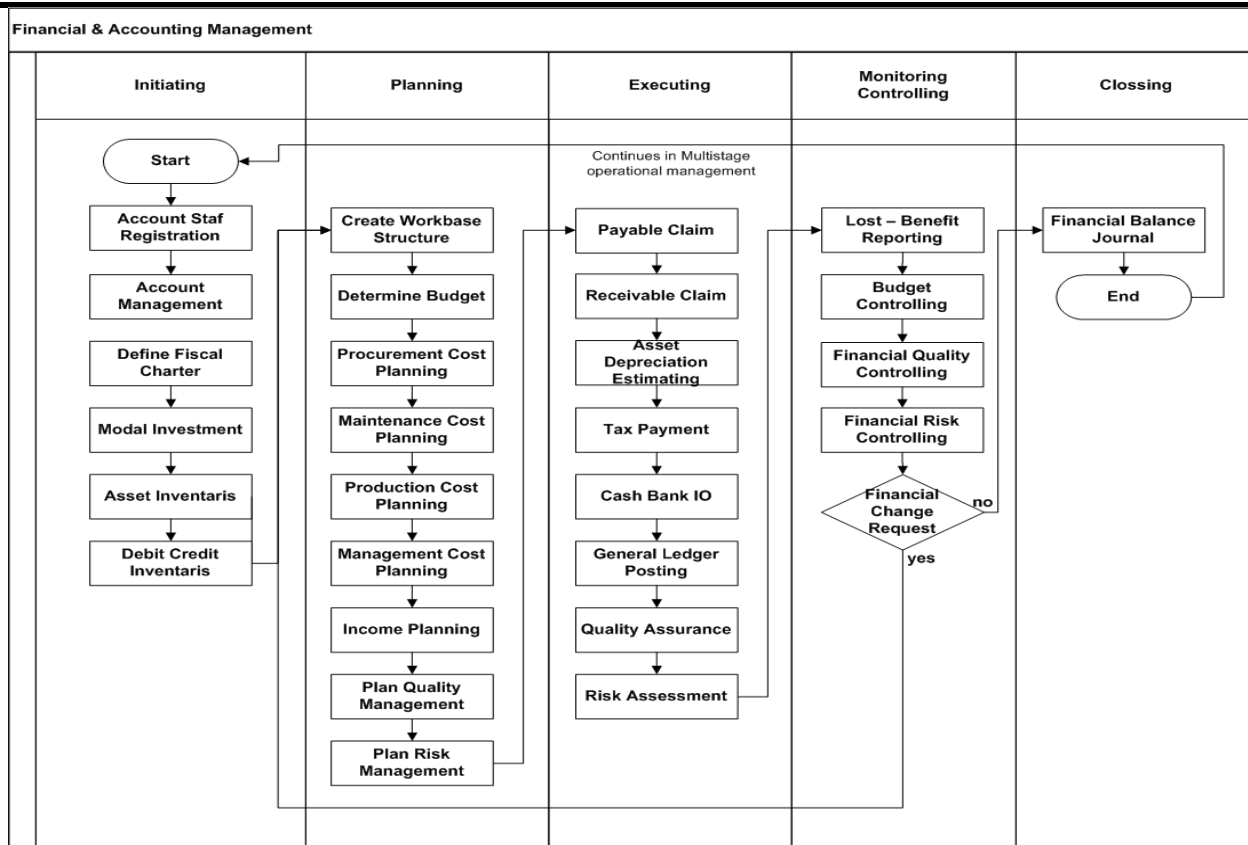
ACKNOWLEDGEMENTS

Fig.5: The Business Process of Financial Accounting within the Adaptive ERP (Source: Author's Compilation, 2016).
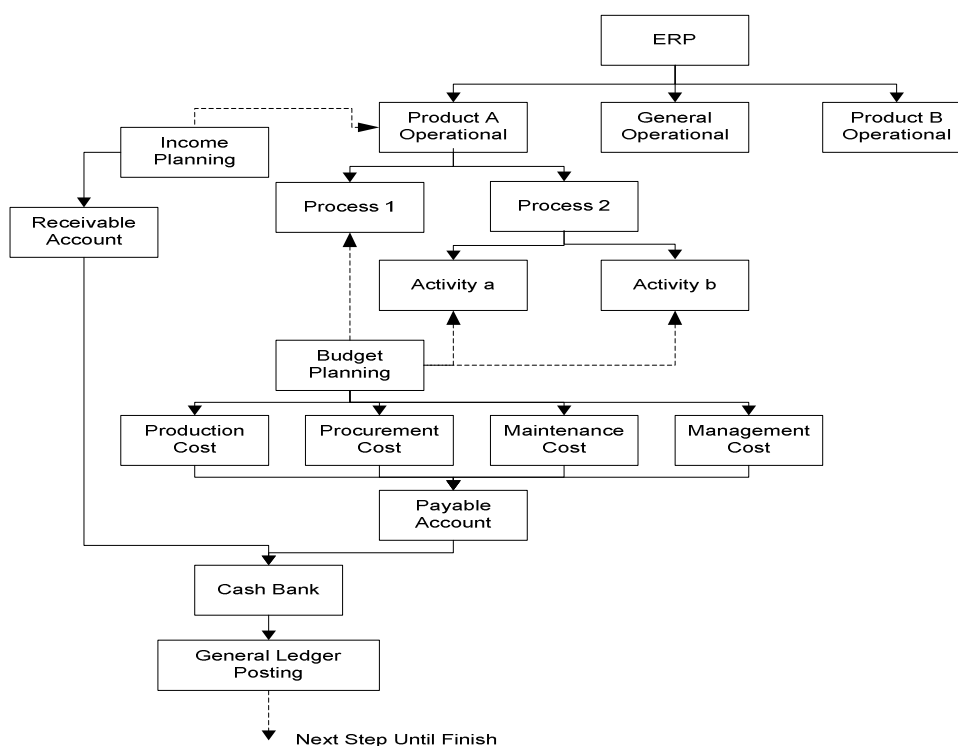

