DEVELOPMENT OF SWIM LANE WORKFLOW PROCESS MAP FOR ENTERPRISE WORKFLOW MANAGEMENT INFORMATION SYSTEM (WFMIS): A CASE STUDY OF COMSYSTEM COMPUTER AND TELECOMMUNICATION LTD (CCTL) EKET

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ABSTRACT

Across the globe business organizations are faced with growing global competitions and ever-changing business environment. In order to contain the challenges and at the same time establish or sustain solid competitive advantage, organizations must focus on automating, optimizing, and continuously improving their core business processes. Accordingly, in this paper, the popular Swim Lane Process Map is used to describe the "as-is" workflow process map, as well as the "to-be" workflow process map for CCTL Enterprise Workflow Management Information System. The development of the "as-is" and the "to-be" Swim Lane Workflow Process Map is approached using Software Requirement Engineering Methodology. The "as-is" workflow process map is used to identify the 'bottleneck' steps and the aspects of the current workflow that requires improvements. Task analysis of the "as-is" and the "to-be" workflow process models, showed that, the "to-be" workflow model has approximately, 72.2% reduction in manual tasks, when compared to the "as-is" workflow model.

Keywords: Workflow, Process Map, Information System, Workflow Management, Swim-lane Diagram.

INTRODUCTION

Nowadays, many business enterprises are continually striving to address the challenges of global competition, financial upturn, and re-invention of their services and products. Such running challenges have also necessitated the adoption of Workflow Management Systems (WfMS) in many enterprises. WfMS allows organizations to define and control the various activities associated with their business processes, Georgakopoulos, Hornick and Sheth, (1995). Workflow management involves: process modelling, that entails workflow models and techniques for capturing and describing processes; process re-engineering, that entails techniques for optimizing the processes; and workflow implementation and automation, that entails methodologies and technologies for using information systems and human performers to implement, schedule, execute and control the workflow tasks as described by the workflow specification, Mentzas, Halaris, and Kavadias, (2001); Georgakopoulos, Hornick and Sheth, (1995). A workflow is basically a collection of tasks organized to accomplish some business process, Mentzas, Halaris, and Kavadias, (2001). Workflow map is a visual representation of the workflow, namely, the steps, the decisions, the actions, or the tasks performed to achieve a certain result. Workflow maps give practitioners an easy and quick way to visualize common processes from beginning to end. Developing a process map, or a visual depiction of a process, can help clarify workflow, identify bottlenecks and outline dependencies. Swim lane workflow maps also show who performs each part of the process and the resources used in performing them.

The focus in this paper is on the development of improved Swim Lane Workflow Process Map for Comsystem Computer and Telecommunication Ltd (CCTL), Eket. CCTL is a Nigerian enterprise that deals on Computer and Telecommunication projects and services. The head office of CCTL at Eket has a number of departments that includes the IT/Technical Computing and Maintenance (ITTCM) unit. The ITTCM unit renders equipment repairs along with computer and network maintenance services to all the departments in CCTL.

Presently, the workflow process management for the centralized computer maintenance and equipment repairs unit is paper-based and not explicitly defined. However, demand for sustainable improvement in workflow process requires explicit documentation of the "as-is" workflow process and the development of "to-be" workflow process. Inevitably, the "as-is" workflow process with the several flaws constitutes a burden to CCTL business operations. Hence, the re-engineering of the "as-is" workflow process model to the "should be" or "to-be" workflow process model is urgently needed to address the observed shortcomings.

Accordingly, in this paper, the popular Swim Lane Process Map is used to describe the "as-is" workflow process map, as well as the "to-be" workflow process map for CCTL - Enterprise Workflow Management Information System (WFMIS). The development of the "as-is" and the "to-be" Swim Lane Workflow Process Map is approached using some aspects of Software Engineering Methodology. Finally, comparative task analysis shows that the "to-be" workflow process model will bring significant reduction in manual tasks when compared to the existing undocumented "as-is" workflow process model.

REVIEW OF RELEVANT LITERATURES

Workflow Management

The Workflow Management Coalition (WfMC) defines workflow as: "the automation of a business process, in whole or part, during which documents, information or tasks are passed from one participant to another for action, according to a set of procedural rules.", Chinosi and Trombetta, (2012); Van Der Aalst, TerHofstede, and Weske, (2003); Reijers, (2003) ; Lawrence, (1997). Workflow management (WFM) can be defined as a technology supporting the reengineering of business and information processes, Georgakopoulos, Hornick and Sheth, (1995). Workflow management involves: process modelling, that requires workflow models and techniques for capturing and describing a process; process reengineering, that requires techniques for optimising the process; and workflow implementation and automation, that requires methodologies and technologies for using information systems and human performers to implement, schedule, execute and control the workflow tasks as described by the workflow specification, Mentzas, Halaris and Kavadias, (2001). On the other hand, a Workflow Management System (WFMS) is defined as: "a system that defines, creates and manages the execution of workflows through the use of software, running on one or more workflow engines, which is able to interpret the process definition, interact with workflow participants and, where required, invoke the use of IT tools and applications" Chinosi and Trombetta, (2012); Van Der Aalst, TerHofstede, and Weske, (2003); Reijers, (2003) ; Lawrence, (1997).

