

**MATURITY MODELS AND BENCHMARKING OF ICT
SERVICES AMONG MINISTRY OF AGRICULTURE
PARASTATALS**

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DECLARATION

This research project is my original work and has not been submitted for a degree award in any other university.

Signed

Date

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This Research Project Proposal has been submitted for examination with my approval as the University Supervisor.

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DEDICATION

To the three very special ladies in my life, my wife Wanjiru and the two Wanjas, my mother and
my daughter

ABSTRACT

The objectives of this study was to produce and test a simple questionnaire based maturity model that can be used in assessing ICT services maturity in Ministry of Agriculture parastatals. In addition, the study was to assess the level of willingness to benchmark within these sister organisations. The study covered Ministry of Agriculture parastatals with majority of the participants being located in the Nairobi County. The resulting data collected was used to test the maturity model with resultant scores of between 32 and 59 where the score range was 20 for the lowest and 100 for the highest score. This placed the parastatals in the second level and breaking into the third level in a five level maturity model. These levels were classified as Initial for level 1, Basic for level 2, Automated for level 3, Web integrated for level 4 and Advanced for level 5. Most of the participants had not heard of maturity models before and literature indicate this is a concept which is very rarely used in the country. Given difficulties associated with resources and commitment which has resulted in capability maturity models, particularly CMMI, be undertaken only by the large organisations, the resulting model could be used as starting point in measuring and benchmarking ICT services in the ministry parastatals and also be a tool that could be used in performance contract assessments. All the participants were very receptive to a model where they could first benchmark against the best in the sector before spending resources when they are introducing a new area in their organisations.

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ABBREVIATIONS AND ACRONYMS

AGRA	Alliance for a Green Revolution in Africa
APITMM	Agricultural Parastatal Information Technology Maturity Model
ASDS	Agricultural Sector Development Strategy covering the period Year 2010 to Year 2020
BM	Benchmarking
BPR	Business Process Reengineering
CAP	Chapter number given to laws in Kenya
CBK	Central Bank of Kenya
CMMI	Capability Maturity Model Integration
COMESA	Common Market for Eastern and Southern Africa
DHL	Currently a division Deutsche Post of Germany and internationally one of the largest parcel delivery companies
DOI	Digital Opportunity Index
E – READINESS	Economist Intelligence Unit’s Electronic Readiness ranking
EFITA	European Federation for Information Technology in Agriculture
GoI	Government of Israel
GoK	Government of Kenya
IBM	International Business Machines
ICT	Information Communication Technology
ICT – OI	ICT Opportunity Index
IFIMIS	Integrated Financial management Information system
ISO	International Organisation for Standardisation
ITIL	Information Technology Infrastructure Library
KEI	Knowledge Information and Knowledge economy Index
KITOS	Kenya IT & Outsourcing Services
MoA	Ministry of Agriculture
NRI	Network Readiness Index
OECD	Organisation of Economic Co-operation and Development
SCAMPI	Standard CMMI Appraisal Method for Process Improvement
SEI	Software Engineering Institute
SEPG	Software Engineering Process Group
UPS	United Parcel Service
Vision 2030	Kenya Governments Development strategic plan – Blue Print - covering the period Year 2008 to Year 2030
WCCA	World Congress on Conservation of Agriculture

CHAPTER ONE: INTRODUCTION

1.1 Background of the study

Kenya's Vision 2030 GoK (2007) projects and plans for a country that will not only qualify as a middle income country but also one which will be providing a high quality of life to all its citizens by the year 2030. To achieve this, agriculture and Information Communication Technology – ICT will play a major roll as is exemplified in the Encyclopedia of Nations (2011), that agriculture still remains the most important economic activity in the country. This is also emphasized in the Agricultural Sector Development Strategy (2010) as “Agriculture being the mainstay of the Kenyan economy directly contributes 26 per cent of the GDP annually and another 25 per cent indirectly. The sector accounts for 65 per cent of Kenya's total exports and provides more than 70 per cent of informal employment in the rural areas. Therefore, the agricultural sector is not only the driver of Kenya's economy but also the means of livelihood for the majority of Kenyan people” p. xii.

As confirmed in the OECD (2003) report on ICT and economic growth – Evidence from OECD countries, industries and firms, institutions with high use of ICT are able to deliver better and more focused services. These would include mechanization and automation, most of which nowadays incorporate ICT. In this age, utilizing effective and efficient ICT based processes will help increase efficiency through use of software and equipment on the farms to process data and manage production on top of office automation. Assuming a staged maturity in ICT usage, mature ICT processes will deliver better services.

The Ministry of Agriculture of Agriculture (MoA) as of 2012 had 32 state corporations and statutory bodies with most headquartered in Nairobi. The utilization level and effectiveness of ICT, or capability and maturity levels among MoA Parastatals and statutory bodies is likely to be varied. The level of maturity – which the Oxford Learners dictionary defines as the state of being grown or developed- Horny (1997) – in ICT service provision will equally be varied.

While these parastatals serve the same sector, there seems to be no evidence of coordinated use of best practices through benchmarking amongst themselves. This means that each institution will most likely start from the beginning when working in a new ICT process area while there is a possibility of an already existing solution among its sister parastatals. If information on working technologies and system were available, or if a concerted effort was put in place to produce solutions based on best practices among these institutions, not only would reasonable savings accrue but the level of efficiency would increase. ICT use is important, for example, a study by Dostie (2008) found significant gains for individuals and firms using ICT in Canada and USA indicating for example that a computer user was 37% to 47%, depending on whether complementarities are included, more productive than a non-user. Also Jorgenson and Stiroh (2000) and Oliner and Sichel (2000) argued prominently that the major productivity boost in the two countries in the period 1995 to 2000, after a big productivity slump, could be attributed to increased investment in ICT while Batte (2005) did a study, among Ohio farmers (USA), which showed computer adoption stood at 44%, up from 32% in 1991. It would be of interest to know the level of maturity in ICT provision in this important sector of our economy. Such a coordinated approach has been picked by the Ministry of Finance in its Ministry wide financial system – IFMIS – from which timely coordination and cost savings are among the main benefits. To deepen its usage, this is being reengineered as advertised in the Daily Nation (2011). While the operations in the Parastatals might not be as uniform as those in the Ministries, there can be some gains which can be achieved from a coordinated effort.

An indication of how well ICT processes are running in these institutions would provide information that could help them benchmark on the best practices. In addition, the current government institutions Board of Directors and institution performance evaluation has a target on ICT performance which currently does not have a standard measure and is left to institutions to set one for themselves. Government ICT managed by the Ministry and the

Kenya ICT Board – latter renamed ICT Authority - generally leaves institution to manage their progression while they try to put in place connectivity.

1.1.1 Information Communication Technology Maturity

Haag, Cummings and Mccubbery (2002) state that while there might be no generally accepted definition on what ICT really is, it generally refers to the storage and use of electronic data, communication of the same and all the equipment and software necessary to run the same. While most people look at ICT from the concept of computer use in the offices and homes, the concept does cover a much wider area including telephones and other wireless communication while ingrained chips in equipment, airplanes, cars, home appliances among others all are part of information communication technology including today's issues of cloud computing and other internet based processes.

Haag et al (2002) reports that agricultural enterprises use computers and ICT in all aspects of business management be it in the offices, on the farm and in assisted decision making. An ICT enabled environment is best captured by Gladstone (1991) in the form of a shadow partner providing information and assistance to fellow partners in the audit firm of KPMG Peat Marwick worldwide. Only that the shadow partner is in the form of well-connected and facilitated ICT systems/units/facilities. Intranets have enabled organization to coordinate work worldwide among its employees or allowed customers to query relevant information. Examples of ICT enabling institutions could be the parcels tracking system at UPS, Federal express, DHL or how large corporations like Hewlett Packard, IBM, and Sun Microsystems among others coordinate and enquire their work globally. In agriculture, advanced fertilizer input control systems and satellite based or wireless systems for monitoring fields and livestock would be examples.

ICT usage and processes normally grow or mature with increased experience and improvement efforts. The more capable or mature an institution's processes are, the more efficient and effective it would be. According to Forrester (2012), mature and capable processes are important steps in embracing change and opportunities. Kohlegger, Maier, and Thalmann, (2009) and other literature on the internet show there are many types of maturity models being practiced but the most common and known is the Capability maturity model (CMM) produced by the Software Engineering Institute of Carnegie Mellon University USA which is sponsored by the countries Department of Defense. The department started this institute and through it CMM to get a tool to use in rating ICT suppliers after frustrations caused by poor or unfinished work from institutions they thought were very good in ICT.

Software Engineering institute acknowledges that CMM was based on earlier works by Crosby with the first staged maturity model being published by Richard Nolan (1973). Since then CMM has grown to Capability Maturity Model Integration (CMMI) – which is an integration of maturity models addressing various sectors of business – and latter divided into CMMI for Development (CMMI - DEV), CMMI for acquisition (CMMI - ACQ) and CMMI for service (CMMI – SVC) as the maturity model for services in ICT. Many other specialist blends exist but these three are able to address ICT issues in organisations as per the Software Engineering Institute who are the developers of the model.

This model expects institutions to grow through five stages of maturity which are the initial at level 1, Repeatable or managed at level 2, Defined at level 3, Quantitatively Managed at level 4 with the highest level being Optimized at level 5. It also assess capability levels at four stages being Incomplete at level 0, Performed at level 1, Managed at level 2 and finally Defined at level 3. Maturity levels relate to the whole institution while capability levels can be assessed for chosen process areas. Our interest in this paper will be on the CMMI for services.