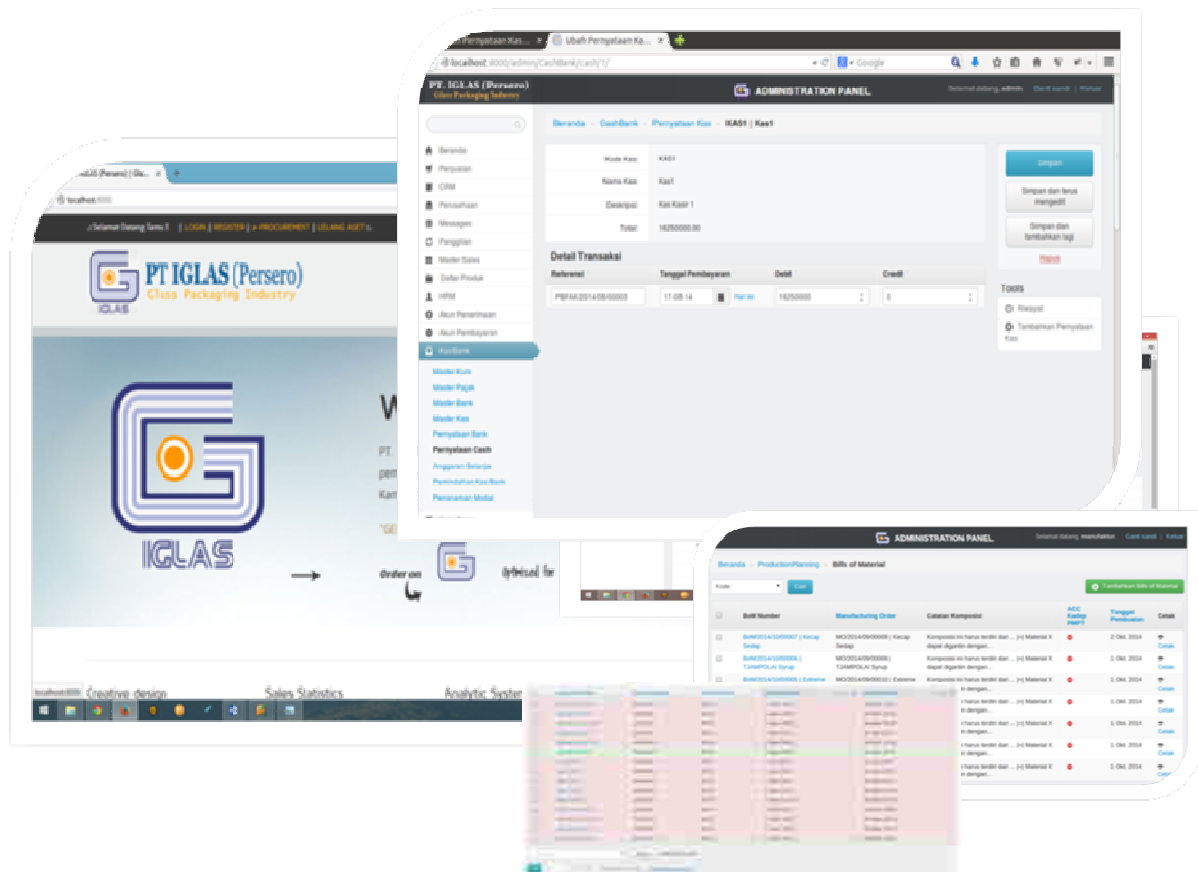*Fig.6: Operational transaction within WBS activity of the Adaptive ERP (Source: Author's Compilation, 2016).*

Fig.7: The Adaptive ERP Software Share Implementation in PT. Iglas Industry (Source: Author's Compilation, 2016).

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