Mentzas, Halaris and Kavadias, (2001) examined the ways in which workflow technology may facilitate the implementation of process management. They further reviewed the pros and cons of adopting alternative workflow representation techniques in modelling business processes and provided guidance to managers as to the characteristics, the similarities and differences of the various workflow modelling schemes. On the one hand, Van der Aalst (1998) discussed the

use of Petri nets in the context of workflow management and presented some Petri-net-based work- flow tools. Trætteberg (1999) compare workflow concept with those used in task modelling and then proposed the integration of workflow and task modelling. Finally, Kim, Suh, and Lee (2002) proposed a document-based workflow modelling mechanism, which employs a case-based reasoning (CBR) technique for the effective reuse of design outputs. They proposed repository to support the CBR process.

Business Process Modelling Notation (BPMN)

Business Process Modelling Notation (BPMN) is a graphical notation that describes the logic of steps in a business process. This notation has been especially designed to coordinate the sequence of processes and messages that flow between participants in different activities, White, (2004); Ko, et al., (2009). Among different flowcharting tools used in computer science, the one mostly used with respect to Business Process Modelling Notation (BPMN) is Swim Lane diagram. Swim Lane diagram, sometimes called a Cross-Functional diagram is a special chart that shows the relationship between a business process and the functional units (such as departments) responsible for that process. A Swim Lane diagram is a process flowchart that provides richer information on who (the entity or unit that) does what and in what sequence, Fleischmann and Stary, (2012). A similar approach is used in ‘‘deployment flowcharts’’ of the Six Sigma tool set. For example, a sales process might be divided up into customer, salesperson, fulfilment, and billing Swim lanes. However, by convention, each process step exists within one and only one Swim lane, although it is conceivable that a step could span the border between adjacent Swim lanes. Instead, interaction is depicted by dashed lines connecting corresponding steps in different swim lanes, which are referred to as cross entity ‘‘messages’’, Sampson, (2012); White, Miers, and Fischer (2008).

METHODOLOGY

Mostly, development of the “as-is” and the “to-be” Swim Lane Workflow Process Maps is among the activities in the early phases of the development of a Workflow Management Information System (WfMIS). As such, the development of the Swim Lane Workflow Process Maps (SLWFPM) for CCTL is performed during the requirement engineering and system design phases of a web-based WfMIS for CCTL. In Figure 1 is the flowchart for the development of the “as-is” and the “to-be” Swim Lane Workflow Process Maps while the requirement engineering process used is given in Figure 2. The requirement engineering process involves identification of the workflow process stakeholders, as well as requirement elicitation, modelling/analysis, negotiation, specification, and management of the requirements for the development of the Swim Lane Workflow Process Maps.

