DEVELOPMENT AND EVALUATION OF A SIMPLE IT PLATFORM FOR RAW MATERIAL MANAGEMENT: A CASE STUDY OF OLAM COTTON GINNERY FACTORY IN UGANDA.

APUULI JOHN

AN INDEPENDENT STUDY REPORT SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF SCIENCE IN LOGISTICS AND SUPPLY CHAIN MANAGEMENT

INTERNATIONAL COLLEGE
KING MONGKUT'S INSTITUTE OF TECHNOLOGY LADKRABANG

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INDEPENDENT STUDY TITLE	Development and evaluation of a simple IT platform for Raw material management: A case study of Olam cotton ginnery factory in Uganda.
STUDENT NAME	Mr. Apuuli John
STUDENT ID	59610059
DEGREE	Master of Science
PROGRAMME	Logistics and Supply Chain Management
ADVISOR	Asst. Prof. Dr. Phaophak Sirisuk

ABSTRACT

Information and data handling have never been a smooth operation more especially in Micro Small Medium Enterprises, even though there are off shelf ERP tools that could redeem the situation. This has not been an option to the majority if any in the Sub Sahara. This is due to the extremely expensive cost of deployment and tooling, maintenance, licensing, implementation besides the complexity of usage and comprehension that often necessities the vendor's certifications yet they depreciate at a breakneck speed. In context, a study was carried on the data - information management and handling challenges resultant from the conventional paperback/file storage as experienced by Olam Uganda Ltd at Hoima Cotton Ginnery, a typical example. The core operations of the ginnery operations were sequentially tracked, investigated and studied such that they could be mapped to yield datasets on would be used produce computer algorithm leveraging data flow diagrams and later flow charts with corresponding pseudocode for documentation, comprehension on which a web-based cotton ginnery management system is developed. Results from the study gathered with a timer and satisfaction questionnaire as felt by stakeholders exhibited that the incorporation of the custom scalable system would viable and practical. Implementation of digital technology would solve the control weaknesses with inefficiencies in logistics and supply chain in Small and Medium Enterprises on budget cost.

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This study project has been a collaboration of very kind and friendly people that I owe appreciation in their respective capacities of contribution. Your efforts were invaluable, immeasurable and priceless.

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I would appreciate the entire community of Olam ginnery and all other stakeholders that participated in the study though you requested to stay anonymous. Well, thanks for the participation.

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Apuuli John

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LIST OF DEFINITIONS

CDO	Cotton Development Organization
CI	Continuous Integration
CD	Continuous Deployment
SOAs	Service-Oriented Architectures
SOAP	Simple Object Access Protocol

CHAPTER 1

INTRODUCTION

1.1 Research Background

Uganda for the past decade has experienced and embraced enormous amount of development than ever anticipated, there are a lot of combined factors that could have yielded this success. Among them is the continuous engagement of Information Communication and Technology(ICT) in outreach, research and agricultural education(Tenywa et al., 2008).

In this study we would focus on Small Argo processing industries in Uganda on how they would leverage technology to embrace efficient Supply chain systems and logistics. Uganda is an agrarian economy. Argo businesses are main sources of employment to a population that is about 78% youth. In a report by AgriProFocus, a community non-government organization observed that Agriculture employees 73% labor force which translated to 26% of GDP in 2015/16.(Alex, 2018).

For the proceeding financial year, the Government would increase the allocation of funds to the agricultural sector in the 2016/2017 budget to UGX 832.42 billion which represents a 65% increase. With an objective to extend extensional cautiousness among services to local communities as close as possible. This was in response to the numerous studies that suggested that Youth engagement in agriculture would help contain the nightmare proportions of the Unemployment.(Ahaibwe, Mbowa, & Lwanga, 2013).

The most commercial crops grown comprise of Sugarcane, Cotton, Tea, Grains and Coffee which contribute to 20% of gross export earnings and next to third of foreign exchange earnings. Under the National Development Plan 2.(UIA) this percentage is forecasted to increase substantially with the continued incorporation of Agro-

processing/Value-addition of these traditional cash crops products with a special emphasis on cash crops mainly in cotton ginning, tea processing, coffee hauling and tobacco handling among others.

However, a report last year by aBitrust (http://www.abi.co.ug/) which had supported over 230 agribusinesses, many of which farmer organizations and small companies were, for the period of 2010-2016 and found that about 60 % of them had questioned expenses. These were due to fraud or misuse of funds, Internal control weaknesses with inefficiencies related to budget monitoring and management, cash handling, management of procurements, asset management and management of document storage or filing systems.(aBi, 2017).

1.2 Problem statement

A special focus for this independent study, is based on the data - Information Management and handling problems as experienced Olam Uganda Ltd at Hoima Cotton Ginnery in their operations routines among these are:

Fraud, this the most rampant Indiscipline. the tickets aren't electronic to be moved securely between the respective offices, once they are issued the clerk is obligated to move with them during the intermediate process especially when trying to ascertain tonnage from the weighbridge, the difference between laden and tare weight. This often leads to accumulations of farmers in the queue, delays the process which in-turn may compromise with the efficiency of the system. Record books are vulnerable to weather, during rainy seasons they often tore, get dump which eventually leads to loss of information. Its commonly realized in the long season when the ginning extends to the months of March and April rarely does it make it to May.

There is less confidentiality with the way information is kept throughout the whole hierarchy as anyone in proximity with the record-book can acquire the information that breaches the trust of the farmer in case his or her details are exposed for misuse. The paper/ book filling is labor intensive in most of the case couple of them are filled and are of different format of which the same information must be the entered by CDO representative to avoid information inconsistency.

Most of the clerks are seasonal workers, change in personals means different handwritings and literature synonyms that are not company standards thus, compromising integrity in data capture. Delay in information traversal due to accumulated hardcopy documentation through the administration hierarchy, hence blocking Agile decision making that would be of competitive advantage. Warehoused hardcopy documentation is often never visited for analysis which may contain the necessary information for planning and forecasting. As the activity of iterating through the archives is monotonous. Therefore, it would be rewarding to investigate and evaluate the current in-production data information capture former and later handling, then propose new ones that may later entail better, practical and secure leveraging the currently available technology with next to none adaption expense but with an enormous amount of value and benefit.

For a typical example of promising small and medium Enterprises that is in the realm of Agro-processing industry. Olam Uganda ltd best suits the description and such would be appropriate for our case study.

1.3 Objective of the study

1. To study, investigate and evaluate the paperback data/information management system.

2. To develop a simple scalable ginnery management system
3. Compare the benefit of the developed system with the conventional one in operation.

1.4 Scope of the Study

To develop web-based system Cotton ginnery management system integrating the functional component of Procuring seed cotton, ginning to produce lint in bales and cotton seeds then Sale to Lint Customers to consolidate the data management centers into one central database in the Ginnery routine activities.

Deploy a prototype to collect the data for analysis, subjective to the questionnaires.

1.5 Methodology

With this study we would study the existing working model of ginnery. Analyze how the three core departments integrate for the holistic objective. Then collect data from operational paperback file storage. Then we would design a novice web-based application that would implement the data and information management from the comprehended working model. The objective of this study is to solve a real information problem in the ginnery, where most of the data entered in files are never revisited and if considered it takes time to traverse the magnitude of the accumulated, isolated, disintegrated and unstructured storages.

User satisfaction and experience survey would be presented as a questionnaire to compare the working environment and productivity between the conventional paperback/file storage and application after deployment. Analysis of data from the Survey for evaluation of relevancy of the system.

CHAPTER 2

LITERATURE REVIEW

2.1 Cotton Industry in Uganda

Streicher, a French Catholic priest, later the Bishop of Rubaga. Introduced the first variety of cotton in Uganda in 1897 this was later replaced by the better variety in 1904 by Kristen Eskildsen Borup as commercial (cash crop) in Uganda after the success of the predecessor variety.(Mugabe, 2014)

Officially cotton growing was introduced in Uganda by the British Cotton Growers' Association under the then British Colonial Government as the first cash crop followed by coffee than tea later tobacco. It was adopted on small-scale farming in the central region of the country, Uganda. Ginning was done in Kenya in the White-owned ginneries with the Indians as the middlemen for both the seed cotton and the lint. Lint would later be exported to Liverpool for subsequent processing in the British Textile Mills. The crop was initially grown only in the Central Region was received by other regions hence spreading to the rest of the Country. Its reported that between 1903 and 1930, cotton was grown purely as a Government crop, mandatory for every homestead to have at least 0.5 hectares as a way of generating a reasonable income. Highest production would be observed as it rose steadily to 44,000 bales in 1920.

For more than a decade, cotton has consistently maintained third largest export commodity after coffee and tea. By 2013 it was a source of livelihood to more than two hundred fifty thousand households, though currently its anticipated to more than 600,000 with an increased area under cultivation. It's cultivated with limited applications of pesticides or insecticides and even fertilizers due to complaint climate.

Cotton is a crop identified with peasants after subsistence farming with a garden of the average size of 0.5 hectares.

Table 2.1 Schedule for Cotton Planting, Harvesting and Marketing season.

Regions	**Planting Periods**	**Harvesting Periods**	**Marketing Periods**
Northern	May- June	December-February	Jan- May
Eastern	May- June	December-February	Jan- May
Western	July- August	January-March	February-June
Mid Western	July- August	January-March	February-June
Central	July-August	January-March	February-June
West Nile	June- July	January- March	February-June

Cotton Development organization, a statutory body reported an increase in yield of 1250 kg/ha by 2010 of seed cotton production as registered by ginners from 625 kg/ha then 1994. Mountain Rwenzori was celebrated for the great contribution amongst all the cotton growing regions. Since then the industry has exhibited consistent growth overall.

With the Cotton Development Act enacted in 1994. The Cotton Development Organization (CDO) was created to promote and regulate production, processing and marketing of cotton. As consequent of the economy shifting towards liberalization. In a liberalized marketing environment, cotton farmers have assured spot cash payments for their crop at the farm gate and a robust private sector emerged. From 1995 onwards, the cooperative unions were relieved from their heavy indebtedness, following their acceptance to dispose all excess ginneries to creditworthy operators and only retain one for their own use. Certification of seeds by the National Seed Certification Service (NSCS) was initiated to ensure seed purity and viability.

2.2 Cotton Ginning

For clarity, Ginning may be interpreted as machining. Cotton Ginning refers to mechanical processes and activities that separate cotton fiber from cotton seeds. Earlier, ginning was done by hands this meant huge labor and time expense though it was appreciated of the lint it produced and the minimal damage on the seeds that would later be used to re-grow cotton and the damaged for production of edible oils, soap, textiles, and seed cake for livestock feeding, among others.

Later, in advance the industry saw the rise of the ginning mill which becomes more of the industry standards, though now we have seen the gin saw. Currently there are 40 ginneries in Uganda, two of which have Gin saw technology but predominantly gin mills. They registered an average national total of installed seasonal ginning capacity of around one million bales of lint production (200,000 tons) by 2013.

Uganda cotton can be categorized as a medium to medium long-staple variety. It is 100% handpicked and almost 100% roller ginned, which makes it a premium fiber. It is common acknowledge that roller ginning is ‘gentle’ as compared to saw ginning as the prior preserves the characteristics and the integrity of fiber. Ugandan Bales are majorly roller-ginned cotton bales with slight variation as per bale press vendor and make, though the majority of proprietary ginners have conformed to the international standards, that are tightly observed through the respective regulatory bodies.

Atypical bale exhibits the following properties

- ✓ Length: 104 cm
- ✓ Width: 51cm
- ✓ Depth: 84cm
- ✓ Weight (Average): 185kg

- ✓ Range: 178-193kg
- ✓ Density: 415.2kg/m3

Uganda cotton grades are grouped into the roller and saw gin sets. The roller gin grades are:

Grade Standard	Major Characteristics			Value Differences.(Points /US cts/lb)	International Equivalent (USDA Standards)
	Length(Inches)	Strength (g/tex)	Micronaire		
Roller Ginned					
UCON	1 5/32 – 1 3/16	30 – 33	3.7 – 4.3	150 points (1.5cts)	Good Middling
UCOB	1 1/8 – 1 5/32	30 – 33	3.7 – 4.3	75 points(.75cts)	Strict Middling
UCOP	1 1/8 – 1 5/32	28 – 32	4.0 – 4.2	Base Grade	Middling
UCOA	1 3/32 – 1 1/8	28 – 30	4.0 – 4.2	-100 points(-1.0cts)	Strict Low Middling
UCOM	1 3/32 & Below	27 – 30	4.2 – 4.4	-225 points(-2.25cts)	Low Middling
Saw Ginned					
UCOSA I	1 3/32 – 1 1/8	28- 30	4.0 – 4.2	100 points(1.0cts)	Strict Middling
UCOSA II	1 3/32 & Below	27 – 30	4.0 – 4.2	Base Grade	Middling

Figure 2.1 Uganda official Cotton standards for 2012/2013.

Cotton classification doesn't only mean how fine or clear or how long fiber is but rather whether it meets the requirements of the finished product, the fiber characteristics must be classified according to a certain sequence of importance to the consequent process and resultant product. The importance of fiber testing to the Spinner, up the cotton chain, to predict problems associated and draw corrective measures mandates the high-volume Instrument testing. This is due to that decisive impact the running impact of production machines as well as the yarn quality and manufacturing costs. (Hule, 2013)

High Volume Instrument (HVI) testing is regularly conducted on Uganda cotton in government laboratory to confirm its intrinsic fiber characteristics.

Table 2.1 Average Fibre Characteristics (HVI Mode)

Property	**Mean**
Spinning Consistency Index (SCI)	62
Micronaire	4
Strength (g/tex)	30
Length (mm)	29
Uniformity (%)	85
Short Fibre Index (SFI)	4.5
Elongation	5
Colour Grade (CG)	31-1
Rd	75
+b	7.5
Maturity (%)	85

2.3 Application of Information Technology in Supply chain

Enterprise recourse Planning (ERP)

After the realization of the success of inventory control packages that leveraged the legacy systems as early as 1960s. for automation of inventory activities. This success bread the Material resourse planning that on stability with master production schedule, breed manufacturing resourse planning in 1980s to optimize manufacturing process through material and production requirement syncronisation. The idea of inter functional integration lead to the Enterprise resourse management integration in 1990s. further addition of packages such as advanced planning and scheduling, customer relationship management Production and supply chain management (SCM) is what is known as extended ERP in the contemporary (Rashid, 2002).

Uganda has seen active participation Supply chain management (SCM) is the 21st-century global operations strategy for achieving organizational competitiveness (Gunasekaran & Ngai, 2004).