1.1.2 Ministry of Agriculture Parastatals

By early 2013, Ministry of Agriculture (MoA) was one of thirty one ministries in the Kenya Government. To deliver some of its functions, the ministry did, through Government, delegate some of its functions to specialist institutions called parastatals to help improve on delivery through specialization.

These are legal entities incorporated through various mechanisms among them being specific legislation, sector legislation or even as part of the country's constitution. They operate in various sectors of our economy providing different types of services all meant to support players in the agricultural sector. Some have national coverage through the use of branches and they are of different sizes and, from general observation, operate at different levels of effectiveness. Areas of operation in the country and sector include provision of finance to farmers, doing research on agricultural products, regulating or managing specific sectors like the sugar or cotton sectors while others specialize in information provision. Majority of the parastatals running commercial activities were formed under the companies Act Cap 486, the ones doing research and teaching under the Science and technology Act Cap 250 while others were formed under the Coffee Act Cap 333 or the State Corporations Act Cap 446. A few had their own special legislation.

The sizes of these parastatals range from very small to very big by Kenyan standards. This means that some have a turnover in the tens of millions while others are in the billions of Kenya shillings range. As for staff numbers, some will have numbers below a hundred while others could be as high as four thousand. They are funded mostly through public funds although a few in the commercial category do raise their own operational funds. Given that they are serving the same sector, it might therefore be useful for the less endowed financially or the ones who are behind in ICT benefit from their fellow players through benchmarking.

In Kenya, majority of the population is involved in agricultural related activities, it is occasionally stated, in government documentation, for example, in Kenya's Vision 2030 and

the Agricultural Sector Development Strategy 2010 – 2020, and by players in the private sector and Donor community that the agricultural sector is the backbone of the Kenyan economy. This in practice is so as residents are aware that a failure in the main agricultural crops, for example maize, tea, coffee, rice among others, has an immediate effect on the lives of the populace resulting in hunger and famine, prices go up and generally a slow-down of the economy would result. Ways of assisting in improvement in the sector would result in improvement of the general welfare of the populace. One of the ways of resulting in this improvement is enhancing service delivery through information technology. To improve on this, it would be useful to know the maturity levels of ICT processes in the sector including the parastatals operating there. With this information, the institutions can address areas they score low levels or benchmark against the best.

In order to properly assess ICT maturity in parastatal performance contracts while at the same time provide information that can be used to pick institutions to benchmark with, there would be need for a tool or maturity model that is cheap to deploy, easy to use, will not have too much technical details so that it can be used by non-specialists in process measurement while at the same time being accurate and consistent.

However, the current guidelines issued by the Reform and Performance Contracting Department for Boards and institutions performance contracts on this parameter leaves it to the organisation to determine what they consider their ideal ICT automation and where they are on that scale resulting in institutions addressing different issues with the final results not being comparable. There currently seems to be no easy to use model that can be used by parastatals in the sector to assess their ICT maturity levels and thus know where each stands among its sister institutions.

If this situation continues, this parameter will not consistently guide institutions towards the intended ICT improvement and maturity uniformly resulting in some institutions taking too long to benefit from existing improved ICT processes. They would thus not benefit

from the gains in terms of efficiency improvement and savings that would affect the general public, the directors, management and the results office coordinating the performance evaluations.

1.2 Statement of the problem

ICT is a dynamic field where players need to keep adapting due to the fast changes for them to gain from the most recent advances. Agricultural institutions more advanced in ICT use have been recorded to be doing better than the ones which are not Dostie (2008), Jorgenson and Stiroh (2000). Normally institutions try to individually keep pace while unguided experimentation in ICT has been recorded to be very expensive Deitle (2005).

In studies done locally related to ICT maturity Kipkemoi (2006) did a survey on factors hindering growth of ICT usage in state parastatals in the country where he found reasonable implementation only in the areas of finance and payroll management which are the same areas given significance in Muriuki's (2006) study on determinants of ICT use in small business enterprises; Kitur (2006) confirmed that ICT did have a strategic significance in a study on the strategic role of ICT in the insurance sector while Nzuki (2006) confirmed ICT audit acceptance in the study on a survey of ICT audit in commercial banks in Kenya. Taneja (2006) also found that age of a company and greater use of ICT resulted in a competitive edge in the study on application of competitive strategies in the information technology industry and Ngure (2008) who did one on strategies applied by selected branded software and hardware providers in the IT industry.

ICT assessment models do exist in the world although the more established ones like capability maturity model have been reported to be expensive and difficult to apply for small and resource poor institutions Duarte and Martins (2011) in a study done in Portugal and Yucalar and Erdogan (2009) in a study done in Turkey on small software companies. They are time consuming and need excessive training for people to be in a position to implement resulting in lost time or focus on main areas of operation. Questionnaire based models have

been found to be easier and cheaper to use as recorded by O'Neill (2011) in his study on the assessment of Hospital IT capability in Ireland and is supported by Staples et al (2007) in their exploratory study on why organisations do not adopt CMMI.

The study intends to document and test an easy to use ICT maturity model and to measure the level of willingness to cooperate among sister institutions through benchmarking among themselves to fill this gap.

1.3 Objectives of the Study

The objective of the study will be to produce a simple capability maturity model that can be used to assess ICT maturity in Agriculture Ministry parastatals.

The specific objectives are listed as:-

1. Produce a questionnaire based Agriculture Ministry Parastatals Capability Maturity Model for ICT services.
2. Test the model on selected parastatals to see its practicality and ease of use.
3. Check whether maturity levels will depend on drivers captured in the model.
4. Assess the level of willingness to participate in Ministry wide ICT services benchmarking among the parastatals.

1.4 Value of the of the study

Performance evaluations have been implemented in most government institutions while the role of ICT in the country keeps growing every day. Management and the Boards of Government parastatals would be able to gain by having a simple tool to assess their positions as regards ICT maturity not only for the purpose of performance reporting, but also for using to pick institutions who are rated better than them for possible benchmarking. The results office in the Devolution and Planning Ministry would have available information and

a basis that can be used to incorporate a more consistent measure of ICT maturity in government institutions than is currently the position. This study will also add to the body of knowledge on assessing ICT maturity particularly in small and less financially endowed institutions. For researchers and academics this would provide a starting point for research in this field which is yet to pick properly in the country and hopes to incite general interest in institutions to want to know how well they are utilizing their ICT facilities. The ministry of Agriculture happens to have the largest number of parastatals under one ministry and is therefore an ideal starting point.

This would remove the need for excessive involvement and cost for a CMMI rating. That is normally done by certified appraisers and involves more than just a questionnaire.

CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction

This chapter covers literature review on the areas of information technology and communication, methods of assessing ICT processes maturity and benchmarking to guide in considering a method to measure the same in agriculture ministry parastatals. Concepts in these areas are discussed while also trying to understand the uptake levels of maturity models in the sector.

Process maturity basically covers the levels of formality and optimization as stipulated by Forrester (2012) giving an edge to an institutions over others. Many methods of measuring ICT maturity have been designed by institutions, some addressing specific sections of ICT, but the one which most literature seem to be leading in acceptance is the capability maturity model which is discussed latter. The review also covers attempts to assess maturity along the lines of CMMI while avoiding areas that are difficult to implement by some. However none of the studies have focused on ways of assessing maturity in organisations similar to the Kenyan parastatals.

2.2 Information Communication Technology

It has occasionally been stated that information is power and information is the currency of today's world. ICT makes it possible for organisation and individuals to manage affairs in a fast and economical way through automation. When it comes to ICT use in agriculture, a number of studies have been done, although mostly concentrated on computer use or adoption but outside Kenya. Gelb and Parker (2005) while summarizing the proceedings of the 5th European Federation for Information Technology in Agriculture, Food and Environment/ World Congress on Conservation of Agriculture reported the conclusions that "ICT adoption for agriculture continues to remain a major problem justifying investment of public funds to alleviate the situation" p. 7 they go further to report the participants noted

constraints of funding and training among others but appreciates that integrating ICT in products used in agriculture will increase uptake without the users necessarily knowing they are using ICT. An ICT system by itself is of no use . Buying the best IT equipment or software without its proper utilization and integration into a business process and strategy would be of no gain and might result in inefficiencies.

Information communication technology has been used in many areas with manufacturing being the early adopters. For example robotics as part of ICT has been able to make significant improvement in production both in the mechanized industrial floor but also in agricultural farms. Farming is taking on automation or robotics and a simple example would be the mechanized date harvesting operator propelled tractor which the operator is able to drive while several meters above it. This was fabricated in Israel to cover for the shortage of labour and capable date palm climbing human harvesters. This is an indication of where ICT is being incorporated even into vehicles currently being produced. A look at most of the items covered in the 2003 catalog of Israel's agro technology industries demonstrate the place of ICT in agriculture.