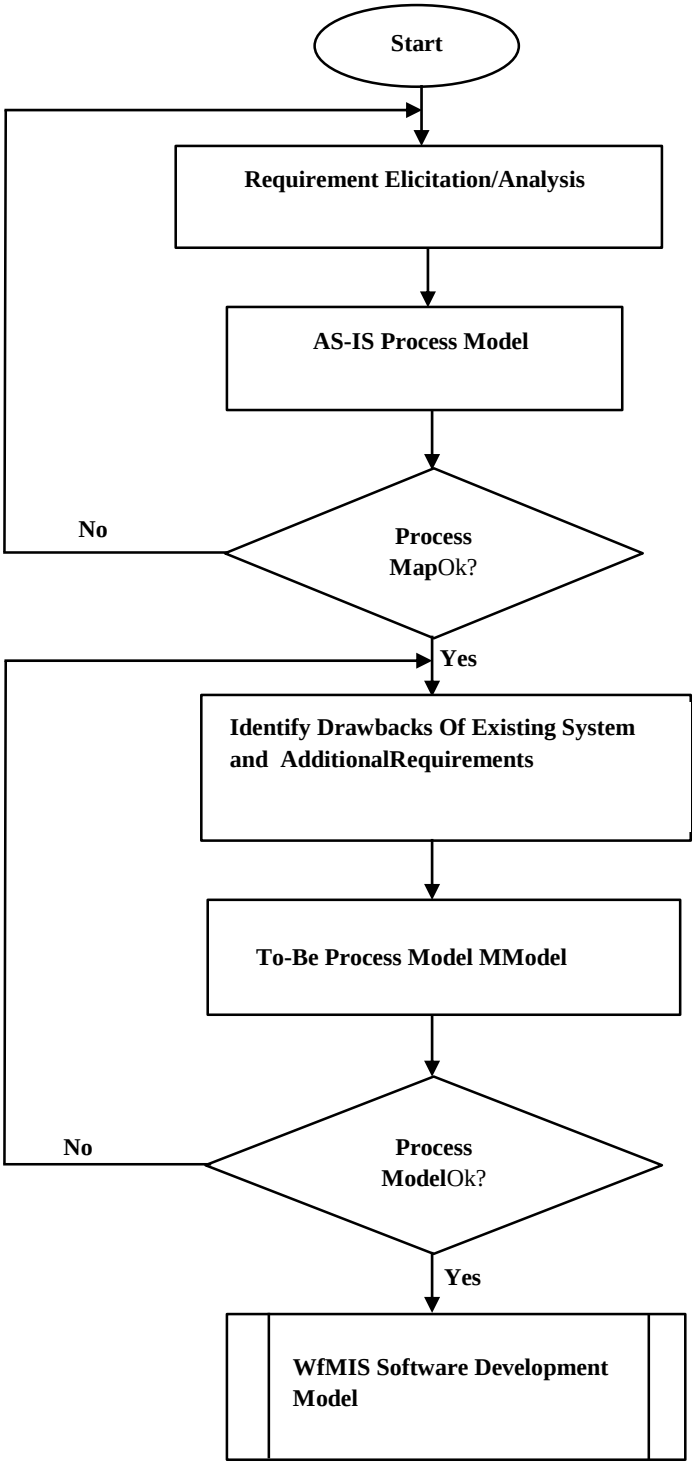

Figure 1, Flowchart For The Development Of The "As-Is" And "To-Be" Swim Lane Workflow Process Maps

In Figure 2, the first requirement elicitation approach used is ***Observation*** of the real life workflow process at the CCTL centralized computer maintenance and equipment repairs unit. Next, some of the workflow process stakeholders at CCTL are purposefully selected and interviewed as regards the workflow process being considered. Eventually, a participatory focused group that includes CCTL staff is formed to further brainstorm and discuss on the preliminary findings from the ***Observation*** and ***Interview*** requirement election activities. Specifically, use-case diagrams and low fidelity prototyping tools are used during the focused

group discussions to create more comprehensible preliminary workflow process maps for the group discussions.

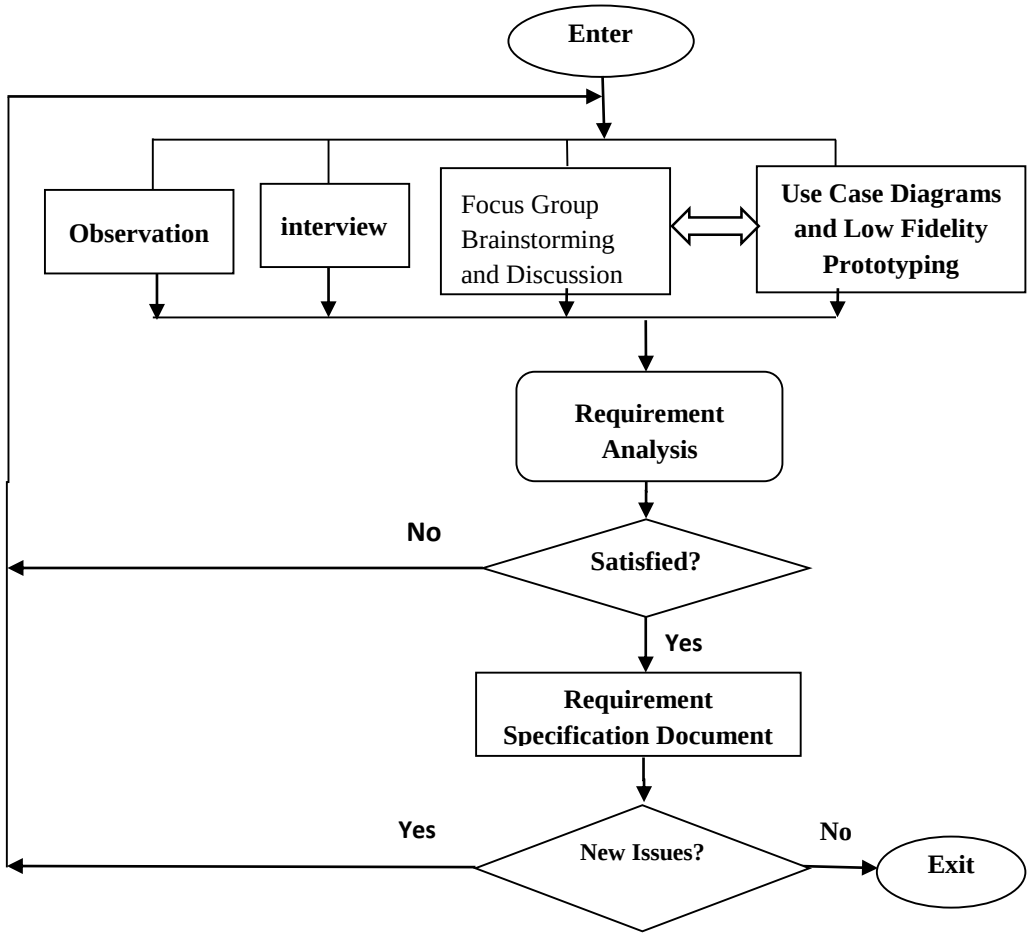

Figure 2, Requirement Engineering Process Diagram Used For The Development Of The "As-Is" and The "To-Be" Swim Lane Workflow Process Maps