Cloud ERP

Cloud ERP consists of Infrastructure as a Service (IaaS), Platform as a Service (PaaS) and Software as a Service (SaaS). These are deployment models virtual ERP a than on premise. Most of the propriety ERP vendors are incorporated in this architecture. (Romanov & Varfolomeeva, 2013)

Infrastructure as a Service (IaaS)

IaaS is a best suit for business with high server demands that might might require lots resources, space or capital of infrastructure modifications on their premises that might not be possible, basically it's the transfer of capital expenditure on infrastructure to an operational expenditure.

Platform as a Service (PaaS)

With platform, hardware, operating system, storage and network. Are the only one provided by the vendor, the choice of ERP are on the onus the customer not the vendor. Sytem upgrades, maintenance and any other forms of administration are customer's responsibility.

Software as a Service (SaaS)

This was developed in mind of company with minimal server resource demands. It offers the a best of breed ERP system, all maintenance issues and upgrades are performed in the interest of the subscriber depending on the terms of agreement prior to the subscription. Number of users and service level are explicit. But again evertthing is scalable as the needs of business.

2.4 Data flow Diagrams

Developer Larry Constantine of structured design, proposed data flow diagrams also known as bubble charts.(Shaw, Subramaniam, Tan, & Welge, 2001) as a practical technique based on Martin and Estrin's "Data Flow Graph" model of computation.(Chau, Cao, Anson, & Zhang, 2003). Data flow diagrams (DFD) are embraced as a standard to visualize a software system processes. DFDs though was originally developed for computer systems, they have been adapted for other business process modeling. DFDs essentially for a document of data flows or to explore a new high-level design in terms of data flow.

Figure 2.2 Data flow diagram example.

Source:https://upload.wikimedia.org/wikipedia/commons/thumb/c/c8/DataFlowDiagram_Example.png/360px-DataFlowDiagram_Example.png

Data flow diagrams are relevant for Analysis and Design phases of the SDLC. There are different notations to draw data flow diagrams (Yourdon & Coad and Gane & Sarson)(W. Stevens, 1974), defining different visual representations for processes, data stores, data flow, and external entities.

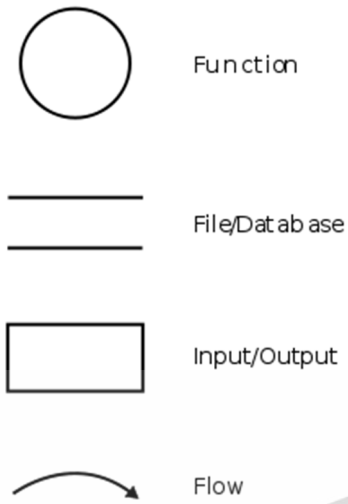


Figure 2.3 Data flow diagram - Yourdon/DeMarco notation.

Source:https://upload.wikimedia.org/wikipedia/commons/thumb/2/24/Data-flow-diagram-notation.svg/160px-Data-flow-diagram-notation.svg.png

- *Function* - is a process or activity in which data is used or generated.
- *Database* - for the persistence of data.
- *Input/output* - an external source, user or repository of the data.
- *Data Flow (connector)* - how data flows through the system

Data flow diagram is a designing tool used in the top-down approach to systems design. A Context diagram is a top-level Data Flow diagram of a processing element depicting a system model to developed, with interactions to the external environment. It disintegrates, to produce a Level 1 DFD that shows some of the detail of the system being modeled and if the resultants are as well complex another level may be desired to generate that is later drawn into a decomposition diagram for visual navigation.

2.5 Flowchart Diagram

The flowchart is a graphical representation of a process or the step-by-step solution of a problem, using suitably annotated geometric figures connected by flowlines for designing or documenting a process or program (ISO/IEC 2382:2015, Information technology -- Vocabulary).

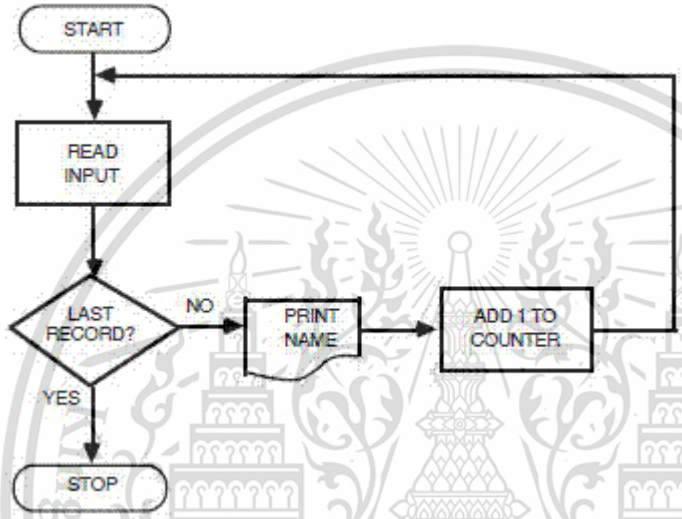


Figure 2.4 An example of a flowchart

Source https://pascal.computer.org/sev_display/images/termImages/Flowchart.gif

Flowcharts identify find flaws, bottlenecks, and other less-obvious features within a system as they track actions or decision correctly. The American National Standards Institute (ANSI) set standards for flowcharts and their symbols in the 1960s (Shelly & Vermaat, 2011). The International Organization for Standardization (ISO) agreed with the ANSI symbols in 1970. (Myler, 1998) The current standard was revised in 1985.

Table 2.3 Common Flowchart elements.

	Flowline	Shows the sequential flow standard top-to-bottom, left-to-right
	Terminal	Designates the "Start" or "End," or of system
	Process	Point of manipulation of input to generate output.
	Decision	Condition handling through provided alternatives.
	Input/output	And Request for Input Response for output.

Sterneckert (Sterneckert, 2003) suggested that flowcharts can be modeled from the perspective of different user groups (such as managers, system analysts and clerks) e.g.

Document flowcharts for controls over a document-flow through a system.

Data flowcharts for controls over a data-flow in a system.

System flowcharts for controls at a physical or resource level.

Program flowchart for the controls in a program within a system.

Pseudocode

Pseudocode employs a structural convention of a language to paint an idea of concept with no strict adherence to normal programming the language syntax intended

for human reading rather than machine reading. Details are compromised that is essential for machine understanding of the algorithm, such as variable declarations, system-specific code and some subroutines. (Bohl, 2007) .A programming language is augmented with natural language description details, where convenient, or with compact mathematical notation.

The purpose of using pseudocode is that it is easier for people to understand the concept regardless of the programming language. The main use is to introduce the novice to high-level languages using this hybrid language.

2.6 Web technologies

Web technologies are ingenuity for the presentation of the high-end application accessible to all devices that can play browsers. Browsers are the interpreters of the web. Common browsers include Google Chrome by Google, Safari by Apple, Firefox by the Mozilla Foundation. The browser is powered by search engines that handle request and response from the users and the server.

With Web 2.0 coined by Darcy DiNucci in 1999 that celebrates changes in the way Web pages are designed and used. (Balachander Krishnamurthy)

Client side

This encompasses the technology used for a presentational layer of our application such as the structure and the design of how the service may be consumed by the target user. These technologies include;

Hyper Text Markup language (HTML)

HTML describes the structure of Web pages. It's for publication of online documents with headings, text, tables, lists, photos, etc. Retrieval of online information via hypertext links, at the click of a button. Design forms for conducting transactions

with remote services, for use in searching for information, reservations, ordering products, etc. Include spread-sheets, video clips, sound clips, and other applications directly in their documents. (HTML & CSS - W3C - World Wide Web Consortium, 2013)

Cascading Style Sheet (CSS).

CSS is for describing the presentation of Web pages, including colors, layout, and fonts animations, and transitions on the web. It allows adaptation with different types of devices, such as large screens, small screens, or printers. (HTML & CSS - W3C - World Wide Web Consortium, 2013).

Server side

For our study, we discuss these below languages that we would use to execute the business logic of our application.ie. The server-side code colloquially the backed-end of our application.

PHP: Hypertext Preprocessor

PHP is a best discribed as the most general-purpose scripting language that powers most of the web development. Fast, flexible and pragmatic. PHP is a widely-used, free, and efficient alternative to competitors such as Microsoft's ASP

JavaScript

JavaScript, often abbreviated as JS, is a high-level, dynamic, weakly typed, prototype-based, multi-paradigm, and interpreted programming language. JavaScript is used to add interactivity to web applications. Currently it has moved to the server with the discovery of NodeJS. (Dasgupta, Nagaraj, & Nagamani, 2016)

Database

The database is where all your data collections are persisted. Databases organize the data to model aspects of reality in a way that supports processes requiring

information. Databases appear catagorically in two flavour the SQL, which is relational in design and the NoSQL that offers a lot of flexibility on fly upon changes to the schema.

MySQL.

It's another popular open-source relational database management system. The MySQL one of the most open source database in production that are licensed under General Public License, as well as other that seconds opensource. AB now owned by Oracle Corporation. For proprietary use, several paid editions are available and offer additional functionality.

Data/information sharing

JSON (JavaScript Object Notation) is a javascript data-interchange format. Of latest, it has established database flavours like documentDB, indexDB and cloud functions powered by Google. It is easy for humans to read and write. It is easy for machines to parse and generate. It is based on a subset of the JavaScript.

CSV (Comma-Separated Values) where data dependent applications on the Web can provide higher interoperability when working with datasets. (CSV on the Web Working Group, 2013). Excel data is typically formatted this way.

Application Programming interface

An API is intended to make it easy for programs to interact with each other to use some of the application's functionality without sharing code through "endpoints" which are like inputs and outputs of the application.

2.7 Questionnaire design

Questionnaires are established objective means of collecting information about people's knowledge, beliefs, attitudes, and behavior. They are often used as sole

research instruments. (Boynton & Greenhalgh, 2004). The questionnaire being the most common form of data collection tool, meticulous construction is more likely to yield data that can be utilized in the pursuit of an objective, quantitative and generalizable truths, upon which practice and policy decisions can be formulated. (Murray, 1999)

A questionnaire comprising eight questions for evaluating the overall performance of the System. The questionnaire would be distributed in the form of an online survey system. All the major stakeholders, i.e., clerks, farmers, regulators, and managers of the ginnery would be requested participate in the survey and results are recorded anonymously.

2.8 Related studies

Welch's, a large grape-processing company of a grower cooperative, experienced complex logistics challenges and difficulties in planning recipes for products sold in retail stores. They had earlier deployed an integrated MRP as well as a cost-accounting system that lacked a module to calculate recipes at an optimal cost based on plant-raw-material and capacity constraints. The resultant imbalance of supply and demand extended complication of the problem to raw materials management. The responsible team in charge of managing raw materials spent a lot of money and time to devise to model the recipes for use at each plant. With a custom, a linear program model they developed themselves with the use spreadsheet optimization proved significant in the daily decision making. From then company testifies of running the very model each month since 1994 to offer senior management with information on the optimal logistics plan. This simple application saved Welch's between $130,000 to $170,000 during the first year. (Schuster & Allen, 1998)

A study titled “Effects of Inventory Management on Organizational Effectiveness in selected organizations in Enugu”, was carried out, to accesses the impact of proper inventory management on organizational performances in Emenite, Hardis & Dromedas and the Nigeria Bottling Company all in Enugu, Enugu State the study gave an overview of the challeges that are recurrent in most of the Small scale enterprises that are in operations with in the sub sahara region. The study aurges that having acustom Inventory sytems that are toilared specifically for situations that are exsistant in their environment of operations was paramount than to deploy they that are suited for the western offshore enterprises. The results were of benefit to the participants and they appluaded the concept for the profitability and effectiveness. (Augustine & Agu, 2013).

CHAPTER 3

RESEARCH METHODLOGY

3.1 Cotton in Uganda

This Chapter discusses the how the study was carried and implemented into the Daily Operations of the facility, the routine operations where observed with scrutiny mapped into technical Analysis diagrams such as Data Flow Diagrams to study how minute process integrated from the delivery of the seed Cotton at the Buying post until either Lint Bales of Cotton seeds were dispatched to respective buyers.

Cotton is grown in a Warm area with 270C - 350 C that often receives minimal rainfall compared to the rest. These include the north Bukedi region and the mid-western region, Kasese. This is because of the Australian breed variety that delivers the best return per unit of water. Growers have moved to growing cotton due to its water efficiency than Coffee and Tea, which are in the same category of premium exports. Cotton is often grown as a family business crop with an average of one acre per garden. The main source of labor are often family members, from garden preparation, planting, weeding and the tedious handpicking (harvesting), rarely is irrigation applied, the activity is often dependent on mother nature. The cotton plant requires around 180 to 200 days from planting to for maturity until it's ready for harvest cotton.

Cotton Farmers are currently in business as Individuals unlike before when they had Unions such as the prominent North Bukedi Co-operative Union (NBCU). After the collapse of the Lint Marketing Board (LMB), that would do the Marketing of the Products. Consequently, this saw the rise of private companies that would exploit the marketing opportunities. Which later brought about private ginners who would do the work to match up the standard that had been raised but the Australian Lint industry. To

regulate the industry, the government of Uganda brought about the Cotton Development Organization, that later stipulated the core functions of ginneries as the regulating Authority.

Cotton Ginning

Cotton ginning processes they are tightly coupled with, producing quality assured Lint to maintain fiber properties, spinning medium-to-fine counts using 28-30mm. Then Lint delivered to customers to both local and worldwide but have increased appeal in certain regions based on flavor profiles and consumer demand.

The Ginnery core operations are Procurement production(Ginning) and packaging and Dispatch. although sometimes ginners go an extra mile of providing tillage facilities such as hiring farmers tractors, training farmers on the proper controlled use of pesticides among others. These are offered on mutual understanding between the farmer and the ginner and its often encouraged by the authority as a way of promotion of Cotton growing.

3.2 Olam Uganda ltd company

Olam Uganda Ltd is an Agro-based business the has manifested a lot of interest in Agro-processing in context of value addition, it realized its operations in Uganda in as early as 1997 with priority in the top six agricultural products of Uganda, these are cotton, cocoa, sesame and coffee. These products are acquired through a distributed chain both middlemen, agents and farmer networks across the country, then processed in the country (http://olamgroup.com/locations/east-africa/uganda/).

Olam head office is located in Nalukolongo, a suburb in Kampala the capital of Uganda, with a chain of regional offices in districts such as Hoima, Kibuuku,

Bundibugyo, Lira, Arua, Kitgum, Pakwach and Mayuge currently. For cotton ginning, they have two fully operational ginneries, one in Hoima and the other in Kibuuku, the former being the older of which is the context of our study tonight.

Currently, the Hoima ginnery factory has a total of six permanent resident employees with often an excess of 100 seasonal workers whose duties are subjective to the prevailing activities, they include mainly laborers and provisional clerks.