Progress in the ICT field has resulted in more timely delivery of information. This is to the extent that in the twenty first century, as mentioned earlier, experts from many disciplines and philosophies believe there exists a new industrial order - under such labels as 'the new economic order' Durphy and Stace (1992), 'Post-capitalist society' Drucker (1993) or 'the information era' Naisbitt and Aburdene (1985). As a premium is placed on knowledge as a central resource in the new order, it will be labeled the knowledge society Drucker (1991). Alesina and Drazen (1991) believe that the information age would be very useful for agriculture. Vision 2030 places high value on Science, Technology and Innovation in that it intends Kenya to become "a knowledge led economy wherein the creation, adoption and use of knowledge will be among the most critical factors for rapid economic growth" p.20

The above has resulted in the use of computers to do things which were formerly being handled manually being taken up by computers, and various collaborative sector initiatives on ICT use are being implemented like the launch of the Agricultural market forum reported in the People Daily (2011) which would be a system that would take advantage of the use of ICT and more specifically mobile telephony in Africa and especially the rural areas to increase access of agricultural market information through a multi country mobile and web based system. This a multi donor and multi country initiative supported by AGRA and COMESA.

A simplified and uniform approach to solve a problem has been shown to bear fruits as exemplified in the early success of the Ford Motor vehicle model T where avoiding diverse production enabled economic production of the car through specialized equipment and methods. ICT helps people work smarter and not necessarily harder. Some of the achievement would not be made even if people worked harder. This would be clear to someone who, for example, tried to process the payroll of Kenyan teachers – who are in the thousands – manually.

2.3 Information Communication Technology Maturity Models

Large scale ICT implementation in business accelerated with the advent of the personal computers in the 70's and 80's as they were cheap enough compared to the large mainframes then operated by large corporations. According to Nolan in a Harvard business review paper written in 1973, this was to facilitate the ever expanding administrative functions and manage the ever increasing computational requirements. This came with its teething problems as implementing ICT processes is not easy and disappointments like the ones quoted by Katakera (2009) where Mcmanus and Wood-Harper (2008) shows of research indicating seven out of eight information technology projects fail to meet the original time, cost, and requirements criteria. Given the complexities, He saw IT as growing through four different stages which he later increased to six in 1979. These stages go through from the

time the computers are introduced with very few people knowing about them to when people start to appreciate their use resulting in buy in and committees to full automation stages when institutions would be practically grounded in the absence of ICT – or their output would only be a fraction of what the ICT enabled environment would do. Since then many maturity models have been designed but the most used is the Capability Maturity Model (CMM) associated with Software Engineering Institute (SEI) and the US Department of Defense development of which is discussed below.

The quality management maturity grid was developed by Crosby (1979) in his book “Quality is free” which advanced the position that quality improvement activities paid for themselves by reducing related costs. The first application of a staged maturity model was advanced by Nolan in 1973 through the “stages of growth model for IT organisations” when he came up with the first four maturity stages of Initiation at stage 1, Contagion at stage 2, Control at stage 3 and Integration at stage 4. He later added the Data administration stage at stage 5 and the Maturity stage at stage 6 in 1979.

The Nolan model latter became the basis upon which the Capability Maturity Model was developed by SEI when Carnegie Mellon University won a tender whose winner was awarded by US Department of Defense the then to be formed and sponsored Software Engineering Institute which was meant to help them produce a tool they could use to rate computer companies in a more consistent way as regards the maturity of their systems. According to Forrester (2012) CMM has grown to CMM Integration in which models targeting different systems in an organisation have been integrated to make them uniform or applicable in the different subsystems. SEI have gone further and come up with CMMI – DEV, for product and service development processes, CMMI – AQC for supply chain management, acquisition, and outsourcing processes and CMMI – SVC for delivery of services within an organisation and to external customers. CMMI – SVC is where provision of ICT services in an organisation would fall as per Forrester and SEI.

There are a number of other tools that one can use in assessing ICT provision like the Information Technology Infrastructure Library (ITIL), ISO/IEC 20000: Information Technology Service Management, Control Objectives for Information and Related Technology (CobiT) and the Information Technology Services Capability Model (ITSCOM) among others. CMMI – SVC is chosen for this study as according to Forrester, the CMMI production Team and other writers, all the other mentioned above have been taken into consideration in CMMI in such a way, for example, CMMI – SVC is complimentary and compatible to ITIL and the same is fully mapped to ISO 20000. Also, while some like ISO 20000 is a certification tool on IT service management developed in 2005 (ISO), CMMI only rates and does not certify. CMMI and its materials have also been offered for free, in the interests of science, by SEI and US Department of Defense. ISO specifies minimum acceptable quality levels while CMMI establishes a framework for continuous process improvement.

Local usage of CMMI is low but examples would be a level 3 requirement on the Central Bank of Kenya website for an IT services contract and also in a Kenya IT and Outsourcing services (KITOS) (2011) newsletter, TECHNO BRAIN, an IT company proudly reports Achieving Level 3 certification. Fourman (2011) also reports in the etransform Africa website – a cooperation of the World Bank (WB), African Development Bank (ADB), and the African Union (AU) to research on ICT in different sections of Africa – advocacy for use of maturity models in benchmarking during an etransform Africa workshop in South Africa in June 2011. Based on local IT training advertisements in newspapers, There seems to be a lot of local training on ITIL, which has more connection with the UK Governments Office of Government Commerce (OGC) and some on Cobit. A SEI partner organisation, Wibas IT Maturity Services (2007) of Germany has come up CMMI – ITIL which it presented in a 2007 European SEPG meeting. According to Wibas, CMMI – ITIL is permissioned by both SEI and OGC. SEI (2012) reports the growing economies of Mexico, Columbia, South

Africa, China, Japan, and Malaysia as major users as also considerable use in Europe. The highest user, however, still remains the USA.

By working on process improvement, business can quickly reduce waste and increase productivity. According to SEI and Forrester (2012), “the quality of a system or product is highly influenced by the quality of the process used to develop and maintain it” p.5. CMMI addresses process improvement as an organisation moves from one stage to the other. CMMI is modeled on five levels of maturity through which institutions progress one stage after the other in the staged maturity progression and four levels of capability in the case of continuous maturity. The difference between the two is that staged assessments look at the whole organisation while continuous representation look at specific processes that are important for an organisations immediate business objectives. These stages are:-

2.3.1 Maturity Levels

Level 1 also called Initial is the first in which processes are unpredictable, poorly controlled and reactive. Processes are adhoc and chaotic while success depends on competence and heroics of people and not use of proven processes. The second, level 2 also called Managed or Repeatable is where processes are characterized for projects and are often reactive. Basic project management techniques are established and successes could be repeated, because requisite processes would have been made, established, defined and documented. In level 3 also called Defined, processes are characterized for the organisation and are proactive – projects tailor their processes from organisation’s standards. Here there is greater attention to documentation, standardisation and integration. level 4 also called Quantitatively Managed – In which processes are measured and controlled. This will be through data collection and analysis and level 5 also called Optimizing is where focus is on process improvement through monitoring and feedback.

2.3.2 Capability Levels

In the case of capability levels, level 0 also called incomplete is where processes are not complete, level 1 also called performed, in which certain processes have been performed but, as mentioned in maturity level 1 above, these depend on individual competence and heroics and might not be repeatable. level 2 also called Managed is a higher level in which characteristics as in maturity levels above apply and finally level 3 also called defined has the same characteristics as in maturity levels above.

According to SEI and Forrester (2012), CMMI has core process areas which are process areas that are common to all CMMI models. There are also shared process areas which are ones shared by at least two CMMI models, but not all of them.

SEI believes that to improve its business, organisations need to focus on three critical dimensions. These are people with right skills and attitudes, procedures and methods well thought out to deliver the objective and the right tools and equipment. These three comprise a process and having them right will result in efficient and successful delivery. There are however no processes in CMMI only process areas related to business process improvement. CMMI is a collection of practices to improve an institution's processes. The assumption is an organisation has its own standards, processes and procedures.

A CMMI assessment is done through SEI certified appraisers in which organisations go through a Standard CMMI Appraisal Method for Process Improvement (SCAMPI) which is a reasonably expensive exercise due to the consultancy costs involved, the training necessary and the evidence that will need to be collected. Institutions can however go through an appraisal through any method, including self-appraisal if they are not interested in their maturity or capability levels being recognised and Okayed by SEI. No certification is issued.

CMMI is currently at version 1.3 which was released in November 2010 while the current CMMI – SVC was effectively implemented in mid-2012. Studies have recorded the serious difficulties of use of CMMI and related models in small organisations while at the

same time registering a positive relationship between size, ISO certification and large but to higher maturity levels.

2.4 Benchmarking of ICT services

Shona (1998) describes benchmarking along the lines of self -examination, checking what fellow players in the industry are doing, evaluating the two and then trying to perform along the lines of the process or procedure producing the best. In this process, one would need to be completely honest and open minded to ensure prejudices do not stop one from picking superior ideas

As regards CMMI – SVC levels in the Agriculture Ministry parastatals or levels produced in the latter proposed model, having scores on level of maturity would be a first step after which evaluation of processes in high scoring institutions would be done with an aim to benchmark on the ones delivering high standards. Benchmarking will, in most cases, result in institutions or organisations using similar systems in their delivery despite the fact that there are some known negative side effects of many people/institutions doing the same thing from a centrally controlled point. Examples of caution on over regulation are Brown and Eissehardt (1998) who in elaborating on the ‘edge of Chaos’ concept which is the point at which institutions are structured for flexibility to accommodate unplanned and unstructured changes that would be beneficial to the organisation. A case is put forward on why centrally managed economies like the Soviet Union would collapse if something at the main operation area would go wrong while less strictly structured ones would most likely quickly adapt and thus would be much more difficult to be affected. Locally, for example, if a serious flow were to happen to the current IFMIS system operated by treasury, the effect on the whole of Government system would be grinding operations to a halt while the case would be different if each Ministry was using its own financial system. Benchmarking helps individuals and organisations learn as they evaluate the systems being used by others and as they try to implement the reviewed system.