Modelling of the CCTL Workflow Process

The CCTL enterprise has four departments or units, namely: administrative, accounts, marketing, and the IT/Technical Computing and Maintenance (ITTCM) unit that oversees the centralized computer maintenance and equipment repairs workflows which is the focus of this paper. Clients from any of the four departments can request for computer maintenance or equipment repairs service. The client request is called Order Service Request (OSR) and it is directed to the ITTCM unit. The Order Service Request (OSR) workflow process involves the following main business activities: User Administration, Order Submission, Order Management, and Distribution of Work Items (tasks), Documentation of Workflows and Contacts, View/Print Status. The order request remitted by clients is processed by four (4) different categories of staff in the ITTCM unit, namely; Administrative Workers, Department Managers, Laboratory Workers and Laboratory Managers. Furthermore, the OSR process model is divided into three (3) major sub-processes and four (4) sub-partitions. The three sub-processes are: Order Service Request, Work Order and Arrange Delivery. The four sub-partitions are:

- Request Submission (Order Submission):- defines all activities related to order submission or reporting of fault;
- Request Authorization (Order Management):- defines all activities related to request authorization by the clients' Department Manager;
- Work Order Creation (Order Management):- defines all activities related to work order creation and endorsement;
- Work Order Execution (Order Management):- defines all activities related to work order execution.

The As-Is Workflow Process Model

The Request (OSR) Workflow Process Model

The CCTL "as-is" Order Service Request (OSR) workflow process model is shown in Figure 3.

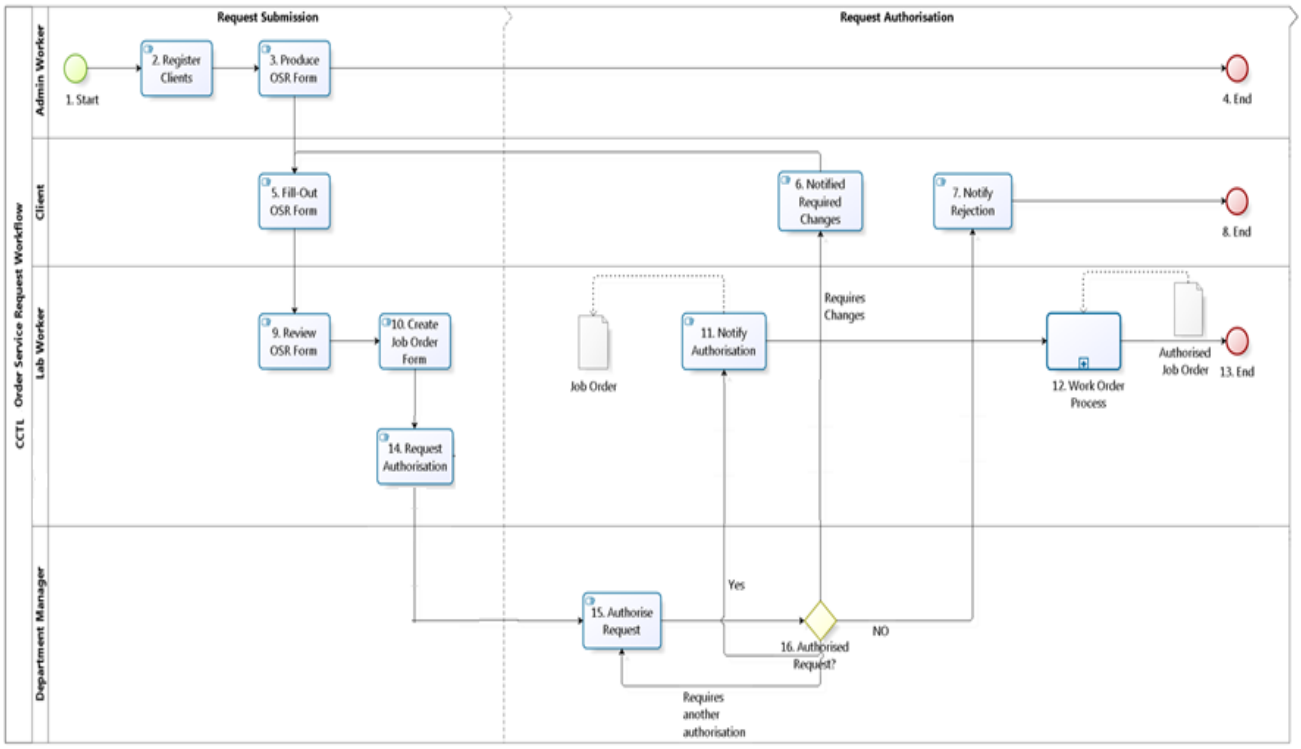

Figure 3 The CCTL As-Is Order Service Request (OSR) Workflow Process Model

The CCTL OSR process in **Figure 3** starts in Step 2 where the Admin Worker register's the clients and also in Step 3 of **Figure 3** the Admin Worker produces the OSR **Log Sheet/Form**, as shown in **Figure 4. Client in this case is any CCTL staff that may request the services of the** ITTCM unit. The OSR **Log Sheet/Form** can be used by the client to submit service request (order) or to report a fault. In the CCTL OSR process of **Figure 3, c**lient's registration process ends in Step 4. In the " as-is" **OSR Workflow Process Model of Figure 3,** the registered Client manually fill the OSR form (in Step 5 of Figure 3) and passes the filled OSR form to the Lab Worker in the ITTCM unit. In step 9 and step 10 of **Figure 3, t**he Lab Worker reviews the filled OSR log form (in Step 9 of Figure 3), analyzes the client's request(s) and uses the information in the filled OSR log form to create a Job Order (JO) form, which is shown in Figure 5.