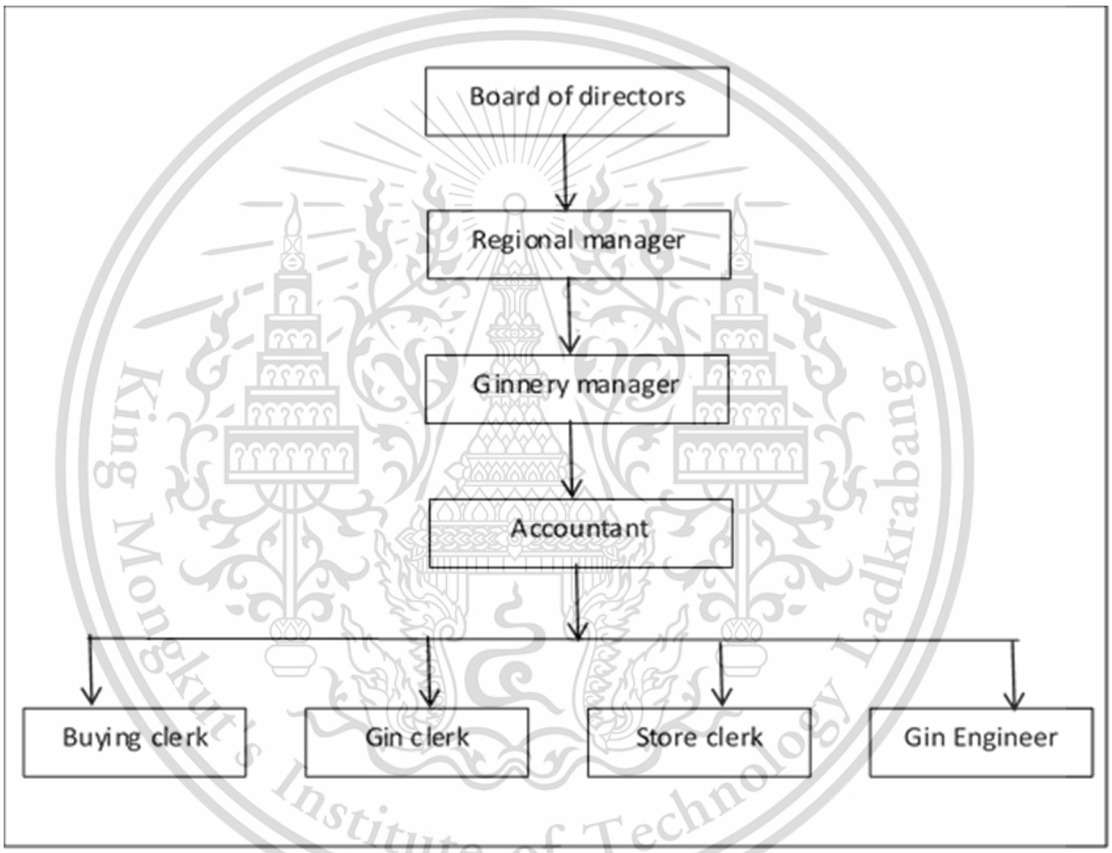


Figure 3.1 The Organizational chart of Olam, Hoima Cotton ginnery.

Working Processes of Ginning.

Seed cotton procurement, this is the initial stage of the ginning process. A farmer or an agent delivers his rosy seed cotton to the ginner's agent on a buying post, often these posts are conveniently and strategically located. The numbers vary from season to season in accordance to the ginner's anticipation. Farmers are always advised to handpick the cotton and remove all impurities before taking it to the buying post.

Once the store at the buying post holds a reasonable quantity of cotton instructions would be issued from the unit offices to transport the cotton to the gin.

With the involvement of the CDO at buying posts has increased transparency from end to end to end of the supply chain through emphasizing and monitoring the minimum purchase price by the government to protect the Grower/farmer from exploitation.

At delivery, a ginnery clerk and CDO representative Check the Quality of Seed cotton in the presence of Farmer to ascertain if the commodity meets the acceptable satisfactory standards i.e. The moisture content often the required is below 12% to 14% depending on the season on which Prevailing weather, Color, Maturity, Contaminants and other related impurities that could as well be identified. When Quality check passes, the three parties proceed to take measurements. For the case when the Cotton is truck a weighbridge is used to record the Laden weight and then directed to the Store for offloading then returns to the weighbridge to record the Tare weight. Necessary details about the area source of cotton and garden details with weights are recorded as offered by the farmer that could be relevant to all parties. This information mandatorily synchronized between the Ginner and Cotton Development Organization as well as farmers who may find it relevant, but rarely do they claim it. A farmer has issued a weighbridge ticket which confirms his tonnage. This is the ticket that is presented to the Ginner's Cashier to claim, the process then receives payment.

Figure 3.2 Seed cotton before the buying post for inspection by the clerk and regulator.

At the Store, here the clerk oversees the amount of cotton received and a second layer of scrutiny is employed to sure the impurities or downgrading factors such as that could have escaped the quality check are identified and picked/sorted out. There is a team headed by the quality control inspector waiting to offload the arriving truck the QCI is responsible for checking the quantity of cotton while the clerk is responsible for careful offload and spread of the cotton to increase the surface area of identifying irregularities and contaminations in the cotton from the truck to the store. There are also some random moisture tests that happen during the spreading to identify if any variability from that registered at the Quality check. in case excess moisture which in this case could be anything above 12% that cotton is rejected in this case the cotton is taken to the rejection area where a team of men and women spread for drying and still sort out the cotton, and any trash is removed or seed before it is way back, and the process restarted. The process is terminated when all records of the details and weighed

impurities are registered then a ticketed is issued to the farmer that she presents to the weighbridge to take her Tare weight.

Figure 3.3 Workers are picking Cotton in the store at Hoima ginnery.

At production, the stored seed cotton is transferred to the processing area/ginning hall by a suction machine such that cotton broken into smaller chunks to remove any other impurities as received on the open platform there are more women who manually recover any other impurities that can still be in the cotton before it is fed to the machine once it's set into the machine then it means any manual handling is over. The ginning happens when its sent to the Gin-mill or Gin-saws that separate seed cotton into seedless cotton, fiber (Lint) and cottonseed. The quality of the fiber is examined to make sure it is clean, maintains the required fiber length and that the seed doesn't come out with fiber. The Lint goes into an enclosed duct to the press where its compressed into lint-bales of the average weight of 200kgs, during processing samples are taken of every lint-bale that's produced. The taken samples are checked for any signs of

contaminant, eventually sent to a laboratory to ascertain a number of fiber characteristics as well as the preparation of the lint. The Lint is then packed tightly using steel wire in cotton cloth, weighed and the weight is recorded against a bale number. A bale number is a unique number that identifies that bale in allots. Then Bales are moved to shade storage when they are kept ready for a sale.

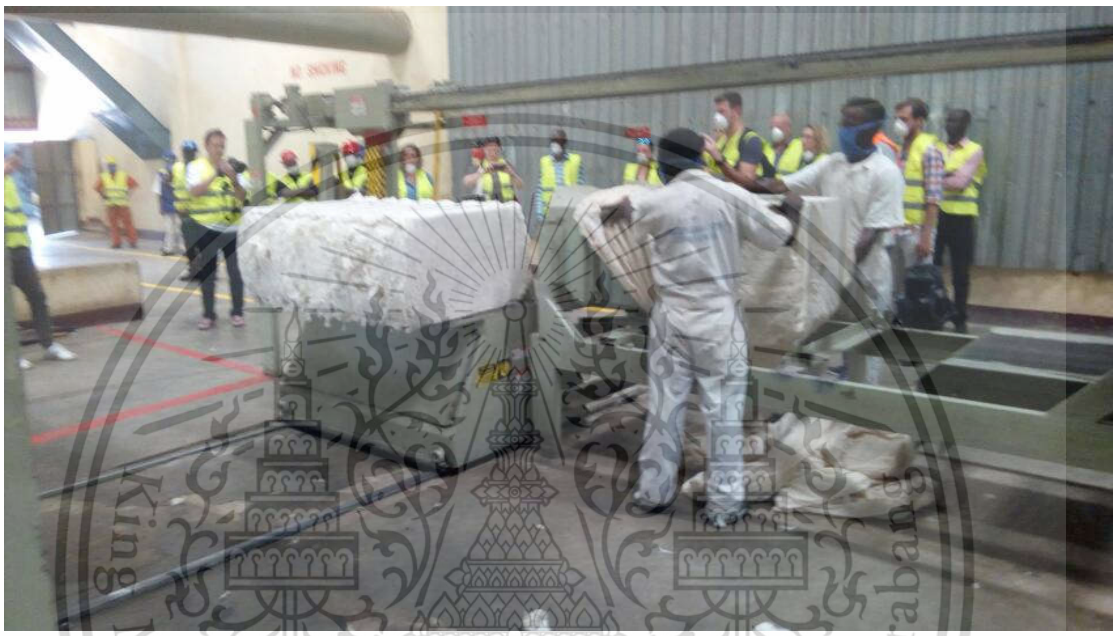


Figure 3.4 Clothing of a bale in a cotton cloth at the baling system**.**

The Seeds are also separated and packaged in bags later put into another store waiting for a subsequent sale. Again, all these processes are carried out under the supervision of CDO representative, the weights of the bales that are recorded on the Bale weight note and on the bale its self with the lot number assigned, with the sample details that are sent to the CDO labs for grading and classification as the authority. All this information need to be in synchronization with both CDO and the Ginner.

The last Operation is the Sale; the selling process involves the ginner sending the authentic results from the Authority (CDO) together with the weight notes to the prospective buyer. Once the trade agreement is reached, the Lint is dispatched in accordance with the signed terms.

3.3 Data Flow Diagram

For modeling the flow of Data from a functional process that holistically integrates ginnery information system. A vivid picture of how objective events and processes interact to the success of the Ginning could be best expressed by application of Data Flow Diagrams. (DFDs)

The context level Data Flow Diagram

A context level diagram shows the interfaces a system would expose for interactions with the external environment to enhance the functional attainment of project's objective. The system was programmed to have four categories of interactions. Farmer / Agent, Customer, Employees, and regulators at the core operations.

The Farmer interfaces would deliver seed cotton, information on both the individual and his Merchandise and then after he would receive details of his payment process assuming his trade was a success.

The Customer Interface would equally allow the Placement of Order for the Bales of Cottonseed, capturing of both the Details of the Order as well as Information concerning the Customer individually. it would as well indicate the progress of his order through Dispatch of the product as well as indicating the Payment.

The Employee interface would be responsible for stating the order Decisions for procuring the seed cotton, provision of the Ginning schedules and the general administration and management of the system to acquire information from all participating parties.

The regulator interface would be able to ascertain Quality and label to the Lint bales and supply Certifications to the Bales for sale to Customers.

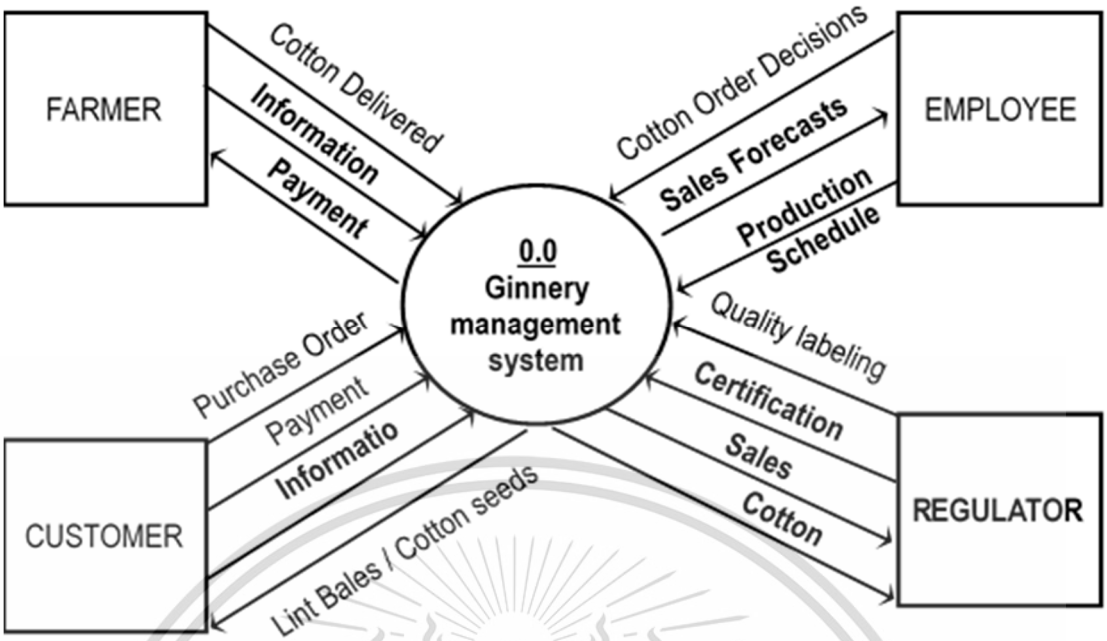


Figure 3.5 The Context Level Data Flow Diagram of the Ginnery management system.

The level-0 Data Flow Diagram

At this level, the system is dissected into three main features of the System, such that their interactions amongst them are observed and analyzed. exposes the precedence of process and events in which they are executed. It is relevant to assign. The material flows down through the value chain and is ejected in two respective products. i.e., Bales and seed for the appropriate buyers.