The above is exemplified in Codling's (1998) and Tidd's (2005) description of benchmarking as along the lines of "being proactively aware; understanding what we have to be best at, then comparing ourselves openly and honestly with others who excel in those areas recognizing the standards we have to achieve in whatever market we are in. And once we have recognized them, setting out to meet – and exceed – them by managing that knowledge in order to achieve or secure greater, competitive advantage".

A benchmark is a reference or measurement standard used for comparison while Benchmarking has variously been defined as learning from others successes. It has also been seen as the continuous process of identifying best practice and implementing the same to achieve superior performance, Benchmarks can be compared for sections in an institution, against outside players in the same industry, against a specific competitor or even with players outside the industry but who could be having processes that are likely to be useful to the organisation doing benchmarking.

In systems and software preparation, quotes by Schach (1991) of Boehm (1981) shows figures that reflect data from IBM - Fagan (1974), GTE - Daly (1977), the safe guard projects - Stephenson (1976) and smaller software projects Boehm (1980). These quotes show that if it costs \$10 to fix a fault during the implementation stage, that fault would have cost \$1 to fix during the specifications phase, however during maintenance the same could cost \$100 to fix. This implies that errors should be discovered early and benchmarking takes advantage of tested and delivered systems to ensure that costly trial errors are avoided where existing successful ways of doing things already exist.

Codling (1998) reports of how Rank Xerox was able to turn tables on its declining photocopying related products sales after an onslaught with cheaper, more efficient and properly delivered Japanese products after its patent expired in 1978. Benchmarking with the Japanese competitors enabled it to stop further loss of market and claw back part of what was already lost. It is noted that with the patent, the company originally had 100% market share

and was then reported as the first to reach the \$ one billion annual sales faster than any corporation in the United States of America had done before.

ICT runs on hardware, software, documented methods and people but the right item among its ingredients can make a big difference among two institutions with the same type of everything else. Benchmarking and involvement of users in the change is important. It is reported that, for example, success of a software development project will normally depend on the acceptability of the resulting system by users and how well it meets the requirements of the users. Cases of software development projects which either are never fully implemented or do not meet the requirements are many in the industry Katarak (2009). Incorporation of user needs would only be possible through the full involvement of the users in guiding the production process. In the case of parastatals in Kenya, Akuma, (2013), in his survey on use of general Benchmarking as a continuous improvement tool by the Ministry of Agriculture Parastatals registers awareness and almost informal use of benchmarking with challenges in process analysis, availability of benchmarking partners, scarcity of resources and bureaucracy. Namu, (2006) in her study on the use of Bench marking in general as a performance improvement tool: - A case of Kenya Power Lighting company also reports very informal use of benchmarking in only two divisions. The reluctance to use the tool was felt to be due to its monopolistic status in the supply of electricity.

According to Kotler (1997) understanding the customer need to incorporate as part of the benchmarking process is important as one can thus be able to offer a solution that will serve that need even if the customer was not aware of that solution.

2.1 Use of ICT services and Maturity Models in Ministry of Agriculture Parastatals

There would seem to be no specific report of a MoA parastatal having undergone a CMMI appraisal which is not surprising given that CMMI usage in the country is low. This study will help to bridge this gap. Other reports on ICT status have however been done like, Kipkemoi (2006) did a study on factors hindering growth of ICT usage in state parastatals

where his main interest was on the factors. The Ministry also occasionally conducts an assessment of how the institutions are doing against specified factors and in its May 2010 report on the seven fundamentals of institution management, it is possible to deduce that the institutions have taken up ICT at various levels although, other than a question on the existence and level of operation of a website, there is no other ICT specific question or evaluation. A simple tool or model that can be used to assess maturity would be of help and this study proposes one.

In the performance contracting mentioned earlier, institutions have been asked to report how far they feel they are towards full computerization, and by implication maturity, and ICT uptake and they have reported varied levels but these indicate that there is more uptake to be undertaken in the years to come. Most institutions have at least their accounting and payroll functions computerized to a reasonable level but due to the items mentioned by Kipekmoi – training, funding and lethargy among others – they are a long way from the ideal near paperless institutions at which level they would reap maximum ICT benefits.

2.2 Research Gap and the Model

CMMI use in the region currently seems to be a bit low despite Forrester (2012) reporting huge gains by corporations that have used it. Siemens, for example, reported a 25% productivity improvement over a three year period, Raytheon decreased costs of rework by 42% at level 3, General Motors met milestones improved from 50% to 85% with focus on CMMI while Lockheed Martin had 20% reduction in software costs by integrating engineering processes using CMMI. Not much research has also been done in this area with most of what is done addressing the difficulties of implementing CMMI in small organisations. Staples, Niazi, Jeffery, Abrahams, Byatt, and Murphy (2007) did an exploratory study on why organisations do not adopt CMMI where cost and level of involvement were the reasons given by small firms. Duarte and Martins used CMMI to try

and come up with a Maturity model for Higher Education institutions where processes were modeled and analysed among others.

Due to the limitations mentioned above, and given the SEI CMMI questionnaire size and procedures involved, an alternatively prepared questionnaire based appraisal can be used to assess the maturity levels at the Ministry institutions as this would not only be cheaper but will not need the use of SEI certified appraisers. Yucalar, and Erdogan (2009) did a similar study titled A questionnaire based method for CMMI Level 2 maturity assessment in which they also elaborate the difficulties of small organisations to undergo a SCAMPI. They were able to draw conclusions on where the institutions were on the level 2 appraisal as per the questionnaire used.

Undergoing a SCAMPI is a very involving and costly process and training would be necessary for lead team members who would guide the process. It would also involve certified assessors who are costly to deploy. Never the less, it would be useful to have a simple method to assess ones level of ICT maturity as a starting point when it is either not necessary or in preparation to undergo a SCAMPI. This study will propose and test a questionnaire based model that would be simple to apply without the need to understand too much of the process jargon. Instead of basing questions on the processes, the questions have been based on expected results visible to the ordinary worker on the basis that those results will be as a result of processes. The questionnaire questions will provide information that will allow rating on twenty areas in which an institution can score between one and five points per area. This means they will score a minimum of twenty points for the lowest maturity and a maximum of 100 points for the highest maturity, The maturity levels for the model have been named Initial for Level 1, Basic for Level 2, Automated for Level 3, Web Integrated for Level 4 and Advanced for Level 5. These levels try to capture the same steps as in CMMI for service but have been given names that will have more practical understanding based on expected results rather than processes.

The indicators covered by the questions have been rated as per existing indicators by various players like the ICT opportunity index (ICT-OI) of the International telecommunication union; the Knowledge Information and Knowledge Economy Index (KEI) of the World bank; The Digital Opportunity Index (DOI) of the International Telecommunication Union; The Network Readiness Index (NRI) of the World Economy Forum; E-Readiness- economist intelligence unit of the Economist and IBM Institute of Business value as mentioned in the United nations UNCTAD (2009) Manual for production of statistics on the Information economy. Where an institution has implemented an indicator, a score based on the recommended level shall be awarded in the model.

CHAPTER THREE: RESEARCH METHODOLOGY

3.1 Introduction

This chapter describes the procedures that were followed in order to achieve the study objectives. The areas covered are research design, population, sampling plan and data collection. Methodology according to Cooper and Schindler (2006) is a framework for conducting a study and should give an outline of steps to be undertaken.

3.2 Research Design

This was a descriptive survey involving parastatals in the ministry of Agriculture as at the time of the study. This was done to help test the simple maturity model while providing maturity scores as per the model for the institutions. A survey research approach was chosen as it has been stated to be the best suited to collect descriptive information by a number of authors, among them, Kotler and Armstrong (1996).

3.3 Population

The population was all the parastatals and statutory organisations in the Ministry of Agriculture which totaled to 32 as at the beginning of year 2013. The institutions are listed in appendix 3.

3.4 Sampling

A large number of these parastatals do have their Headquarters in Nairobi. ICT penetration is also seen to be more prevalent in Nairobi than in the rural areas. This can be looked at as an experience survey and according to Churchill (1991), it is important to include in the sample only those people who have the competence and experience to be able to provide useful information for the survey. Given that it is also an aim of the survey to pick out best practices in the field with the possibility of the others latter benchmarking or

reengineering around. It is felt that surveying only those parastatals headquartered in Nairobi will give a good representation of the information sought. In the case of institutions with country wide branches, their head of ICT and general coordination of ICT policies are expected to be done from Head Quarters in Nairobi making it possible to capture their status without having to go physically to the branches.

It is further realized that some of parastatals, particularly the statutory ones, operate within the Ministry itself or have not gotten sufficient autonomy to make decisions that would make institution specific differences in this area as they plan as part of the Ministry. Institutions in this category which operate closely with the Ministry have also been left out. Any Institution which is currently under receivership or is moribund in its operations is also left out as they might not give the current best in the field due to their financial status or non-operation.

After all the above was taken into consideration, sixteen parastatals, as listed in appendix 4, were to be approached to participate in the study. Of the sixteen, two of the parastatals were not able to participate in the study as it turned out their headquarters had moved to Kitale and Kisumu for institutions listed as number 3 and 15 respectively on appendix 4. A sample of fourteen parastatals was thus utilized.