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CCTL COMPUTER LAB ORDER SERVICE REQUEST LOG SHEET					
DATE: 12-01-15					
ITEM S/N	ITEM	SERVICE REQUEST DESCRIPTION	CLIENT	DEPT	COST
1.	HP 17" MONITOR	CUSTOMER ORDER – MONITOR NEEDS TO BE CERTIFIED OK.	FABIYI ABE	MARKETING	₦1, 400
2.	D-LINK 8 PORT SWITCH	FOR INTRA NETWORK EXPANSION NEEDS – SWITCH TO BE CONFIRM WORKING?	JOHN NWODO	IT	-
3.	HP DESKJET 6620	CUSTOMER EQUIPMENT FAILURE – PRINTER STOPPED WORKING-PAPER JAM	UBONG UNANAM	MARKETING	₦12, 500
4.	DELL LAPTOP N5050	CUSTOMER EQUIPMENT LAPTOP COMES ON BUT SCREEN BLANKS OFF	FABIYI ABE	MARKETING	₦17, 850

Figure 4, Screen Shot of CCTL Order Service Request (OSR) **Log Sheet/Form**

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JOB ORDER (JO) FORM				
DATE	OSR JOB ID	WORK TITLE	DESCRIPTION	REQUEST STATUS
12-01-15	JO-002	Repairs-Faulty Dell N5050 Laptop	Dell laptop N5050 power on but screen still turns off	Submitted

Approved by: .....
Department: .....
Sign: .....

Figure 5, Screen Shot of CCTL OSR Job Order (JO) Form

Every JO needs to be authorized by the Clients' Departmental Manager (DM) before it can be sent to the computer maintenance and equipment repairs office. Accordingly, the Laboratory Worker request for Authorization (Step 14 of Figure 3) of the completed JO form; the authorization request of Step 14 of Figure 3 is sent to the Clients' Departmental Manager. The

Clients' DM may choose to reject the request or subject the request to a number of modifications and inform the client of the required changes via phone. If the OSR is rejected, the client is notified (Step 7 of Figure 3), in that case, the order process ends (Step 8 of Figure 3). On the other hand, if the Clients' DM authorizes the OSR (Step 15 of Figure 3) the request, Clients' DM notifies the Laboratory Worker (Step 11 of Figure 3) who then collects the approved JO and takes it through the **Worker Order (WO) Process** captured as Step 12 of Figure 3 and elaborated in Figure 6, Work Order (WO), then ends OSR process (Step 13.).

THE AS-IS WORKER ORDER (WO) PROCESS

Work order process **(WO) of** Figure 6 starts with work order creation phase of OSR process, where the Lab Worker in the ITTCM unit creates work order (in Step 20 of Figure 6). Then, upon creation of WO, the Lab Worker proceeds with the WO execution (Step 24of Figure 6) or pass on completed WO form with the hardware or software material item(s) to the Lab Manager for approval (Step 33 of Figure 6). This is usually the case when material item(s) is/are needed for WO execution. The Lab manager, upon approval sends notification via phone (Step 23 of Figure 6) to the Lab worker to progress to WO execution task. The WO execution phase starts with execute work order (Step 24 of Figure 6), and terminates with update WO status tasks (Step 31 of Figure 6), where the status describes the final execution state, namely; completed or deferred. In the OSR workflow process model, completed status means an end-to-end workflow process that continued from beginning to end without interruption or any issue(s). Conversely, deferred status indicates that the end-to-end workflow process met an obstruction or issue that is out of the scope of the work order specification. In the case where the status is completed, the Lab Worker proceeds with arrange delivery (Step 30 of Figure 6) process. Otherwise, if work process is not completed, WO is deferred (Step 27of Figure 6) and work order process (Step 29 of Figure 6) restarted. At the end of the WO process, WO status is updated, client is notified (Step 17 of Figure 6), and then the entire OSR workflow process ends in Step 32 of Figure 6.