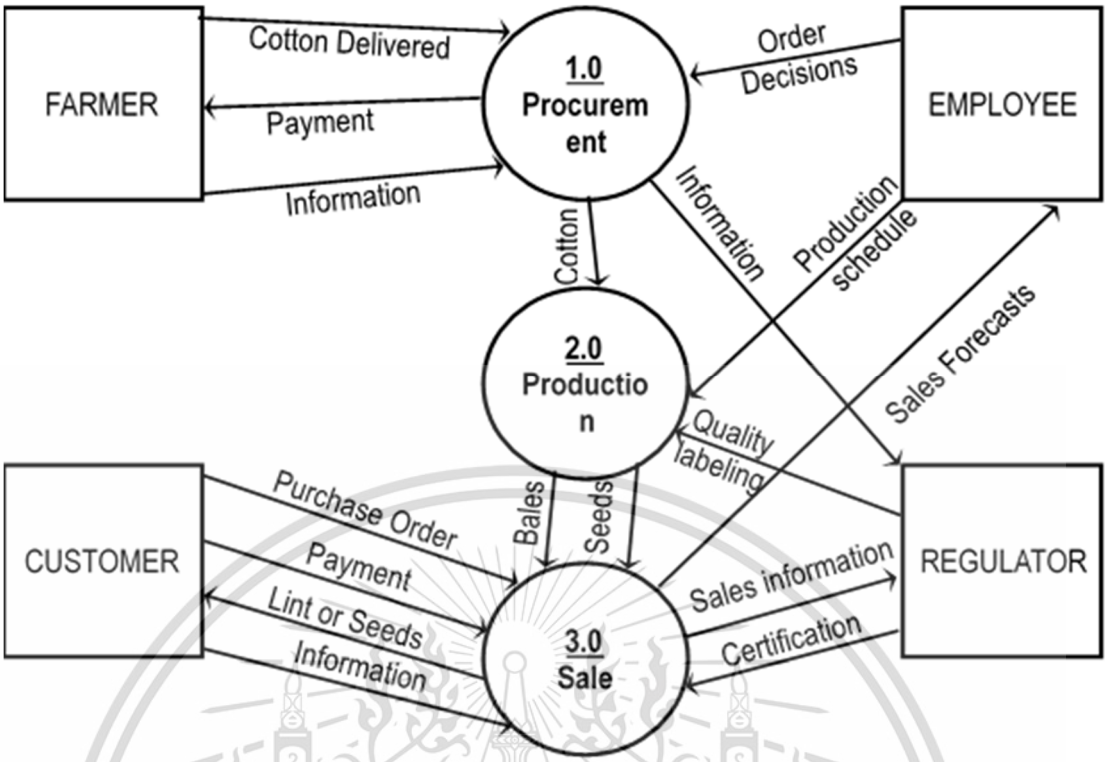


Figure 3.6 The level-0 Data Flow Diagram of the ginney management system.

This is next level below the context diagram, in this case, its constituents the internal logistic. material and information flow from left (farmers) to the right (spinners) of the ginnery supply chain.

The level-1 Data Flow Diagrams.

1.0 Procurement

The Procurement module, the initiation points of the ginning chain, it would kick-start by the arrival of the farmer with the merchandise (Seed Cotton) at the buying Post where he is received by the buying Clerk. That takes all the necessary details that may as well include the capture of Data that would be relevant to creation of his profile account with the company to track his interactions with the company that's if the farmer has been a recurrent agent as well he would be taken through the process review, clarity and update of the status since the ginning activity is seasonal.

It all also would capture the details of his products such as the variety, pesticides, and fertilizers that the farther used with the location of his garden as this information is often of concern to the regulators.

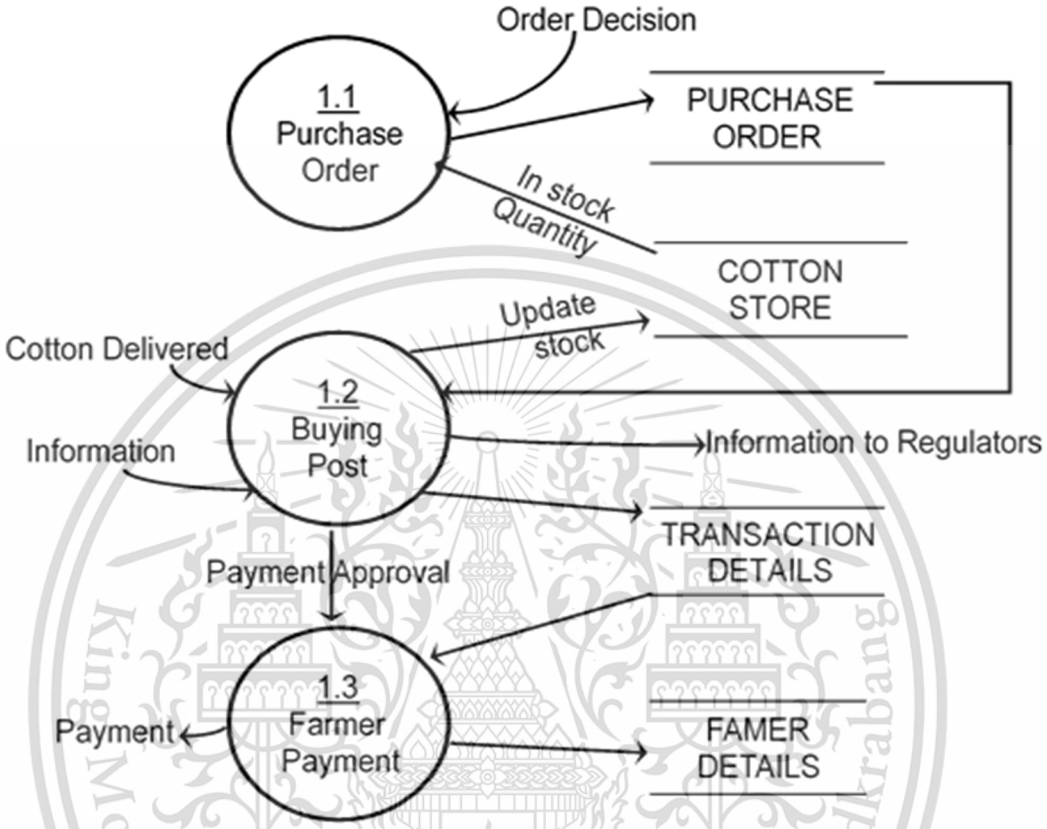


Figure 3.7 The level-1 Data Flow Diagram, 1.0 Procurement.

1.1 Purchase order

Purchase Order is colloquially known as the *"Raising the Scale"*. It may be translated as the launch of the season. A Clerk is issued with A document that commissions him/her to carry out the activity on behalf of the ginner. It bears the guidelines to follow in their order of precedence. The most important context in this document id the *Buying price*, *Start-date* and the anticipated *End-date "Un-raising the scale*" that is subjective to change as the season progresses. Furthermore, it contains on how to evaluate both qualitative and quantitative characteristics of seed cotton such as fiber-strength, coloring, moisture-content among others.

1.2 Buying post

At Buying Post, it's when a farmer agrees to commit a transaction with the company in correspondence with a purchase order. The delivered cotton is inspected for impurities/non-cotton or trash, then random moisture tests are taken on the delivery to ascertain that the agreed percentage isn't exceeded. Weight is taken and recorded along with the necessary details unique to that very transaction/purchase.

1.3 Farmer payment

After successful transaction, information account is created if he isn't recurrent with personal details or updated accordingly. This information is used to track his transactions, discipline with the company as well as to process his payment if bank payment is preferred than off cashier's counter.

It's after a confirmed payment voucher is presented to the farmer that the merchandise is moved to the Cotton store/Warehouse.

2.0 Production/Ginning

The Ginning module is the mechanical production, separation of the fiber from seed to yield lint that is later compressed into lint bales of average weight 200kgs. The other product is the cottonseed that is an as well packaged in plastic sacks of average weight 65kgs.

At the battery compressor during baling, samples are taken from randomly chosen bales of a Lot for a laboratory test to determine the Quality and Lint. This is done by the Regulator within the company of the Clerk.

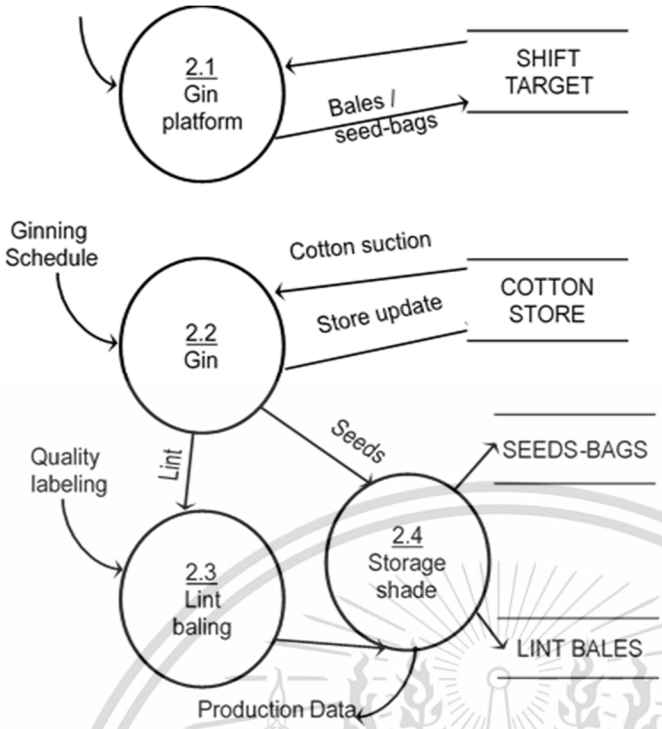


Figure 3.7 The level-1 Data Flow Diagram, 2.0 Production.

2.1 Gin Platform

When threshold capacity for cotton ginning the cotton is reached. A production schedule is issued on how the production should proceed it often entails how many workers would be assigned tasks, number of shifts and any other communication that may be necessary.

2.2 Gin

Its initiated by the pressure sucking of cotton from the store unto the ginning table. This also does some drying of the cotton prior to the gin saws. There are also identified and removed of contaminants that are weighed and recorded by the Clerk in charge of the shift. When the ginning table is filled, Cotton is feed into the gin-saws that are already running.

The gin-saw are separators of *Lint* and *seeds* from cotton. Seeds are channeled into a conveyor system to where they are packed into sacks that average 65kgs whereas lint is sucked into a battery compressor.

2.3 Lint baling

After Gin, lint is sucked into battery compressor. The sucking is aimed to remove lint-dust, and better strong lint is gathered in the compressor. When the compressor is full. Its compressed by a hydraulic pressing machine into a bale. Samples of each produced bale are picked to be taken to the regulator's laboratory for tests.

After samples are taken, steel wires are used to tie the bale then its dressed in a cotton cloth on which details of Lot number and weight are calibrated as well as recorded into the weight note by the Clerk.

2.4 Storage shade

A warehouse where lint-bales are kept prior to sale, the bales are stacked in their lots for easy locating, it a well-aerated hole and weather protected to prevent dampness. Well, occasional maintenance is observed such as replacing torn bale-cloths that often experienced during stacking. Packaged seeds may also be kept in here prior to their dispatch as well.

3.0 Sales

Sales module is kickstarted by the Reception of an Order of either Bales or Seeds. Then the stock is checking to ascertain the availability of the ordered tonnage of the product. For the case of Bales if the demand is mate, an Invoice is prepared and accompanied with the Certificate of Quality as would be issued by the Regulatory Body. Whereas for the Seeds no certificate is offered. Upon agreement on terms and process of payment between the customer and Manager. The dispatch note is issued as well containing the exact individual detail of situation of Bales as they leave the Factory premises.

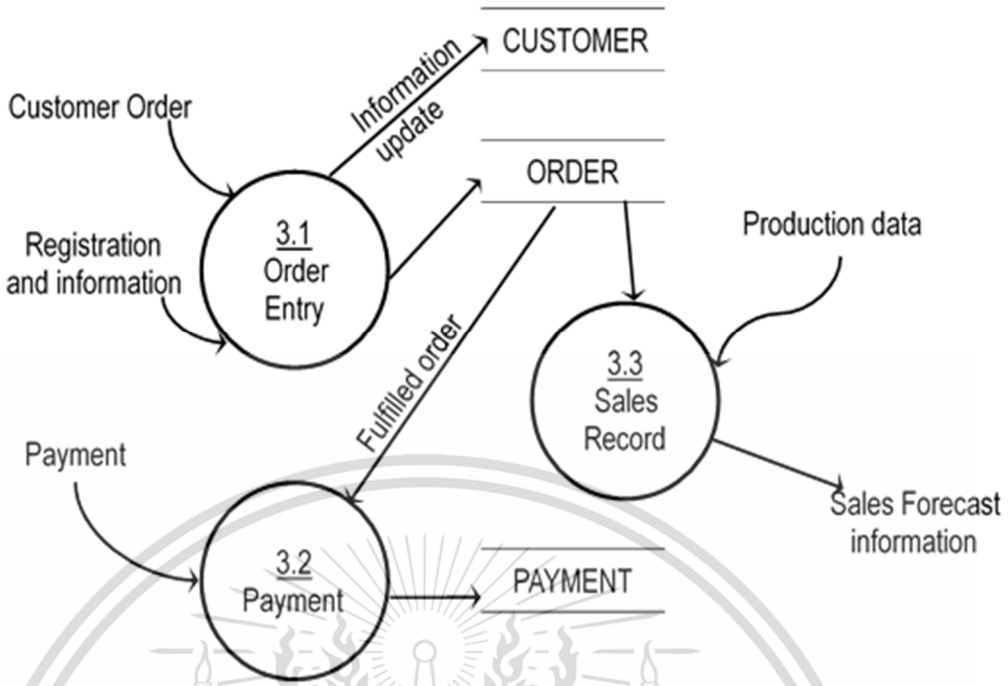


Figure 3.8 The level-1 Data Flow Diagram, 3.0 Sales.

3.1 Order Entry

It's the initiation of the Sales module, its where the details of customer order placed by the customer are recorded. At the placement of order, the information of the customer is gotten as well as the proposed shipper that could be relevant in the future consequent activities such as preparing of Invoices and Dispatch notes.

3.2 Payment

This is where payment records are registered for successful, fulfilled orders of customers. It details the mode of payment, the standing invoices waiting for a settlement. The information from these records portrays the business health of the ginnery as an entity.

3.3 Sales Record

This records the details of sales with less concern on financials as the 3.2 payment on bales and seed dispatched, the shipping company any other association

concerning sales. The information gathered is used to draw sales forecasts and adjust production patterns.

Decomposition Diagram

The diagram below shows how the unit modules of each core function would aggregate to give monolith information logistics of the system as well as their position in the structure of the system.