3.5 Data Collection

In this study Primary data collection was done through the filling of a standard questionnaire. The questionnaires were filled in an interview session with a representative of the target institutions. Where requested, copies of the questionnaire were left with the officers to allow for familiarization on the subject matter. These interviews were held with the heads of the ICT department in the target institutions. The questionnaire had three sections, Section 1 collected general institutional information to be used in analysing information collected in the other two sections, section 2 collected data on the status of ICT service in the institution for comparison with known expectations while section 3 assessed for willingness to

cooperate in benchmarking. Frequencies of data collected were filled in predesigned category forms. Most of this data was descriptive in nature.

3.6 Data Analysis

The collected forms were scanned for completeness and consistency and then coded by allocating numeric values to the replies provided so as to assist in calculating the descriptive statistics to be used in the analysis. The tested regression model relating ICT maturity to its drivers was of the form $S = a + b_1x_1 + b_2x_2 + b_3x_3 + b_4x_4 + e$. Where S = maturity score; a = the S intercept when x is zero; b_1, b_2, b_3, b_4 are regression weights attached to the variables; x_1 = no of employees; x_2 = years since ISO certification; x_3 = ICT budget in millions; x_4 = total organisation budget in millions and e allows for errors.

A regression analysis using the Descriptive Statistical Data Analysis tool provided in Excel was used to test – at the 95% confidence level - the following hypothesis:-

H_0 : None of tested maturity drivers are significant predictors of ICT maturity in MoA parastatals

H_1 : At least one of the tested maturity drivers is a significant predictor of ICT maturity in Moa parastatals

Objective one on the questionnaire based maturity model and objective two on the testing of the same was analysed through the practical utilization of the tool with the ICT officers in the organisations while noting the general time taken to fill the tool. Objectives three and four on the maturity drivers and willingness to benchmark were analysed through the use of scatter graphs and regression statistics.

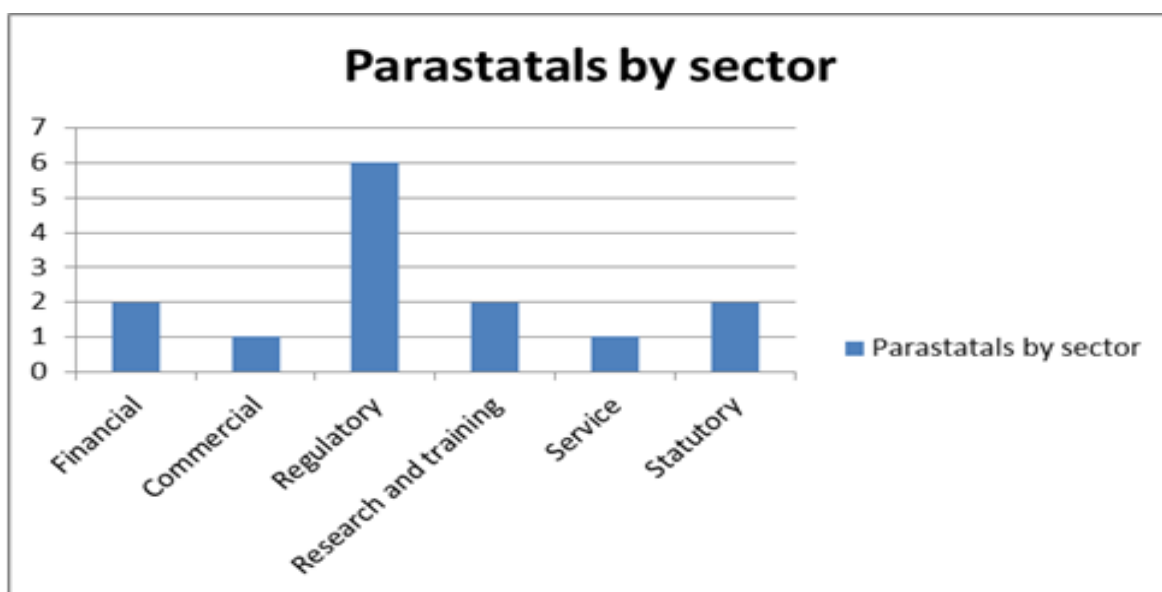
CHAPTER FOUR: DATA ANALYSIS, RESULTS AND DISCUSSION

4.1 Introduction

This chapter presents data analysis, findings, and discussions. The purpose of this study was to develop and test a simple questionnaire based maturity model and check for willingness to benchmark amongst Ministry of Agriculture parastatals.

Data collection involved visiting the offices of the target institutions and of the sixteen parastatals sampled, data was collected from fourteen representing a response rate of 88% which is felt to have covered a good representation. Most of the institutions visited were within the Nairobi County while the furthest visited was in Ruiru in Kiambu County. Parastatals in the regulatory sector were the highest in number as shown in Figure 4.1

Figure 4.1 - *Parastatals Interviewed by Sector*



4.2 Findings

No problems were encountered during the filling of the questionnaire and the duration taken ranged between fifteen and forty minutes to complete. The maturity model produced maturity scores ranging from 32 as scored by parastatal number five as the lowest to 59 as the

highest which was scored by parastatal nine and thirteen as is shown in Figure 4.2. It will be remembered that the score range was between 20 for the lowest maturity and 100 for the highest maturity. These figures indicate a level 2 maturity level generally for most of the parastatals with some tending towards the early areas in level 3. This seems consistent with other questionnaire based assessments done by others for small organisations examples being Yucalar and Erdogan (2009).

In the specific areas queried, the organisations scored a combined high of 100% for the operation of a website followed by 71% on access to internet for its employees. On the low side, they scored a low 20% on the provision decision making aids to senior management followed by 26% on the level of integration of the systems. It seems that although most of the organisations are trying to install an Enterprise Resource System – ERP – majority have already bought Microsoft Dynamics Naivision system – most information is currently kept on different silos which are not interconnected. In particular, assets management system is yet to be seamlessly interconnected with the other systems. As mentioned by Kipkemoi (2006) the most active systems remain finance, payroll and to some extent human resource.

4.3 Maturity Levels

Results on the levels of maturity indicated in Figure 4.2 show there is quite a big gap between the institution scoring the lowest with the highest almost achieving double that score. This would seem to indicate the need for cooperation in this area so as to learn from each other

When the maturity scores were averaged by sector, the range remained almost the same at between 36 and 56 with the financial sector having the highest maturity average. This could be due to the fact that information technology is a very important tool for success in that sector. The commercial and statutory sectors which have scored a low 36 involved institutions which have not adapted to information technology in their business methods. See Table 4.1.

Figure 4.2 – Parastatals Maturity Scores

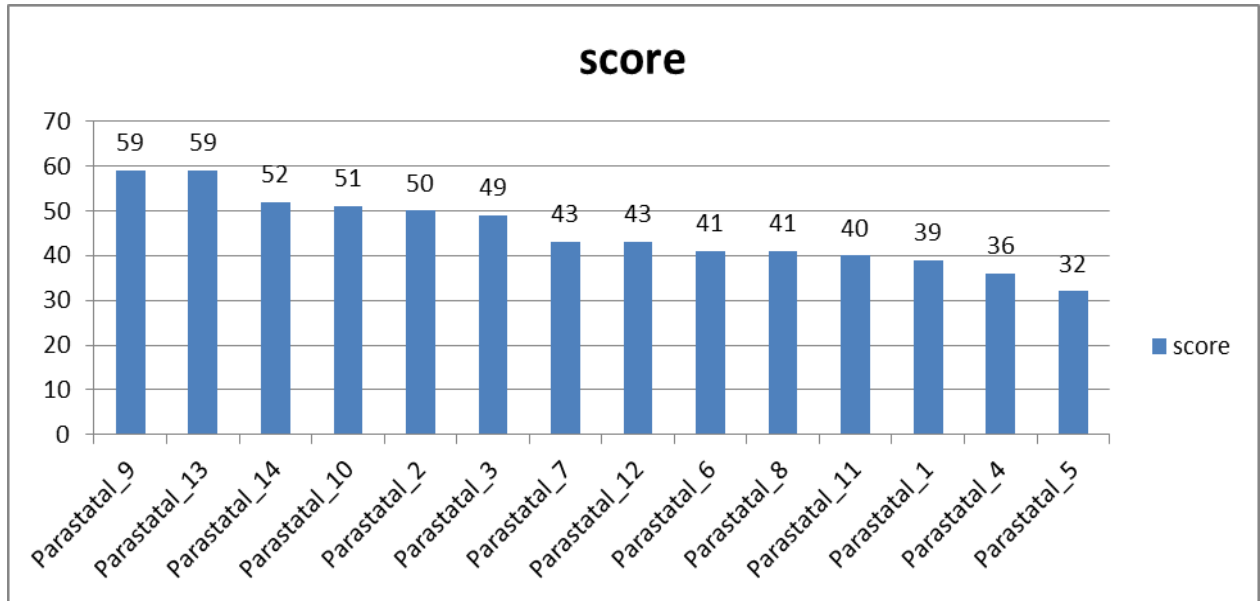


Table 4.1 – Parastatals Average Scores by Sector

Sector	Interviewed Parastatals by sector	Score by sector	Average by sector
1 Financial	2	111	56
2 Commercial	1	36	36
3 Regulatory	6	284	47
4 Research and training	2	84	42
5 Service	1	49	49
6 Statutory	2	71	36

4.4 ICT Maturity Assessment

In Table 4.2 and Figures 4.3,4.4,4.5 and 4.6, the parastatal maturity scores have been mapped against number of employees, organisation budget, IT budget and how early an institution achieved ISO certification. The first three were checking for the effect of size and commitment to the level of maturity in an organisation. While previous studies, Staples et al (2007) for example, among IT companies did show a positive correlation between size of the organisation and budget levels to its corresponding maturity level, this study showed no relationship between these factors as can be seen in the Figures 4.3,4.4,and 4.5. A maturity

model guides an institution from the trap of having its success being dependent on the heroics of specific individuals without the possibility of replication of their good actions, and avoidance of the actions not helping the organisation, in their absence. This failure to support other studies indicating correlation between size and budget with maturity scores, although mostly in the IT industry, looks like an area needing a further research on as it would be normal to expect a higher provision of resources to result in better quality of services.