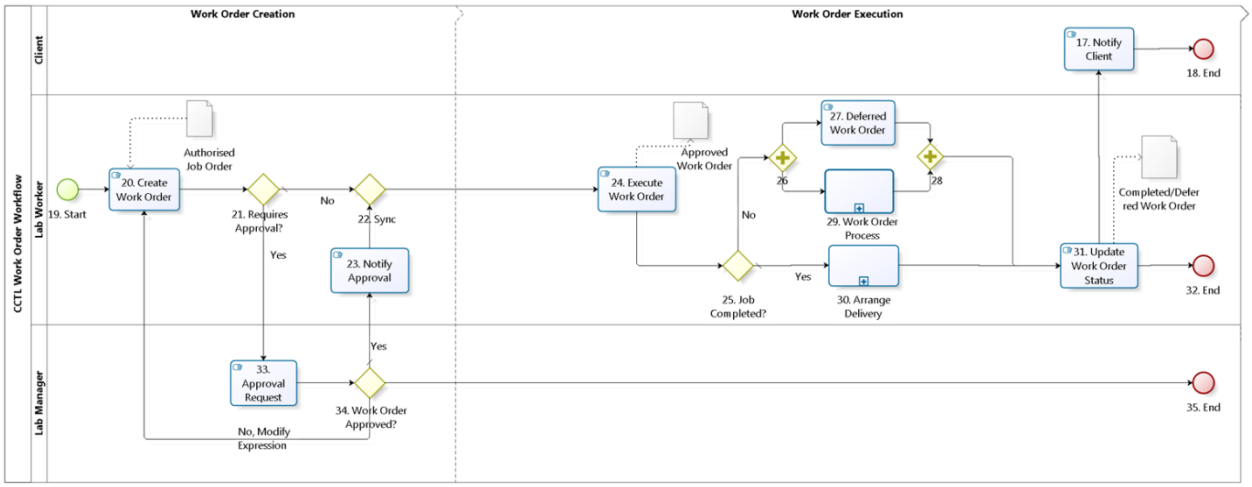

Figure 6 As-Is CCTL Work Order Workflow

Weaknesses Of The As-Is Workflow Process

The present "**as-is" workflow process model** has the following weaknesses:

- Most of the workflow activities/processes are based on direct human interaction. This give rise to excessive delay in business operations and service delivery due to manual processes involved.

- Most of the activities are documented and communicated via paper-based workflow process steps. This give rise to increasing large volume of data since there is no centralized database to minimize redundant data. Furthermore, in this type of workflow arrangement documents accumulate overtime and become unmanageable.
- Reduced reliability and productivity as there were no well-defined end-to-end procedures to satisfy and follow–up clients' requests.
- Lack of efficient mechanism for systematic viewing or printing of reports of the different OSR cases or system variables which affects future planning and expansion.
- Increasingly level of risk and high incidents errors due to high level of manual activities.
- Lack of balanced and timely distribution of resources needed for high quality service delivery.
- Under utilization of company's existing facilities like inter and intra network or IT facilities
- Low user satisfaction due to all of the above shortcomings of the "as-is" workflow process.

The "To-Be" Process Model Definition
User Registration And User Access Management

User registration starts (in Step 1 of Figure 7) with the user/client notifying the system administrator (Administrative Worker) of any access needs or issues. Upon the reception of the user/client login challenge notification, the Administrative Worker signs in (Step of Figure 7) and creates (Step 3 of Figure 7) new user account or rectifies the access issues via manage settings (Step 4 of Figure 7). The Administrative Worker then provides feedback through e-mail to the user/client (Step 10 of Figure 7). In the case of new user, Administrative Worker sends account details (username and password) for sign in via e-mail to the user/client; the registration process ends (Step 5 of Figure 7).

The Order Service Request (OSR) Process

The "to-be" Order Service Request (OSR) process model, shown in Figure 7 starts in Step 6 with a registered client signs in Step 7 of Figure 7 using his account details. Non-registered system users are registered by Admin Worker via registration process stated above. Upon successful login, the client can submit order or report a fault by updating online OSR form (Step 9 of Figure 7). Once the request is submitted by the client, the system automatically notifies the client's Departmental Manager (DM) who needs to authorize it (Step 17 of Figure 7). In order to authorize OSR form, the DM signs in (Step 18.), views and then authorizes the request (Step 19.). The DM may choose to reject request or subject the request to a number of modifications. If the OSR is rejected, the system will automatically notify the client via e-mail ofthe rejection (Step 12.), then the order process ends (Step 13.). In the case where the OSR form is modified, the client will be notified (Step 11.) via phone by the DM of the required changes. On the other hand, if the DM authorizes the request (Step 19.), the system will automatically notify the Laboratory Worker (Step 14.) who will need to sign in, to process the authorised OSR form for the Work Order Process in Step 15. Then OSR process ends in Step 16 after the Work Order Process in Step 15.