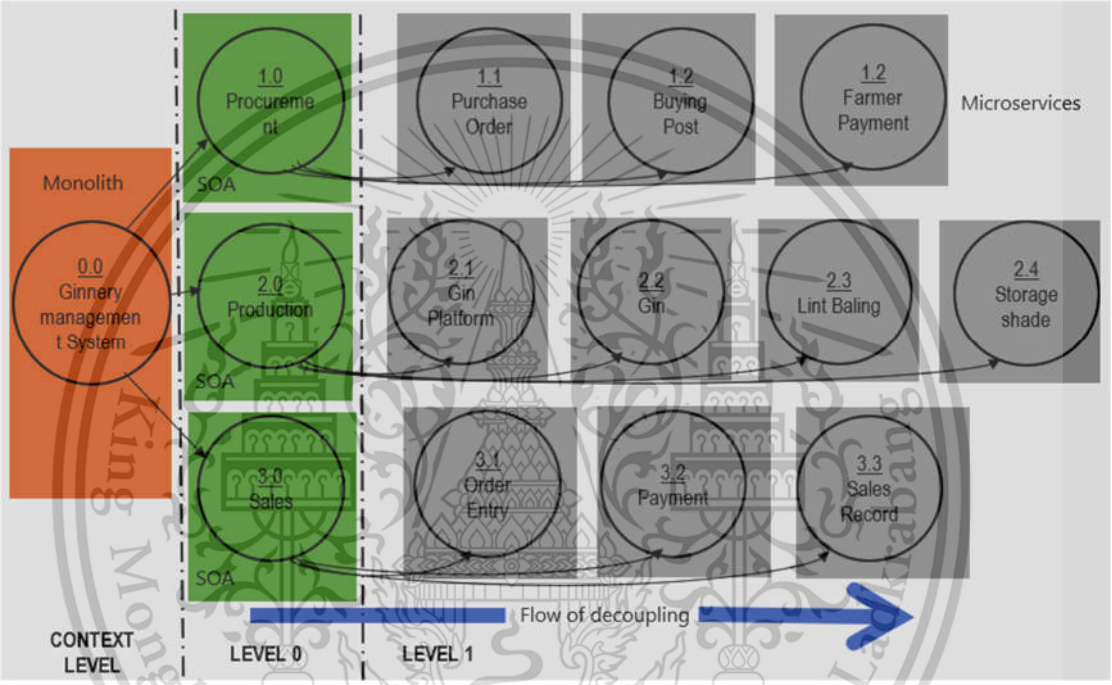


Figure 3.9 The decomposition diagram of ginnery management system.

From the study of the DFDs we would consider the Application of Software-oriented architecture as a design implementation given such that unit modules (microservices) would interact through APIs that is more associated with REST and JSON that is easier for both external and internal usage than the conventional SOA that uses XML that requires more markup. Given SOA is more than just a protocol that uses SOAP that might not be of a fit for such situations.

CHAPTER 4

RESULTS AND DISCUSSION

This chapter we would discuss the development phases do realization of the Application. We would start with the flowchart the details the procedural flow of process events and tasks.

Pseudo code would be presented for the business logic. Interfaces to enhance the better experience and improve the user engagement. the results would equally be presented such as printout.

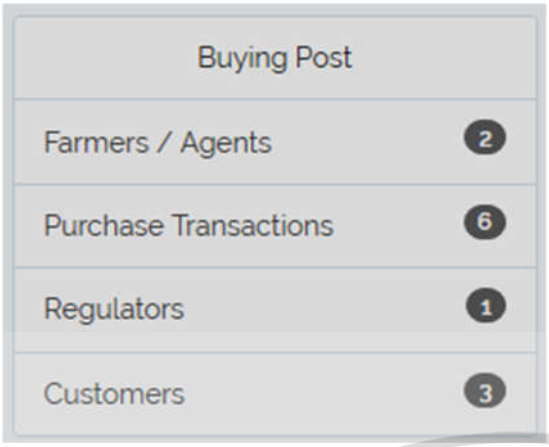
Software specification is equally discussed within here such that suitable conditions are meet are for performance. After deployment then user interactions are realized.

4.1 Flowchart diagram

The flowchart below shows the holistic system processes but again offers great details on how they follow each other. It's onto this diagram that business logic is developed on which our program would run.

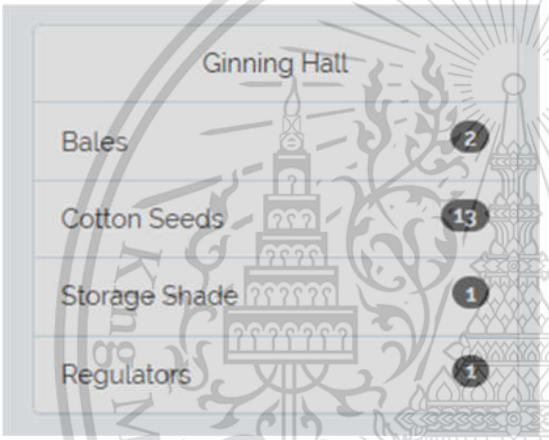
It would allow us to implement a modular structure to map a distinction of the three core functions. Whereby each of the function could operate independently. Procurement module, Production module and Sales module.

This is realized through separations of Concerns of each module. This embraces scalability of the application and continuous integration within individual departments as well as a system.



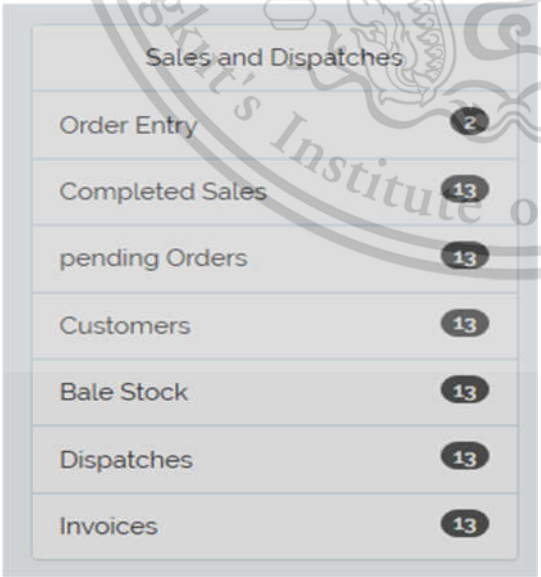
This represents the set of information that is gathered at the procurement module through the interactions amongst clerk, farmer and regulator during the purchase of the seed cotton.

Figure 4.1 Procurement module.



This production line, to be precise it's at the bale press. It is realized by both the gin clerk and the regulator as they receive the bale and take samples before assigning it to A lot.

Figure 4.2 Production module.



This typically encompasses the inventory operations of Bales and cotton seeds, such as sales, payment, dispatch notes and invoices. It's an interaction between Store clerk, and the regulator and documents are authenticated by the managers.

Figure 4.3 Sales module.

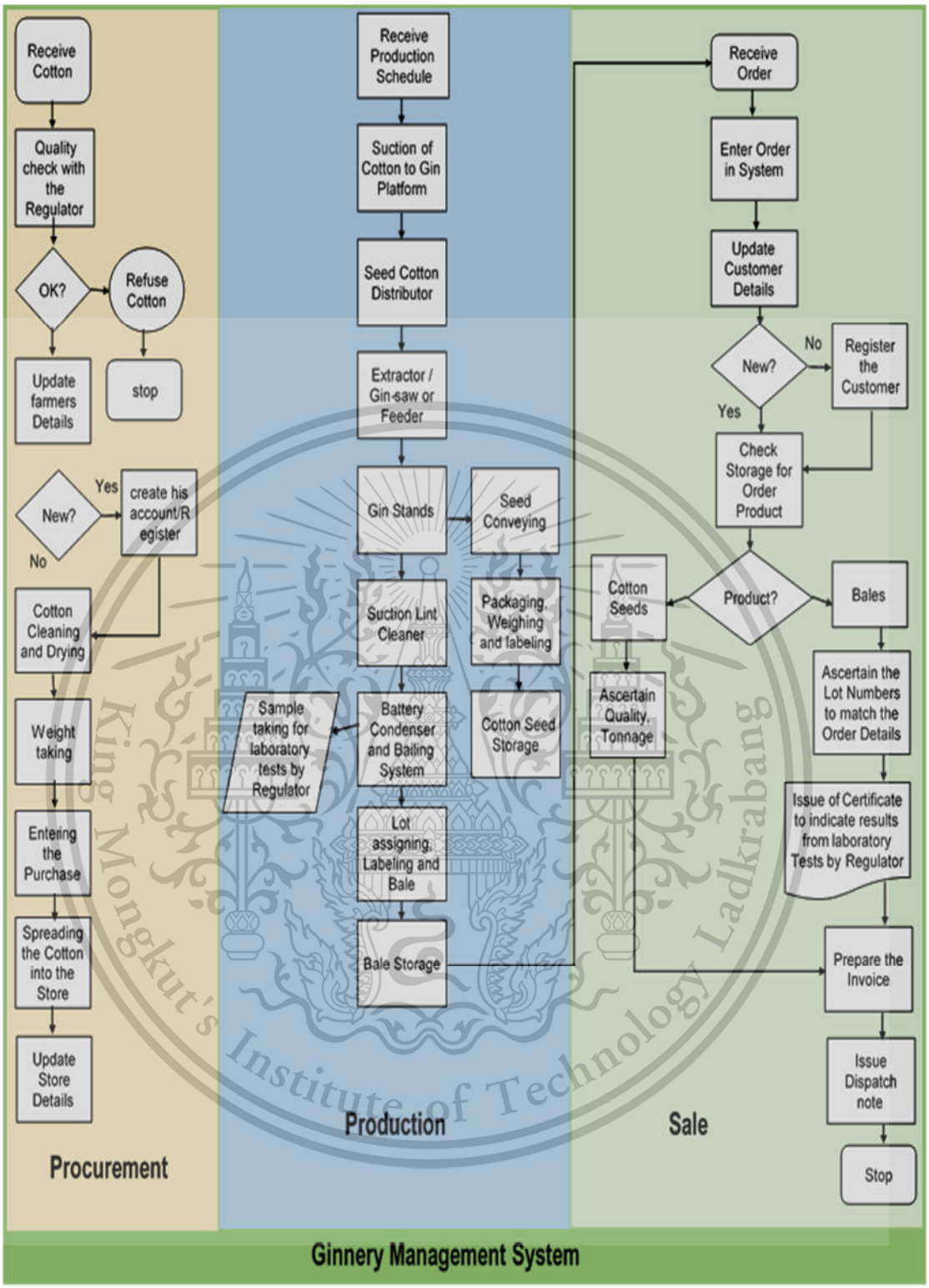


Figure 4.4 Holistic flow chart for the Ginnery management system.

A comprehensive flow of the logistic information in the ginnery with clear distinctions of concerns by the three modules. That is established for the development of the web-based application.

4.2 Procurement module programming

when the application is loaded in the browser, registration is required for login. If you registered as a Buying Clerk, you would be presented with purchases latest entries. With a link as well to present you a form to enter a purchase.

Purchase entry pseudocode

```
Login in as “Buying Clark” or else “Register “as one;
Navigate to “/Buying-post/purchase/create”;
On load,
Automatic Creation of Transaction Collection with;
            Keys                    Values
            Name:                   =>   selection   of   names   already
                                    persisted on which you choose name
                                    Else; Add the name with corresponding
                                    data to existing Farmer’s collection;
            Color:                  =>    select one option between “White”
                                    or “brown”,
                                    Else, defaults to “white”,
            Fiber Strength:  =>     select one option between “Good”,
                                    “Fair” and “poor”
                                    Else, defaults to “Fair”,
            Fiber Maturity:   =>    select   one   option   between
                                    “Mature”, and “Immature”
                                    Else, defaults to “Mature”,
            Contaminations:   =>    select one option between “low” or
                                    “High”,
                                    Else, defaults to “low”,
            Moisture:               =>    only values below 12 in percentage
                                    are allowed,
                                    It’s a mandatory value, otherwise you
                                    can’t persist the transaction,
            Laden weight:            =>   only Numeric values in kilograms
                                    are allowed,
                                    It’s a mandatory value, otherwise you
                                    can’t persist the transaction,
```

Source Address: => selection of names is present on which to choose for the Address,
Else; Add the name with corresponding data to existing Address's collection,

Regulator: => Selection of names are present on which to choose for the regulator,
Else; Add the name with corresponding data to existing Regulator's collection,

AR: => select one option between *"AR"*, and *"BR"*
Else, defaults to *"AR"*,

On click *"commit purchase"* button;
If (validation passes)
Persists the transaction->With (login user for a Clark);
Redirect to *"Buying-post/purchases"*;
else
Redirect back to *"/Buying-post/purchase/create"* ->With (filled values);
Alert Errors;
Endif;
End;

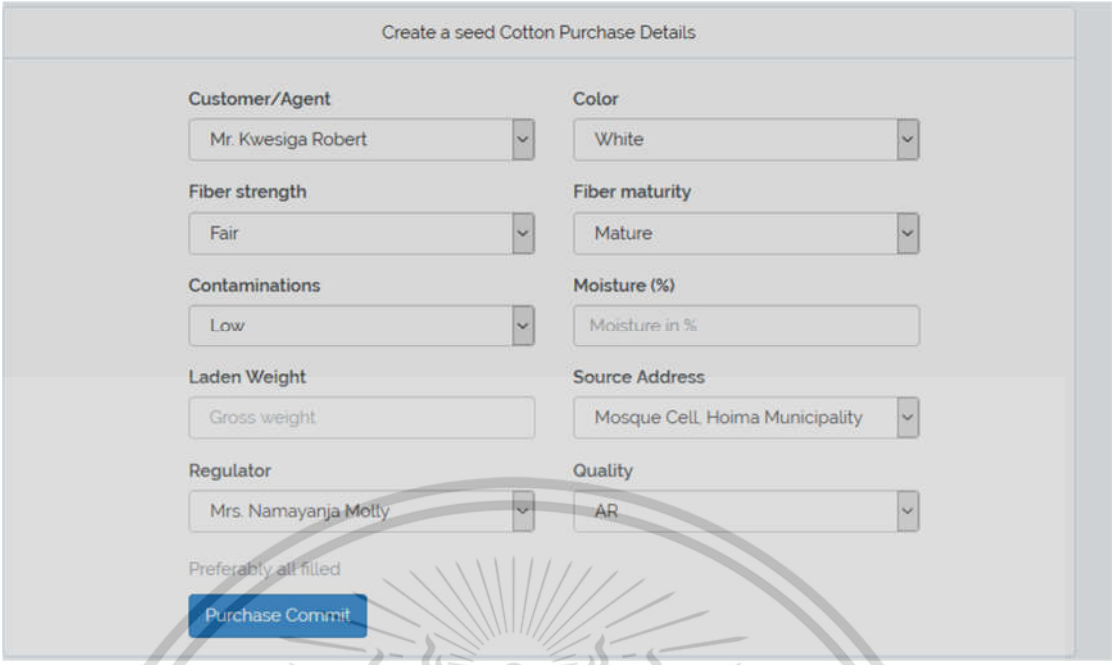


Figure 4.5 Interface, Buying module.

Purchases store.

This is the collection of the successive purchases where a transaction can be updated or even deleted. It offers the ability to search through entered or stored entries as well as printing the paid ticket for the farmer.