It will however be noticed that there is a relationship between the time one achieved ISO certification and the maturity level achieved as can be seen in Figure 4.6. ISO is a form of quality measurement and its early adoption might indicate an institutions interest in perfecting its systems which includes ICT and thus a possible indication of an institutions progress in ICT maturity. Provisions in the parastatals likely to affect the level of maturity are mapped against the maturity scores each parastatal achieved as shown on Table 4.2 and the graphical representations of the tested drivers in Figures 4.3,4.4,4.5 and 4.6

Table 4.2 – *Maturity Score Mapped against Number of Employees, Budget size and Years since ISO Certification*

Organisation	score	No of Employees	Years since ISO certification	ICT (Millions) Budget	Total org. (Millions) Budget	score
Parastatal_1	39	54	0	35.0	40	39
Parastatal_2	50	52	4	27.0	523	50
Parastatal_3	49	400	3	20.0	1,000	49
Parastatal_4	36	420	5	20.0	1,425	36
Parastatal_5	32	1,000	0	62.0	1,292	32
Parastatal_6	41	52	0	2.0	100	41
Parastatal_7	43	3,000	2	283.0	1,900	43
Parastatal_8	41	267	3	6.0	638	41
Parastatal_9	59	80	6	50.0	540	59
Parastatal_10	51	430	5	20.0	385	51
Parastatal_11	40	200	4	10.0	256	40
Parastatal_12	43	47	1	6.0	67	43
Parastatal_13	59	33	4	10.0	300	59
Parastatal_14	52	600	3	58.0	463	52

As mentioned earlier, the model being tested was a regression model of the form $S = a + b_1x_1 + b_2x_2 + b_3x_3 + b_4x_4 + e$. Where S= Maturity score; a= the S intercept when x is zero; b_1, b_2, b_3, b_4 are regression weights attached to the variables; x_1 = No of employees; x_2 = Years since ISO certification; x_3 = ICT budget in millions; x_4 = Total organisation budget in millions and e allows for errors with the results as indicated in the table below.

Table 4.3 – *Regression Results*

<i>Regression Statistics</i>	
Multiple R	0.787487911
R Square	0.62013721
Adjusted R Square	0.451309303
Standard Error	6.049999433
Observations	14

ANOVA					
	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>
Regression	4	537.7918474	134.4479619	3.673191368	0.04864412
Residual	9	329.4224383	36.60249314		
Total	13	867.2142857			

	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>	<i>Lower 95.0%</i>	<i>Upper 95.0%</i>
Intercept	40.79844722	3.370253635	12.10545307	7.14663E-07	33.17440382	48.42249063	33.17440382	48.42249063
Employees	0.007161652	0.010261679	-0.697902542	0.502868755	-0.030375182	0.016051878	-0.030375182	0.016051878
ISO certification	2.68845395	0.947860043	2.836340628	0.01951937	0.544245564	4.832662336	0.544245564	4.832662336
ICT Budget	0.117909848	0.090547403	1.302189175	0.225188699	-0.086922608	0.322742303	-0.086922608	0.322742303
Tot. Budget	0.007616302	0.005795739	-1.314120929	0.221310634	-0.020727174	0.00549457	-0.020727174	0.00549457

With a correlation of about 79% - multiple R – and the coefficient of determination - R square of 0.62, this implies the overall model reasonably predicts ICT maturity to a level of 62%. The overall strength of association, without taking individual drivers into consideration, is thus good although a much higher percentage would provide a more assured tool for the intended prediction. It is noticed that when R square is adjusted for predictors that might not be giving value to the model, it falls to below 50% at 45%. This would imply there are a number of

predictors which might need to be replaced or removed so as to improve the overall predictive capacity of the model. These are looked at latter below.

In the analysis of variance, the regression explains a large percentage of the ICT maturity with an F value of 3.673. This further supports the fact the overall model can be used to a certain extent to predict maturity as the significance of F is registered at 0.0486 which is below the cutoff of 0.05.

With individual drivers, the coefficients for number of employees (0.007161652) and total budgets (0.007616302) are approaching zero and therefore cannot be of value to the model. This is further supported by the respective p values of 0.50287 and 0.22519 which are way above the set p value of 0.05.

As regards the ICT budget, this registered a positive value implying it could be used to predict ICT maturity but this ruled out by the fact that its p value at 0.2259 is way above the cutoff point of 0.05. The results thus indicate number of employees, ICT budget and total budgets in parastatals in the MoA cannot be used as predictors of ICT maturity in those organisations. As discussed earlier the reported situation is likely to be due to the way the resources related to the respective drivers are used in relation to ICT maturity. For example, a large number of the employees and a big proportion of the funds are used in none ICT processes like on the farm.

Duration since ISO certification has a positive coefficient of 2.69 and is recorded as significant as its p value, at 0.01952, is below the cutoff of 0.05. This implies that this driver could be used as a predictor of ICT maturity in MoA parastatals. ISO being a quality measurement tool is related to ICT maturity which supports its relevance to the model.

4.4.1 Graphical Representation of Drivers

Scatter graphs of the tested drivers as they relate to maturity scores are presented in the following pages which go to indicate support for the regression results that only years since ISO certification is indicated as a possible predictor of ICT maturity levels in the firms.