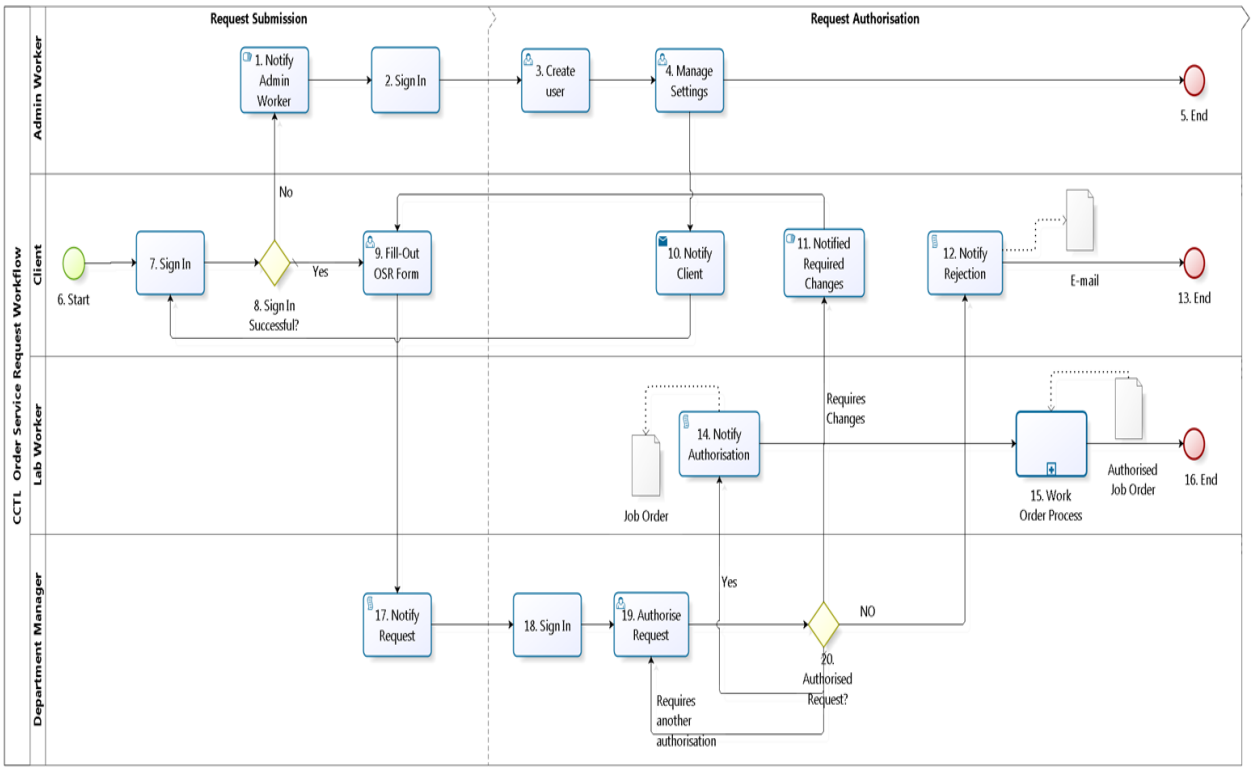

Figure 7 The "To-Be" CCTL Order Service Request Workflow Process

The "To-Be" Worker Order (WO) Workflow Process

The "to-be" WO process starts with work order creation phase of OSR process, where the Laboratory Worker in the ITTCM unit signs in (Step 24 of Figure 8) updates/creates online work order (Step 25 of Figure 8.)and submits it for the Laboratory Manager's approval when material item is needed for the execution of the OSR. The Laboratory Manager is the IT/Technical Computing Unit Manager. When material item(s) is/are not required, upon online completion of WO, the Laboratory worker proceeds with the execution of the work order (Step 29.). When material item(s) is/are needed for WO execution, upon online submission of completed WO by the Laboratory Worker, the system will automatically notify the Laboratory Manager (in Step 38). Laboratory Manager signs in (Step 39.), approve request (Step 40.) At this stage, the Laboratory Manager may request for modification for number of times within the time frame from the Laboratory Worker via phone before final approval. Upon approval by the Laboratory Manager, the system automatically sends notification (Step 28.) to the Laboratory worker to progress to WO execution processes. This is usually the case when material item(s) is/are needed for WO execution.

The WO execution phase starts with execute work order (Step 29.) and terminates with update WO status (Step 36.), where the status describes the final execution state, which can be completed or deferred. In the case where work process is completed, the Laboratory Worker proceeds with arrange delivery process (Step 35). Otherwise, if work process is not completed, WO is deferred (Step 32.) and work order process (Step 34.) restarted. At the end of the WO process, WO status is updated (Step 36.), client is notified (Step 21.), and then the entire "to-be" OSR workflow process (Step 37).

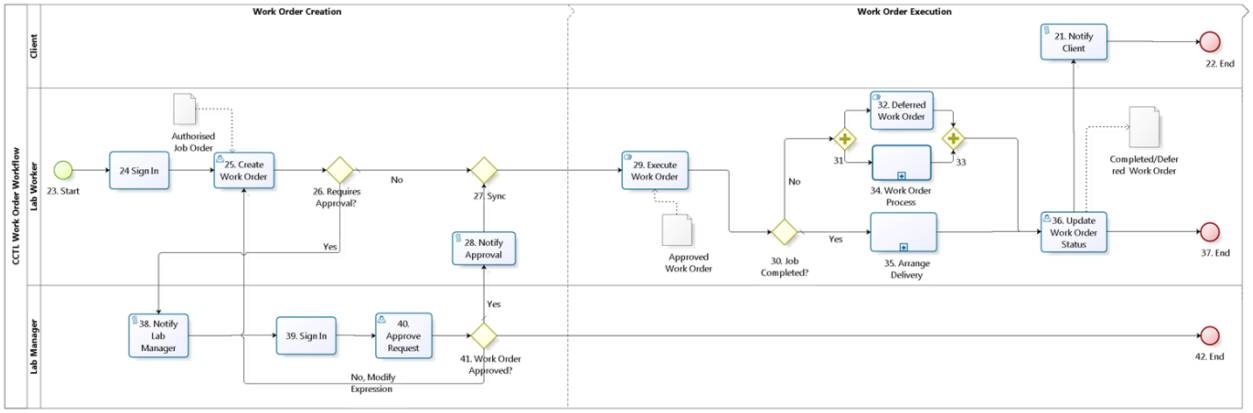

Figure 8, The "To-Be" Worker Order (WO) Workflow Process

Analysis Of The OSR Workflow Core Tasks

The core tasks of the "as-is" OSR Workflow and the "to-be" OSR Workflow are evaluated. In the "to-be" OSR Workflow, some of the tasks are automated, that means, the tasks are performed automatically by the system in which case software programs or script runs and performs the tasks. However, some of the "to-be" OSR Workflow tasks are performed by humans with the assistance of software (as represented in Table 1). In essence, the "to-be" OSR Workflow runs a semi-automated process model. The "as-is" OSR Workflow runs on manual mode only. The overall tasks analysis of the "as-is" and the "to-be" OSR workflow process models, as shown in Table 1, indicates significant reduction of the manual processes in the "to-be" OSR workflow model when compare to the "as-is" OSR workflow model. The data valuesin Table1 indicate that the "to-be" OSR workflow model has approximately, 72.2% (that is, 100% - 27.8% = 72.2%) reduction in manual tasks when compared to the "as-is" OSR workflow model.