Purchases pseudocode

```
Login in as "Buying Clark" or else "Register" as one;
Navigate to "/Buying-post/purchases";
On load,
      Automatic Creation of a collection of cotton transactions with
      the latest saved transaction on top grouped in items of ten
      transactions;
      For each transaction is listed in the record of fields headed
      as Transaction, Customer Source Laden and Moisture with the
      corresponding link to the mode or delete the very transaction,
If (the desired transaction not listed)
      Enter the farmer name or transaction number as "search word";
      Search for the "search word" from the purchases storage where
      the "farmer name" equals exact "name" in the storage or the
```

```
      "transaction number" equals exact "number" in the purchases
      collection as well;
            If (match found)
                  Get all results with the latest entry first in a
                  collection of ten items;
            Else
                  Alert ("No matches found");
Else
      Clear the search variable;
      Redirect back with the latest transaction on top;
End if;
End;
```

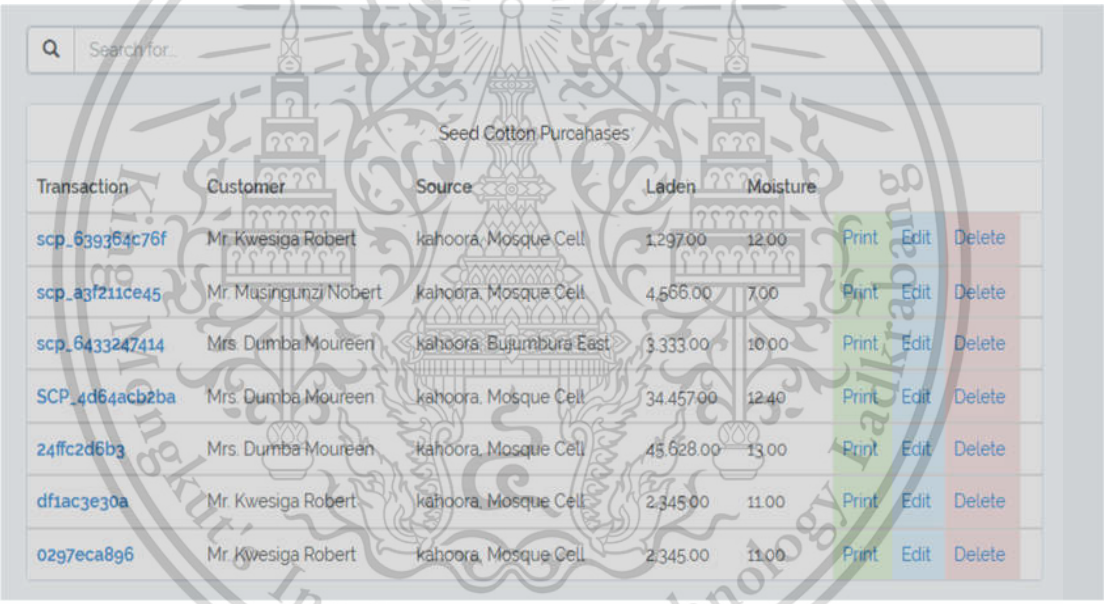


Figure 4.6 Interface, purchases in procurement.

After a purchase is entered you are redirected back to the purchases where you may print the farmer payment voucher.

Olam Ginnery
Hoima
Duhanga, Rusembe
P: (256) 999-9999

Date: 11th February 2018

Transaction #:scp_6433247414

Mrs. Dumba Moureen's Payment Voucher

Details	Value	Price	Total
Quality	AR		
Colour	white		
Fiber worth	fair		
Moisture Content	10.00		
Weight	3,333.00 kgs	2600 shs	866,580,000.00 /=
		Subtotal:	**866,580,000.00 /=**
		Tax:	**--**
		Total:	**866,580,000.00 /=**

served by clark : - apuuli john and regulated by : - Mrs. Namayanja Molly. on 2018-02-09 07:05:29

Figure 4.7 Farmer's payment Voucher.

4.3 Production module Programming

This is accessible to Production Clerks and Regulators, it registers the produced lint bales where they are considered for samples in a lot.

On login you are presented with the list of the latest bales produced as well as a link to register a new bale as shown below

This interface presents links such as edit to update individual details as well as to destroy the record by clicking on the delete link. The link to print a weight note as well is visible.

Production pseudocode

```
Login in as "Production Clark" or else "Register" as one;
Navigate to "/Production/lint-bales";
On load,
      Automatic Creation of a collection of "bales" with the latest
      saved entry on top grouped in items of ten bales;
      For each bale is listed in the record of fields headed as "Lot
      number", "Bale number", "Weight", "Sampled" and "Bought" with
      the corresponding link to print, edit or delete the very bale,
If (desired bale not listed)
      Enter the bale number as "search word";
      the "search word" from the bales storage where the "bale number"
      equals exact "number" in the very lot is matched;
            If (match found)
                  Get all results with the latest entry first in a
                  collection of ten items;
            Else
                  Alert ("No matches found");
Else
      Clear the search variable;
      Redirect back with the latest transaction on top;
End if;
End;
```

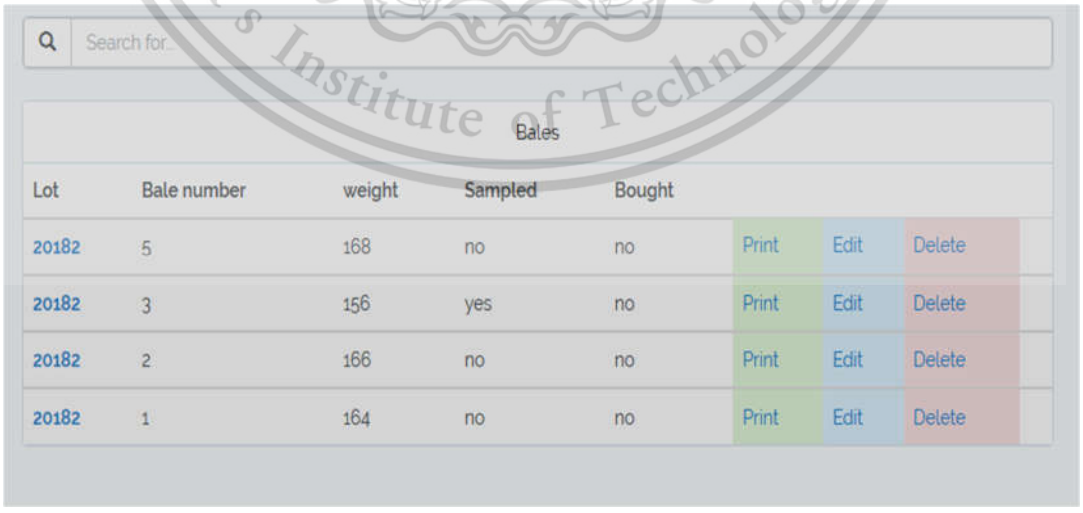


Figure 4.8 Production module, Bales list interface.

Bale entry pseudocode

```
Login in as “Production Clerk” or else “Register” as one;
Navigate to “/production/lint-bale/create”;
On load,
Automatic Creation of bale Collection with;
            Keys                    Values
            Lot number:       =>    selection of lot numbers already
                                    persisted on which you choose name
                                    Else;  Add  the  lot  number  with
                                    corresponding  data  to  existing  Lots’
                                    collection;
            Bale number:      =>    enter an integer between 1-50;
            Bale weight:      =>    enter a float with a maximum of
                                    two decimal places;
            Sample:            =>   select one option between “No”,
                                    and “Yes”;
                                    Else, defaults to “No”;
            Bought:           =>    select one option between “No”,
                                    and “Yes”;
                                    Else, defaults to “No”;
            Regulator:         =>   Selection of names are present on
                                    which to choose for the regulator,
                                    Else; Add the name with corresponding
                                    data    to    existing    Regulator’s
                                    collection,
On click “enter bale” button;
If (validation passes)
      Persists the bale->With (login user for a Clerk);
      Redirect to “Production/Lint-bales”;
else
      Redirect back to “/Production/lint-bale/create” ->With (filled
values);
      Alert Errors;
Endif;
End;
```

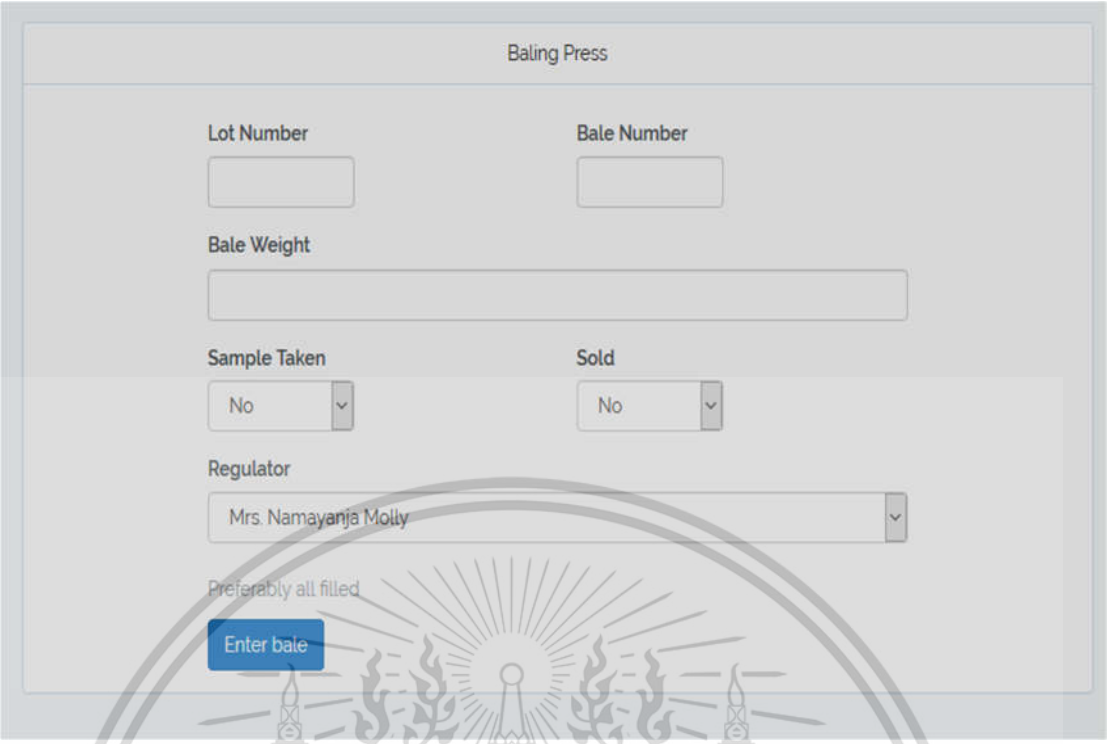


Figure 4.9 Interface, bale weight entry.

4.4 The sale module programming

This is accessible to sales Clerks and Regulators, it locates the and trucks bales in their respective lots as they are received in the bale shade and well as are consigned of to their destination, on login you are presented with the order entry to record a purchase, Orders are taken in lots than individual bales as shown below

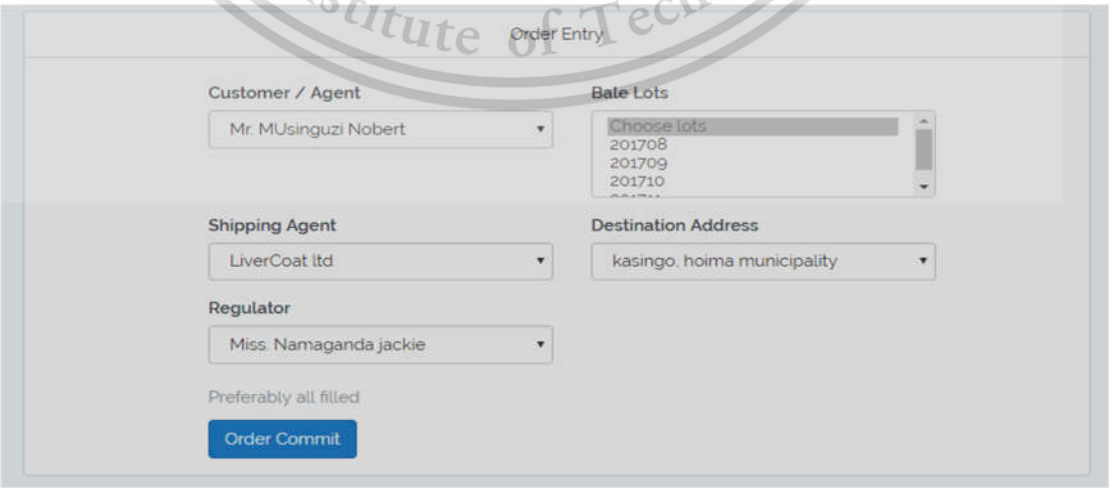


Figure 4.10 Interface, Order entry.

Sales order entry pseudocode

```
Login in as “sales Clerk” or else “Register” as one;
Navigate to “/sales/order/create”;
On load,
Automatic Creation of bale Collection with;
            Keys                    Values
            customer:          =>   selection of customers already
                                    persisted in which you choose a name
                                    Else; Add the add customer with
                                    corresponding data to existing
                                    customer’s collection;
            Bale lots:         =>   multi-select of already existing
                                    bales in the bale shade;
            shipper:           =>   selection of shippers already
                                    persisted on which you choose a name
                                    Else; Add the add shipper with
                                    corresponding data to existing
                                    shipper’s collection;
            Address:           =>   selection of addresses already
                                    persisted on which you choose
                                    Else; Add the add address with
                                    corresponding data to existing address’
                                    collection;
            Regulator:         =>   Selection of names are present on
                                    which to choose for the regulator,
                                    Else; Add the name with corresponding
                                    data to existing Regulator’s
                                    collection,
On click “enter bale” button;
If (validation passes)
      Persists the bale->With (login user for a Clerk);
      Redirect to “Sales/orders”;
else
      Redirect back to “/sales/order/create” ->With (filled values);
      Alert Errors;
Endif; End;
```

4.5 Software specifications

Purpose

Ginnery management system is a beginner web application to digitalize the Core functions of a Cotton Ginnery. Procurement, Ginning(Production) and Sale.

Intended Audience

The system is intended to be of use the Ginnery managers, Clerks, accountants, Farmers/Agents and Regulator in the daily routine of typical Cotton ginnery

Project Scope

This product is tailored to automate the core functions of the ginnery that's to say, from the Buying Post to the Store operations that prompt data taking then through the Ginning platform including Bale pressing and weighing labeling then taking the location of storage of the bales and cotton-seed bags in the storage/Shade

Product Perspective

This is an educational study project on how to improve on data and information management in Cotton ginnery facility, there is no guarantee whatsoever for production deployment.