Figure 4.3 – *Maturity Levels Graphed against Organisation budget*

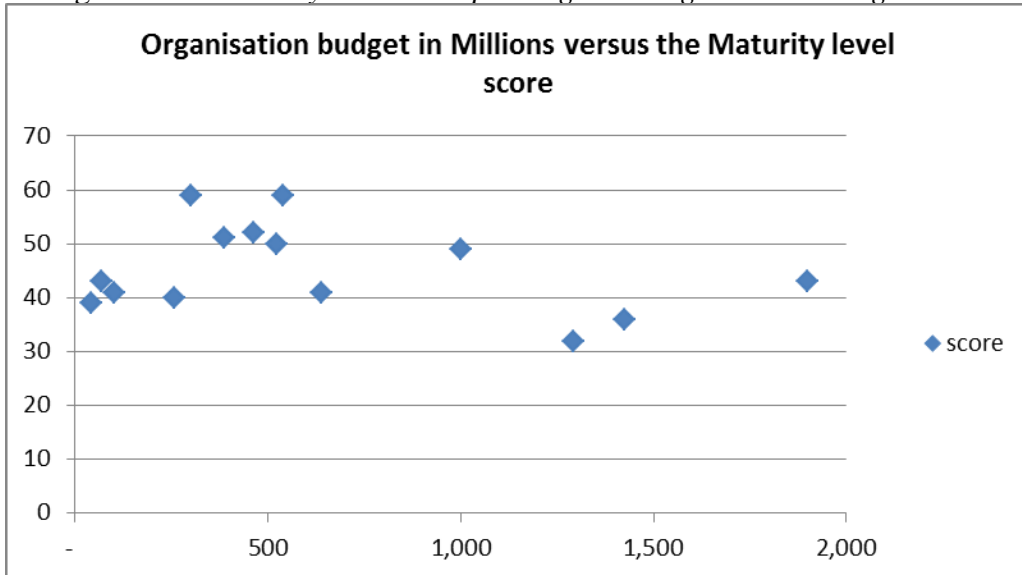


Figure 4.4 – *Maturity levels Plotted against IT Budget*

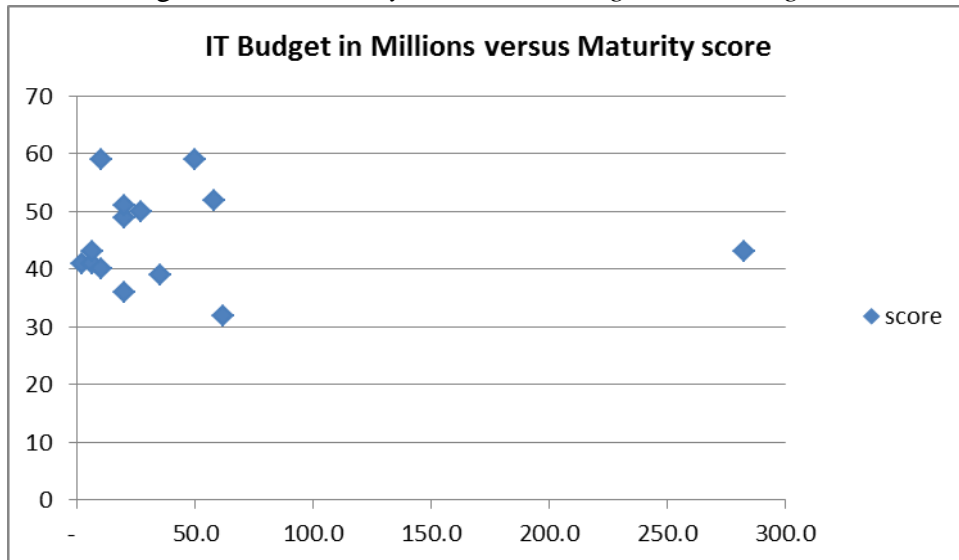


Figure 4.5 – *Maturity levels Plotted against Number of Employees*

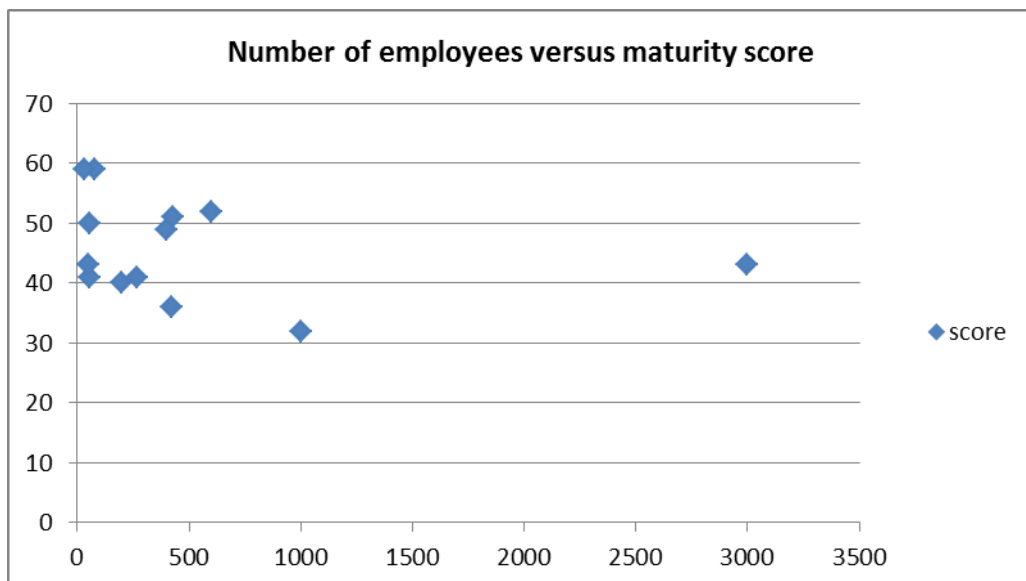
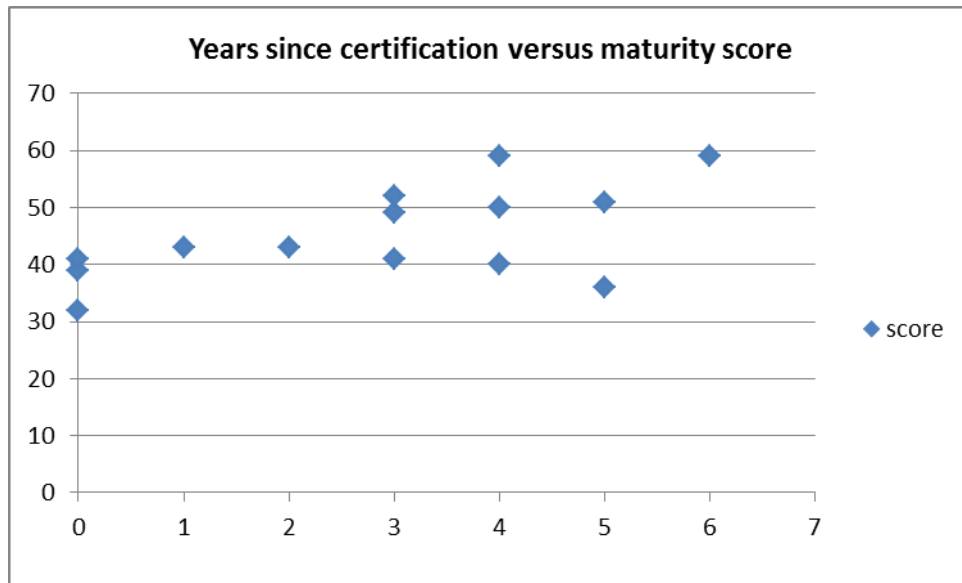


Figure –4. 6 *Maturity Scores Plotted against Time elapsed since ISO Certification*



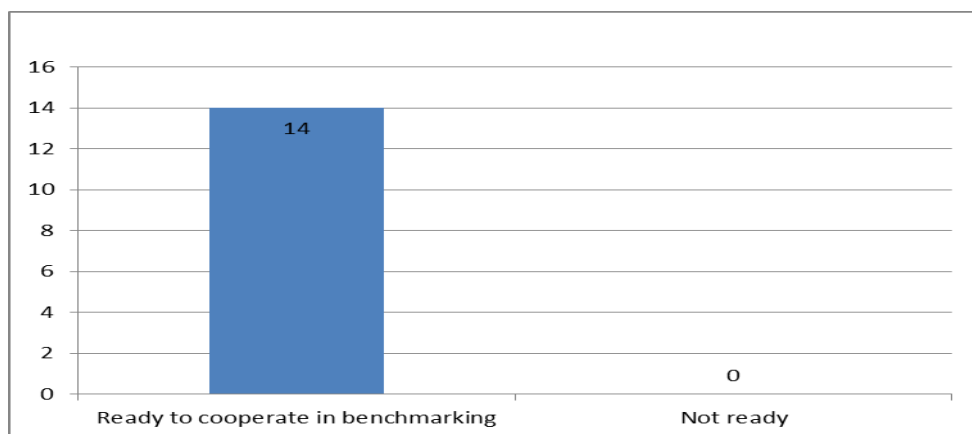
The first objective to produce a questionnaire based ICT maturity assessment tool result in a tool which was easy to administer given that it took a short time to fill – between fifteen and forty minutes. The cost involved would also be minimal as it would only involve printing of the questionnaire, administering it on the head of ICT to check for any changes and then analysing it. On the second objective, the tool was tested on the sampled parastatals without any problems implying its possible use to compare these institutions using the model. On the third objective, the overall correlation reported again confirmed the possibility of use of the model to measure ICT maturity but the individual drivers mostly failed to support the expectation that the y would be good predictors of ICT on MoA parastatals except for years since ISO certification which passed the test. This is thought to be because size in these agricultural parastatals is in resources being used in other areas other than ICT. For example, a large number of the employees could be in the agricultural fields with very little utilization of ICT tools. The budgets also would be used in the fields. In the detailed figures, provision of computers scores the second highest figure of 64% which could explain why where we have large IT budgets this does not result in higher maturity values given that it is the existing processes and not necessarily the hardware or software one has that indicates maturity.

4.5 Willingness to Benchmark

On the issue of institutions benchmarking against each other through some coordinated information provision on what exists in sister organisations, this was picked very positively and all the interviewees replied positively to this question. See Figure 4.7

The IFMIS system being run by treasury has been in use for quite some time now with reported gains, a lower version of this type of using what is working best in these institutions could be picked to fast track implementation and reduce time spent researching various options when a working solution may already be in existence in one of the parastatals.

Figure 4.7 - *To Benchmark or Not*



This willingness to benchmark is supported by studies by Akuma, (2013) and Namu, (2006) which indicated parastatal do benchmark although not in a formal way due to the tool not being formally mainstreamed in the organisations with challenges like information flow difficulties due to bureaucracy in the free sharing of information. Some formal Benchmarking has however been undertaken like in the case of personnel issues where Research Institute Management coordinated an exercise about eight years ago to try and come up with a document which incorporated the best from individual organisation policies. The MoA also does do a biannual survey on ten key fundamental management factors and shares the report with the parastatals from which an organisation can place itself among its peers. As mentioned earlier, ICT is only measured through the presence or lack of an internet site.

CHAPTER FIVE: SUMMARY, CONCLUSION AND RECOMMENDATION

5.1 Introduction

This chapter summarises the findings in relation to questions raised in the statement of the problem and objectives of the study. The chapter also highlights the limitations of the study and concludes with some suggestions for further research.

5.2 Summary of findings

This study started out to develop and test a questionnaire based maturity model for Ministry of Agriculture parastatals and check for willingness to benchmark against fellow institutions in the provision of ICT services. The produced model produced results which indicate most of the institutions are operating around the second level which is consistent with other questionnaire based studies done for small organisations. While the overall model passed the significance test indicating its possible usefulness, only one tested maturity driver – time since ISO certification – did pass the significance test of usefulness as a possible predictor of ICT maturity in Ministry of Agriculture Parastatals. Early adopters of the ISO certification were found to have higher maturity scores. The other three tested drivers viz – No of employees in the organisation, The ICT budget and the Institutional total budget all failed the significance test thus indicating they cannot be used as predictors of ICT maturity in those organisations. Institutions gave strong support to the need to benchmark in order to gain from fellow parastatals with a higher maturity score in the ICT area.