Table 1 OSR Workflow Tasks Analysis For The CCTL "As-Is" And The "To-Be" OSR Workflow Process Models

OSR Workflow Tasks	"As-Is " Workflow Process ModelTasks Rate			"To-be" Workflow Process ModelTasks Rate		
	Manual	*Semi-Automated*	*Automated*	*Manual*	*Semi-Automated*	*Automated*
Request Submission	*5*	-	-	*1*	*1*	*1*
Request Authorization	*4*	-	-	*2*	*3*	*2*
Work Order Creation	*3*	-	-	-	*2*	*2*
Work Order Execution	*4*	-	-	*2*	*1*	*1*
Total	*16*			*5*	*7*	*6*
Percentage Of manual Tasks	$\left(\frac{16}{16}\right) * 100\% = 100\%$			$\left(\frac{5}{18}\right) * 100\% = 27.8\%$		

The proposed system is expected to deliver the following key business functions:

- Security Policy which Utilizes Dynamic User Privileges that allows different levels of access to different categories of users of the system.

- Online Access which allows submission, sharing, and monitoring of OSR workflow tasks , as well as online viewing and printing of reports.
- Online moderation, management and endorsement or authorization of OSR workflow tasks and services.
- Request Status Facility which allows system stakeholders to closely follow-up the progress of requests and get timely notification of status.
- Personnel Performance Status which allows monitoring of personnel performance and helps in optimizing job allocation and time sharing.

CONCLUSION

In this paper, the "as-is and the "to-be" workflow process models for CCTL at Eket is developed and discussed. Software development methodology is employed in the development of the models. Comparative task analysis shows that the "to-be" workflow process model significantly reduced the amount of manual tasks when compared to the existing undocumented "as-is" workflow process model.

CCTL can use the various workflow process steps and flows presented in the "to-be" workflow process model to identify the functionalities in CCTL's enterprise Workflow Management Information System (WFMIS). In essence, the "to-be" workflow process model developed in this paper serves as the basis for the development of automated or semi-automated enterprise WFMIS. Also, it is the tool for further workflow process improvement.

RECOMMENDATION FOR FURTHER STUDIES

In this paper, the "as-is and the "to-be" workflow process models are developed for CCTL Eket. The "to-be" workflow model is essential for the development of Workflow Management Software (WfMSW) for CCTL. However, development of the WfMSW is not discussed in this paper. As such, further work is required develop the workflow management software based on the "to-be" workflow model presented in this paper.

REFERENCES

Chinosi, M., &Trombetta, A. (2012). BPMN: An introduction to the standard.Computer Standards & Interfaces, 34(1), 124-134.

Fleischmann, A., &Stary, C. (2012). Whom to talk to? A stakeholder perspective on business process development. Universal Access in the Information Society, 11(2), 125-150.Sampson, S. E. (2012).Visualizing service operations. Journal of Service Research, 1094670511435541.

Georgakopoulos, D., Hornick, M., &Sheth, A. (1995). An overview of workflow management: From process modeling to workflow automation infrastructure.Distributed and parallel Databases, 3(2), 119-153.

Kim, J., Suh, W., & Lee, H. (2002). Document-based workflow modeling: a case-based reasoning approach. Expert systems with applications, 23(2), 77-93.

Ko, R. K., Lee, S. S., &Wah Lee, E. (2009). Business process management (BPM) standards: a survey. Business Process Management Journal, 15(5), 744-791.

Lawrence, P. (ed.) (1997): Workflow Handbook 1997, Workflow Management Coalition. John Wiley and Sons, New York, 1997.

Mentzas, G., Halaris, C., andKavadias, S. (2001). Modelling business processes with workflow systems: an evaluation of alternative approaches. International Journal of Information Management, 21(2), 123-135.

Reijers, H. A. (2003). Design and control of workflow processes: business process management for the service industry. Springer-Verlag.

Trætteberg, H. (1999). Modeling work: Workflow and Task modeling.InComputer-Aided Design of User Interfaces II (pp. 275-280). Springer Netherlands.

Van der Aalst, W. M. (1998). The application of Petri nets to workflow management. Journal of circuits, systems, and computers, 8(01), 21-66.

Van Der Aalst, W. M., TerHofstede, A. H., and Weske, M. (2003). Business process management: A survey. In Business process management (pp. 1-12). Springer Berlin Heidelberg.

White, S. A. (2004). Introduction to BPMN. IBM Cooperation, 2(0),

White, Stephen A., Derek Miers, and Layna Fischer (2008). BPMN Modeling and Reference Guide. Lighthouse Pt, FL: Future Strategies.