Product Features

The top product feature includes: -

Procurement / Buying post

- Registering a farmer
- Quality assignment
- Entering of the purchase Details
- The process of the farmer payment

Production /Ginning Hall module

- Sample taking of lint bales

- Allocating Lot numbers to bales with the respective Weight
- Allocation of storage to bales for identification
- Weighing and labeling of cotton seeds

Sale module

- Entering the sale order
- Registering of the customer
- Issuing of the sale invoice
- Issuing of the dispatch note
- Register of payment

User Classes and Characteristics

There are three types of users, they include:

Administrators (Managers and Accountants/cashiers);

They have unlimited rights to every module in the system such as setting the purchase price, buying and closing dates.

Super users (Clerk and Regulators);

They have access only to the modules they are allocated. e.g. A buying Clerk would only have access to the Procuring module and read-only to other modules as well as Regulators only to designated departments.

Standard users;

These include Farmers and Bale/Cotton-seeds customers who would only be able to edit their Personal details/profiles. As we as dedicated information the administrators would wish to communicate to them.

Operating Environment

The system is a web-based application that exploits Web technologies and protocols, they can be played on all platforms that have web browsers. It is a server-

client technology that uses a PHP language as the backend, MySQL to persist data and with some JavaScript to offer more elaborates interactivity to the user experience.

Design and Implementation Constraints

The system prompts a secure authentication for all users. Making it easy to track user's activity throughout his navigation. However, the Authorization and related rights assignment can be audited by the Administrators as they so wish. The system should be maintained under continuous delivery that embraces the continuous integration, automated testing and continuous deployment. To optimize system performance and resources utilization.

Assumptions and Dependencies

It is assumed that the System would be deployed on cloud, off the Ginnery premises for as its convenient for both Farmers and Customers to track their activities off the facility. Since the system leverages Web technologies, it's easier to consume the latest updates and definitions/signatures to keep up with both Security and Performance vulnerabilities.

4.6 Time comparison between the paperback system and the application.

After the application was deployed, to run concurrently with the paperback system the following was observed;

There was a lot of repetition of entries by the Clerks more so they that were on buying posts these included villages as many of the customers often shared their residence address with the source of cotton. Whereas for the system it would leverage relationships.

There were also inconsistencies in data capture as other details were ignored that would again be relevant at some level, this would require the clack to back and pick

the data. Whereas the system implemented input validation, making sure mandatory fields where entered.

Error correction and updates to entries were so clean, neat and smooth compared to the books where there crosses that would make data unreadable, and if it went worse it would require duplicating the entry.

The information sharing was so fast across all parties if your login into the application, it didn't require physical movement of an individual from his/her point of execution whereas the conventional would require personal contact as well as time being spent duplicating it.

There weren't any arithmetic problems experienced or observed in the system as many were observed in the books due to human error. Through either capturing of calculations.

Below are observations recorded when both systems were put to measure against time first as modular i.e. Procurement, production and sales, them as an integrated system for both cases.

Table 4.1 The performance of paperback and Application with time.

	Time(minutes)			
	Procurement	Production	Sales	Integrated system
Application	4	4	5	8
Paperback system	10	6	20	30

There were a lot of time differences in the Procurement and sales than production due to repetitions that are made these functions. And they were contained in the application with the pay tickets, invoices and dispatch notes being automated.

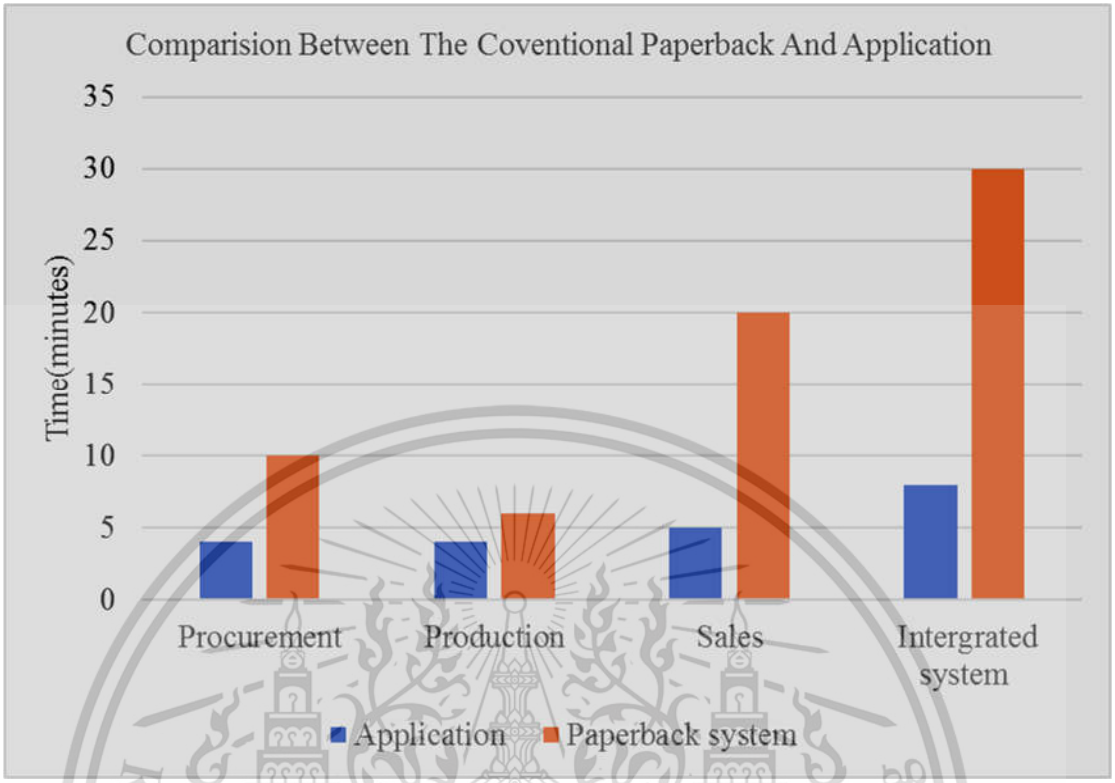


Figure 4.11 A bar graph of both modules and integral systems against time.

4.7 Satisfaction questionnaire

The Questionnaire attached in the appendix section was tailored to measure the contentment that was attained by the participants. They were fifty (50) in number; these included managers, accountants, Clerks (buying, production and storage) the occasional users such as auditors.

The objective was to measure qualitative assessment of the program in comparison with prevailing system. It comprised of brief and on point question for easy comprehension. The response to these questions was cast to five levels of satisfaction which were; Strongly agree, Agree, Neutral, Disagree and Strongly disagree.

The results were plotted on bar graphs to offer detailed visualizations for analysis. The graphs are arranged in a manner that corresponds to order of which questions were arranged.

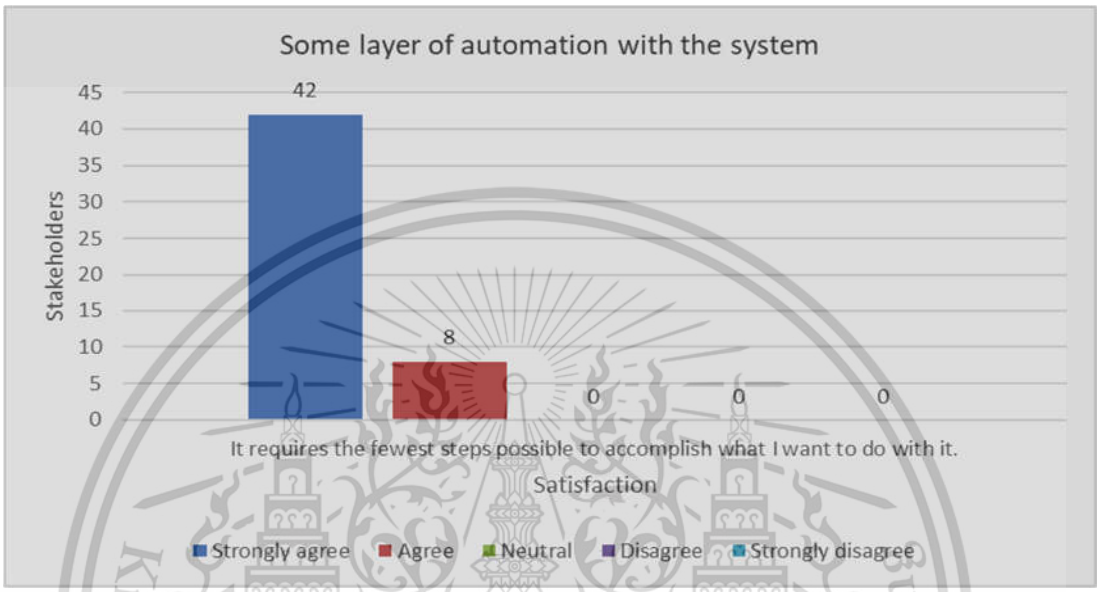


Figure 4.12 A bar graph that shows how effortless-ness of the system.

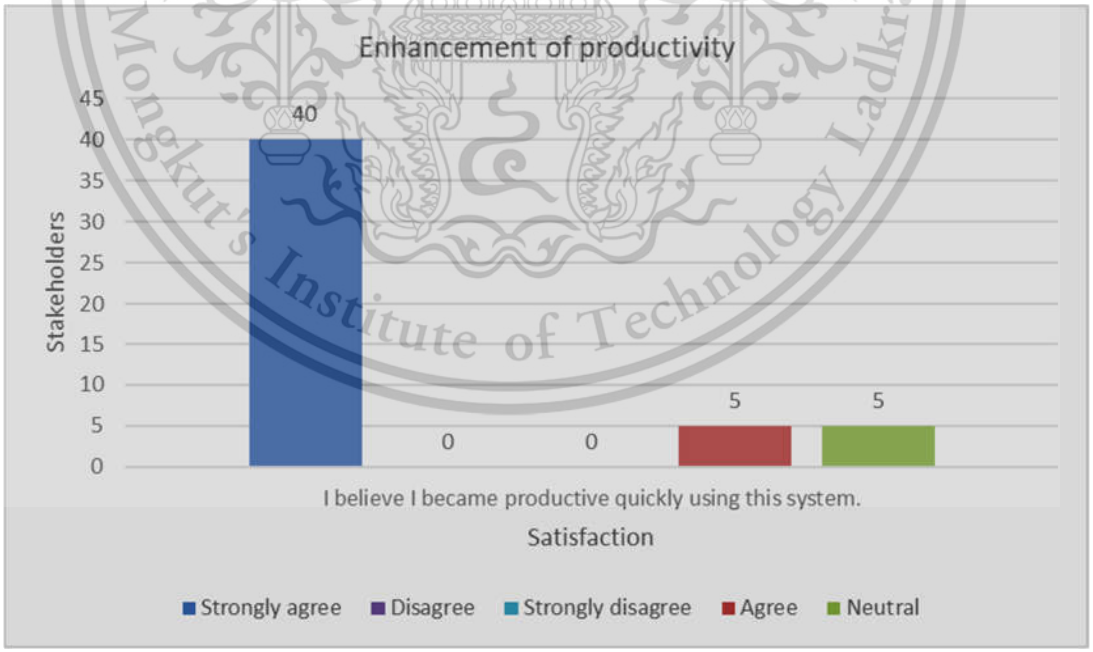


Figure 4.13 A bar graph that shows how quick and easy to amend mistakes.

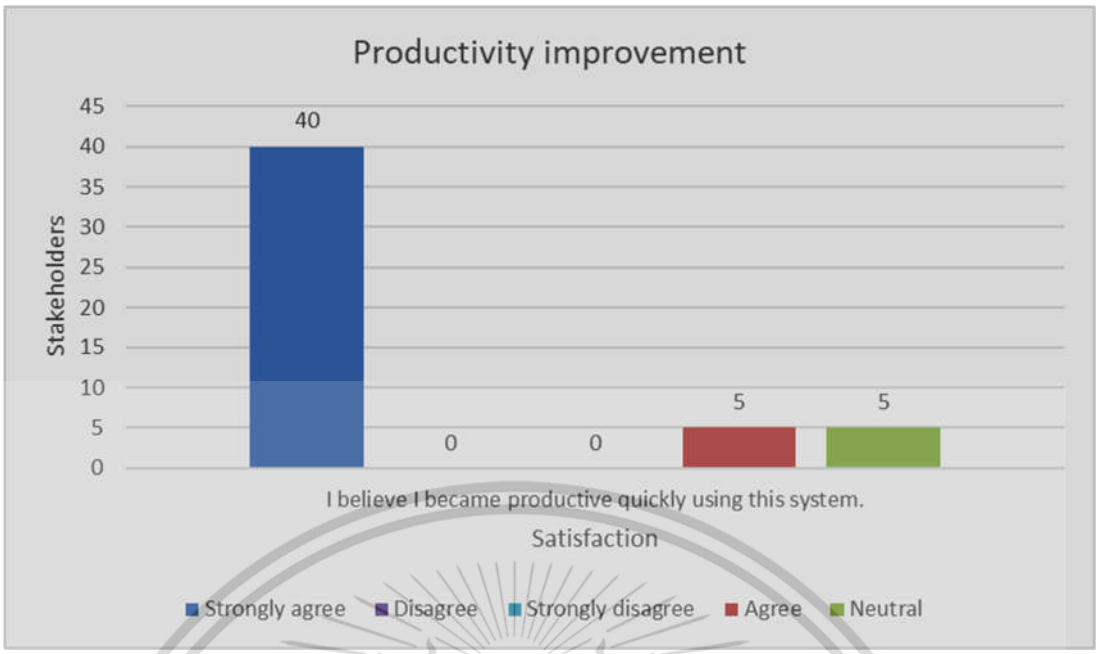


Figure 4.14 A bar graph of productivity using the system.

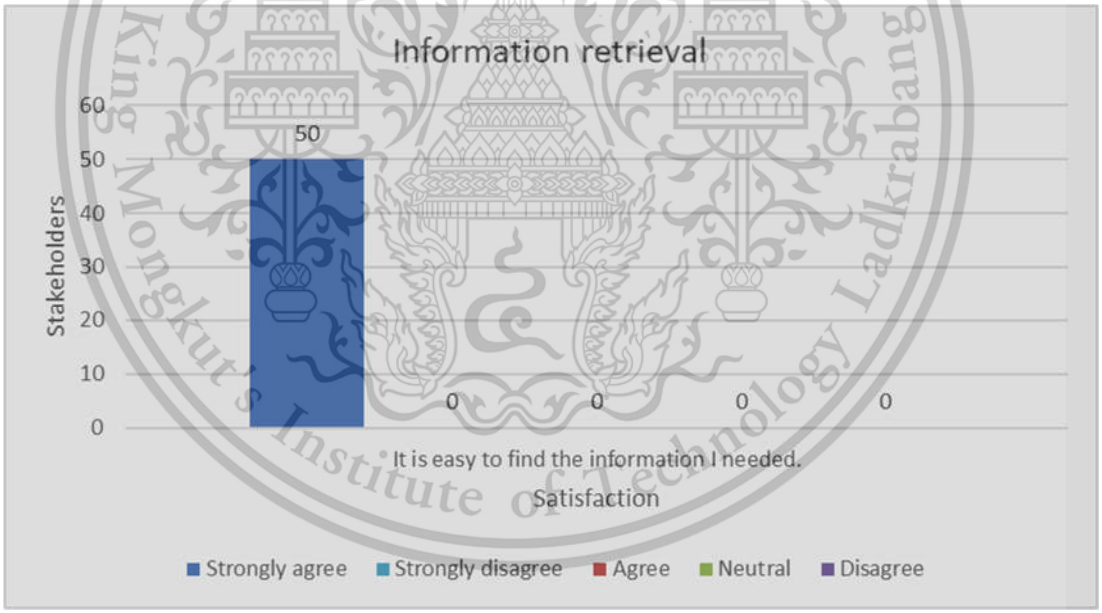


Figure 4.15 A bar graph of easiness to find information in the system.