5.3 Conclusions and Recommendations

Institutions with high maturity scores in ICT services provision would end up providing better services to its customers and the nation. While there exists a number of maturity models which can guide organisations as they go up the maturity ladder, the most

renown especially CMMI have been shown to be expensive and cumbersome to implement for small or resource poor organisations. This supported by studies which have tried to look for alternatives to the expensive, technical and very involving CMMI. Examples would be by Murphy (2007) and O'Neill (2011). Questionnaire based ICT maturity measuring tool have been tested for ease of use and expense and found to be acceptable alternatives to undergoing a SCAMPI for institutions that would not afford it. An acceptable tool would help them assess themselves in their annual evaluations and also be able to know who are performing better than them with a possibility of learning from them. Due to the need to have a consistent tool to assess ICT maturity particularly during the annual performance contract exercise, this tool could be used as a starting even as it is revised to check or confirm why the other four drivers did not pass the test as indicators despite this having been so in IT companies. It cannot be claimed that this is an absolutely reliable method but can be used as a good indicator although there is a place for CMMI particularly for institutions that can afford it.

5.4 Limitation of the study

This being a case study, the findings cannot be generalized and therefore conclusions can only be restricted to organisations similar to the parastatals covered. Due to logistics and finance, the study only covered the parastatals based in Nairobi. While a large proportion is represented in Nairobi even where they operate in the provinces, a study covering more locations would give a more complete picture.

5.5 Suggestions for further research

A study involving more likely drivers with an aim to perfect the model would be encouraged so that a tool can be in place to measure ICT maturity. Segregating various factors of the drivers covered in this study would help remove aspects of those drivers that would not be helpful to the model. For example the ICT budget could be broken into various funded components and only components related to ICT maturity be included in a study.

Other studies have registered positive correlation between size of an organisation and levels of budget to ICT maturity but in this case there was none. It would be useful to do a study to pick the main reasons why size in Ministry of Agriculture Parastatals has no relationship to ICT maturity.

As regards the performance measurement, an interrogation or use of the maturity model, as part of a study or during actual performance appraisals would provide useful feedback and help evaluate its usefulness and bring to mind performance by other parastatals so as to enhance benchmarking.

Given the importance of ICT in today's world and in particular Kenya, some form of maturity measurement should be popularized and put in practice to help improve in process efficiencies. This thus calls for further research in this area.

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Questionnaire forwarding letter

APPENDICES

Appendix 2

Survey on ICT services Capability Maturity in the Ministry of Agriculture Parastatals

Thank you for availing your time to fill this questionnaire

Please mark boxes with a tick :



or fill as appropriate

Section 1.

1. Name of Parastatal _____

2. Sector _____ (1.Financial 2.Commercial 3.Regulatory 4. Research and Training 5. Service 6.Statutory)

3. No of Employees in the organisation: _____

4. No of IT Employees: _____ (Employees listed in the Section/Department)

5. No of office locations/Branches: _____

6. No. of old provinces –now named regions - currently operating in _____ out of eight. (1. Central, 2. Coast, 3. Eastern, 4. Nairobi, 5. North Eastern, 6. Nyanza, 7. Rift valley and 8. Western) – *Provinces or regions have been used as a number of people have not mastered the counties Nationwide while positioning in the old jurisdictions are clear. This will be sufficient as results of this question will only indicate level of spread.*

7. Phone: _____ Optional

8. Email: _____ Optional

9. Interviewee Name _____ Optional

10. Position/Title _____

11. Organisation mandate:

12. Brief Description of Office/Branch Network:

Section 2.

1. Does the Institution have a local area network - LAN?

- Yes
- No

If Yes, How many computers are connected to it _____

2. Does the Institution have a wide area network - WAN?

- Yes
- No

If Yes, Please state the branches connected to it

And the method of connection

3. What is the internet connection bandwidth?

- None;
- Unknown;
- <4mbps;
- <8mbps;
- <16mbps;
- 32mbps;
- <=32 mbps

4. What is the total number of computers in the organisation?

5. What is the total number of laptops in the organisation?

6. Does the Institution have an offsite backup system?

- Yes
- No

If Yes, Please state the dates of the last five backups

And the method of delivery to backup site

7. Dividing the institutions staff salary scale into five segments, Please state the number of IT staff who fall under each group

Lowest group _____	Scale _____	No. of IT staff _____
Next _____	Scale _____	No. of IT staff _____
Next _____	Scale _____	No. of IT staff _____
Next _____	Scale _____	No. of IT staff _____
Highest _____	Scale _____	No. of IT staff _____

8. What is the title of the Head of IT and how many job groups is s/he below the CEO?

Title _____ Job Group _____

9. Is there a routine training program for IT staff and users?

- Yes
- No

If Yes, Please give a brief description

10. If an asset was bought and received today, would a manager be able to get it listed among the institutions assets on her/his desk computer the next day together with its depreciation schedule as a matter of routine?

- Yes
- No

11. Please list the number of systems that are fully integrated. (for example, an entry in the personnel system can immediately be reviewed from the financial system or vice versa)

12. Does the institution have installed an Enterprise Resource Planning (ERP) system like SAP or Oracle?

- Yes
- No

If Yes, Please state the name of the system

And the systems running on it

13. Does the institution produce manual receipts?

- Yes
- No

If No, Please describe briefly how you receipt

14. What was the last major application installed?

For this please indicate the following:-

- a. Was the installation timely Yes No and if not by how much time was the delay _____
- b. Were all the institutions requirements met Yes No and if not what arrangements are in place to rectify the situation

15. Please list the names of applications installed in the institution that handle the below listed functions. Write none where none is in place.

- DSS – Decision Support System _____
- DW – Data Warehousing _____
- DM – Data Mining _____
- MDB – Multidimensional Database _____
- KM – Knowledge Management _____
- EIS – Executive Support System _____
- SIS – Strategic Information System _____
- BI - Business Intelligence _____
- CIS - Competitive Intelligence system _____
- E-Commerce _____
- SCM – Supply Chain Management _____
- Mobile commerce _____

16. What is the number of employees who have official internet access on their desk PC's?

17. Does the Institution have a website?

- Yes
- No

If Yes, Please state the domain name _____

And where hosted _____

18. Do you have an online payment system?

Yes

No

If Yes, Please briefly describe how it works

19. What policy is documented and operational?

None

Quality policy (ISO, CMMI or Other _____ state)

Investment and upgrade for Hardware and Software

ICT privacy and security policy

ICT piracy policy

20. If a policy exists, what is the ICT budget as a percentage of total development budget?

Less than 5%

5% or higher but less than 15%

15% or higher but less than 30%

30% or higher but less than 40%

40% or higher

Section 3

1. Is your institution ISO 9001:2000 certified.

Yes

No

2. If the answer to 1 above is Yes, Please indicate the date of certification and name of certifier.

Date _____ Name of Certifier _____

3. What was the Institutions 2012/2013 Operating budget (For this purpose this will be Total institutional budget less the Salaries and capital budgets)

Kshs _____

4. What was the Institutions 2012/2013 IT budget (Total including IT components of Salaries and capital budgets)

Kshs _____

5. By 30th of June 2013, were you aware of CMMI?

- Yes
 No

6. Have you attended formal training on maturity models?

- Yes
 No

7. With cooperation from fellow parastatals, would players support a move where institutions first looked for improved practices from sister institutions, when trying to improve or introduce a new IT service, before going out or producing one.

- Yes
 No

8. Please indicate your (Head of IT) highest academic level achievement.

9. Please indicate your (Head of IT) highest IT related qualification.

Thank you very much for filling this questionnaire

Appendix 3

List of Ministry of Agriculture Parastatals as at January 2013

Sector	No.	Corporation Name	
Financial	1.	Agricultural Finance Corporation	
	2.	Coffee development Fund	
Commercial	3.	Agro-Chemical and Food Company	
	4.	Chemelil Sugar Company	
	5.	Nzoia Sugar Company	
	6.	South Nyanza Sugar Company	
	7.	Muhoroni Sugar Company (Under Receivership)	
	8.	Miwani Sugar Company (Under Receivership)	
	9.	Kenya Seed Company	
	10.	Pyrethrum Board of Kenya	
	11.	Nyayo Tea Zones Development Authority	
	Regulatory	12.	Cotton Development Authority
		13.	Coffee Board of Kenya
14.		Horticultural Crops development Authority	
15.		Kenya Plant Health Inspectorate Service	
16.		Kenya Sugar Board	
17.		Tea Board of Kenya	
18.		Kenya Sisal Board	
19.		Pest Control and Products Board	
20.		Kenya Coconut Development Authority	
Research and Training		21.	Tea Research Foundation
	22.	Coffee Research Foundation	

	23.	Kenya Agricultural Research Institute
	24.	Bukura Agricultural College
	25.	Kenya Sugar Research Foundation
Service	26.	National Cereals and Produce Board
	27.	Agricultural Development Corporation
	28.	Kenya Farmers Association
Statutory	29.	Central Agricultural Board
	30.	Sugar Arbitration Board
	31.	Agricultural Information Resource centre
	32.	Seed and Plant Tribunal

Source: Ministry of Agriculture

Appendix 4

Sampled Ministry of Agriculture Parastatals

Sector	No.	Corporation Name
Financial	1.	Agricultural Finance Corporation
	2.	Coffee development Fund
Commercial	3.	Kenya Seed Company
	4.	Nyayo Tea Zones Development Authority
Regulatory	5.	Cotton Development Authority
	6.	Coffee Board of Kenya
	7.	Horticultural Crops development Authority
	8.	Kenya Plant Health Inspectorate Service
	9.	Kenya Sugar Board
	10.	Tea Board of Kenya
Research and Training	11.	Coffee Research Foundation
	12.	Kenya Agricultural Research Institute
Service	13.	National Cereals and Produce Board
	14.	Agricultural Development Corporation
Statutory	15.	Sugar Arbitration Board
	16.	Agricultural Information Resource centre