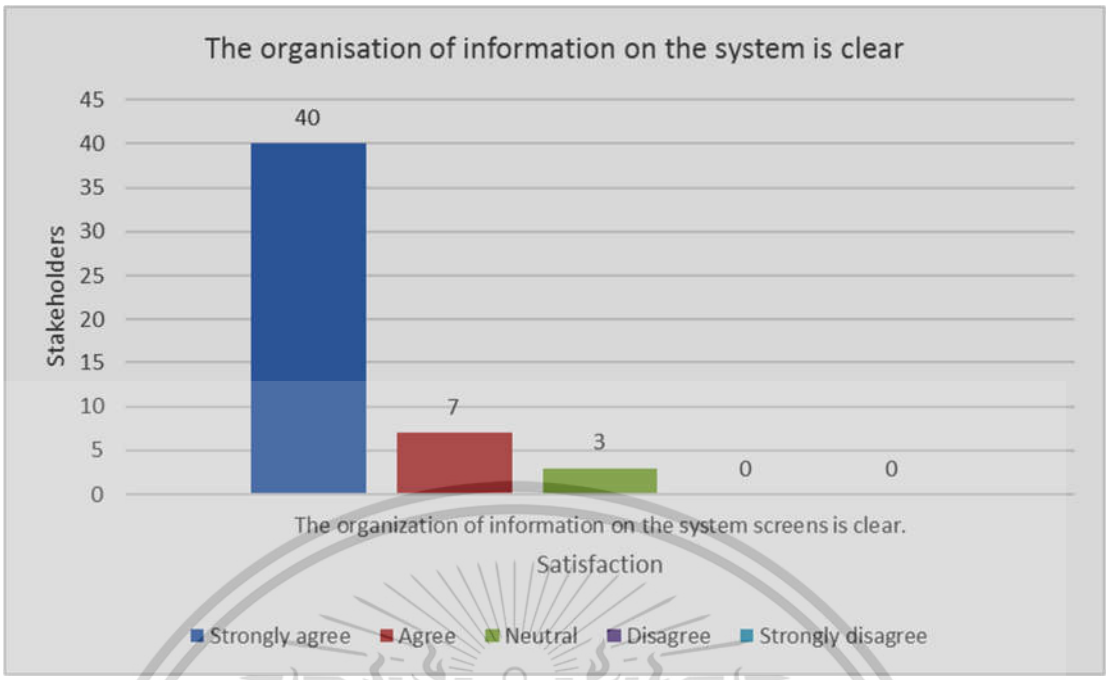


Figure 4.16 A bar graph for Organization of information in the system.

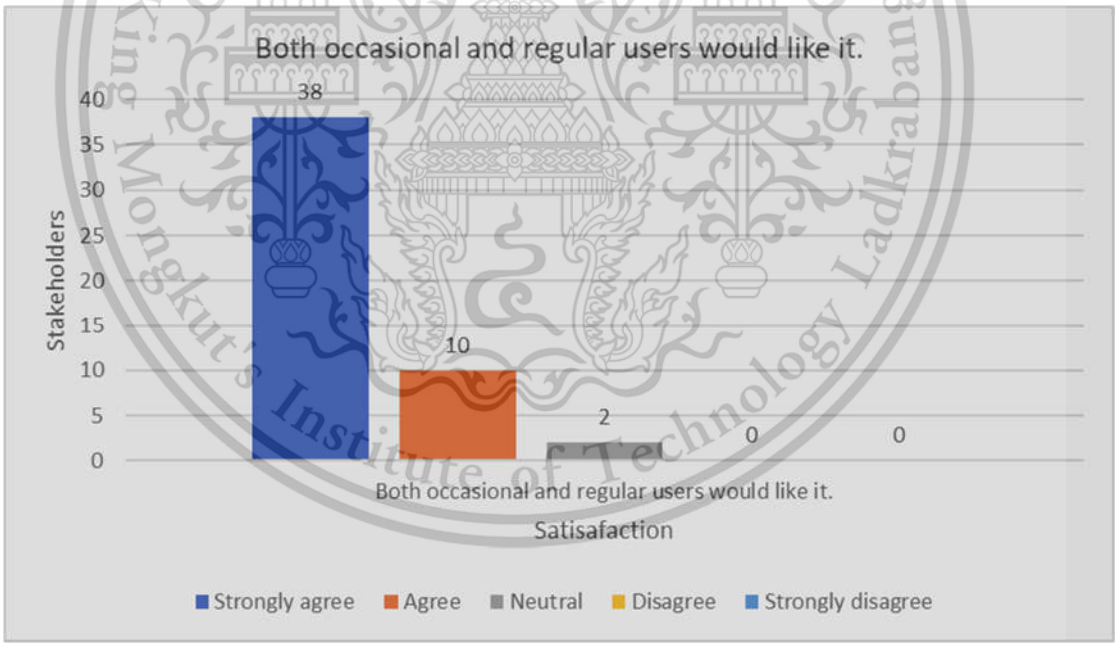


Figure 4.17 A bar graph for Occasional and regular users of the system.

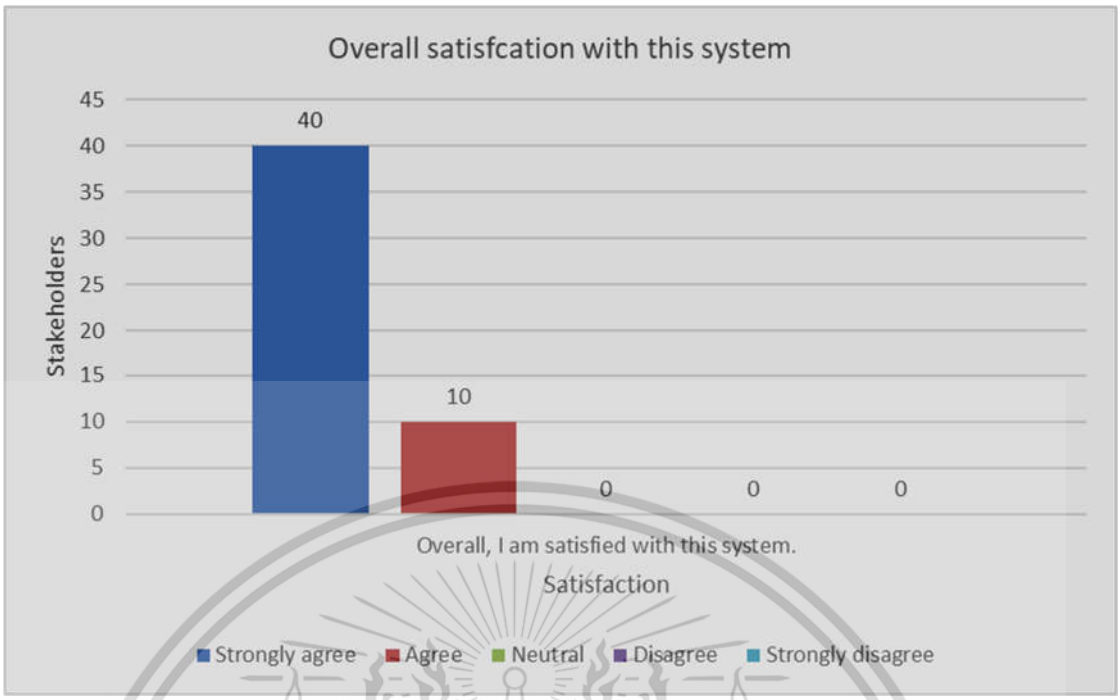


Figure 4.18 A bar graph for satisfaction by use of the system.

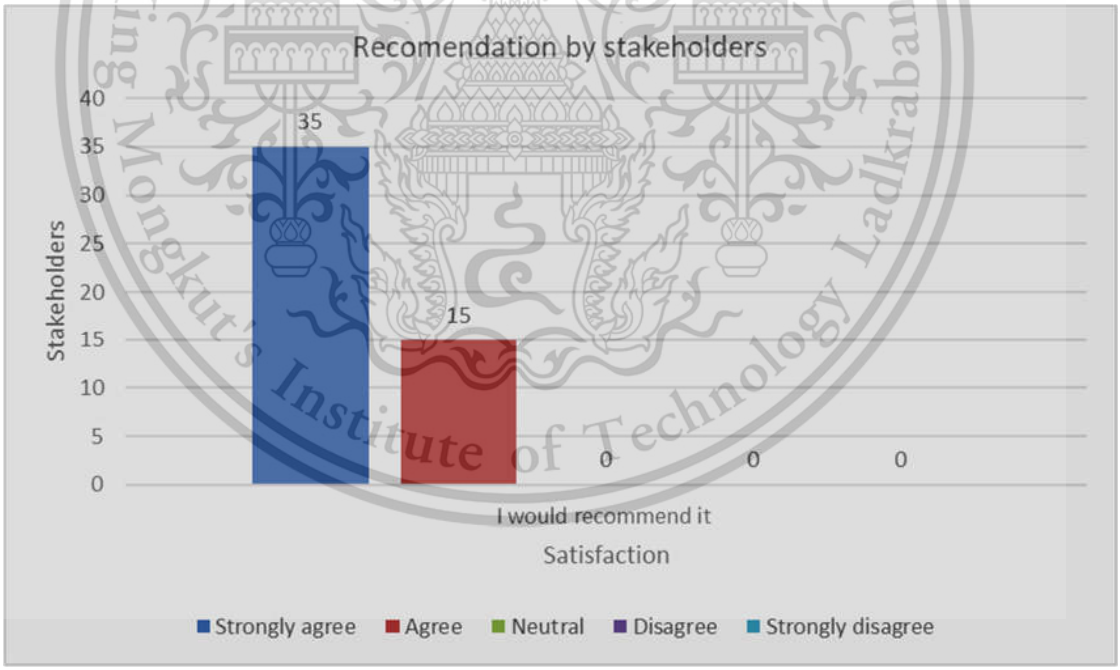


Figure 4.19 A bar graph of user recommendation of the system.

CHAPTER 5

CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusion

It was well established in chapter one , that the most in the Supply management as well Logistics problems experienced by majority of Uganda's promising companies were vulnerabilities due to fraud or misuse of funds, Internal control weaknesses with inefficiencies related to budget monitoring and management, cash handling, management of procurements, asset management and management of document storage or filing systems that were resultant from the use of the unscalable use of the paperback filing system. With the conventional paperback system, it was next to impossible to track and retrieve information for a time in a customized format that satisfies the user, this made it had to make agile management decision as the activity of iterating through the accumulated heaps of documents monotonous leading to low integrity reports, a conducive environment for fraud. With the incorporation of the technology such as Web-based data management systems that would leverage the available mobile resources would address most of the stated problems.

In chapter two we described tools that would help as a study, comprehend, analyze and measure the value of our derived solution. These include Data flow diagram, flowchart, and pseudocode for conceptualizing the application that was translated into the demonstrable system using the web technologies, i.e., HTML, CSS and JavaScript for the frontend, PHP for business logic with MySQL for data persistence for the backend that would be hosted on a server.

In chapter three we meet the first objective where we studied an investigated the paperback data/information management system by use of Data Flow Diagram to

inspect the ginning process as implemented in our case study factory for understanding the integral functions. i.e., procurement of the seed cotton. Production better termed as ginning and later the sales function that completes with the dispatch of either lint bales or cotton seeds. A context diagram that describes the position of the anticipated system with its interfaces on which it would interact with the external environment (users). Then followed the level-0 DFD that are mean to address the functions of the Ginnery, that were later dissected to the level-1 DFD that reflects process and activities of each function in the prior level. The Decomposition diagram visually displays all activities that are to be implemented in the system holistically.

In chapter four we developed a system that mapped our study from chapter three into realization then implementation of the conceptualized idea through leveraging the use of flow charts and Pseudocode to enhance the development of the system. This entails the data layer, business logic and presentation logic on how they are structured to produce the functions as studied in the preceded data flow diagrams. Later in the chapter software specifications are stated establish the environment to run the application. The results from the execution period tests between the operating system and the prototype are that using application reduced work time. And measure satisfaction using a questionnaire registered huge contentment from the stakeholders as the graphs depicted.

5.2 Recommendations.

This study may be extended in other domain such as tea, coffee, sugar cane and sisal growing industries face the similar challenges in their operations to streamline their logistics and supply chains.

Further works should be done to improve the program to include more services such data analysis tools to enhance data visualization to aid decision making at all various levels of management. Strategic, Tactical and Operational. It would be a lot better if other modules may be added as well such as Equipment maintenance, Employee management among others.

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APPENDIX A

A survey questionnaire that was employed to measure the satisfaction of the system by the stakeholders. A total of 50 members participated.

	Strongly agree	*Agree*	*Neutral*	*Disagree*	*Strongly disagree*
It requires the fewest steps possible to accomplish what I want to do with it.	42	8	0	0	0
I can recover from mistakes quickly and easily.	45	5	0	0	0
I believe I became productive quickly using this system.	40	5	5	0	0
It is easy to find the information I needed.	50	0	0	0	0
The organization of information on the system screens is clear.	40	7	3	0	0
Both occasional and regular users would like it.	38	10	2	0	0
Overall, I am satisfied with this system.	40	10	0	0	0
I would recommend it	35	15	0	0	0

AUTHOR BIOGRAPHY

Author: Mr. Apuuli John
Degree: Master of Science
Date: 28th April 2018
Date of Birth: 27th August 1991
Place of Birth: Kampala, Uganda

Undergraduate and Graduate Education:

Master of Science in Logistics and Supply Chain Management,
King Mongkut's Institute of Technology Ladkrabang, Bangkok, 2018

Bachelor of Science in Information Technology,
Amity University, Noida, India Uttar Pradesh, 2014

Major: Logistics and Supply Chain Management