



## **Practices, Challenges and Approaches for Software Project Risk Management in Kenyan County Governments**

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### **Abstract**

In the recent past the county governments in Kenya have embarked on an aggressive drive to automate their processes and systems in an effort to improve service delivery to their citizens, improve revenue collection and better management of resources. Part of these efforts have been the initialization of software projects that have either required the development of bespoke software or acquisition and customization of existing products from vendors. However, it has not always been smooth sailing for these projects as they often delayed, experience cost overruns and experience scope creep occasioned by the materialization of various risks in the projects. This study examined the practice of risk management at the Nakuru county government ICT department in order to establish the specific risks facing software projects at the county level, the challenges faced in managing them and proceeds to make specific recommendations for risk management at the county level for software projects risk management.

**Keywords:** county government, risk management, software project

### 1. Introduction

Risks are inevitable, and there is always a degree of risk involved in every project. Project Management Book Of Knowledge defines project risk as “an uncertain event or condition, that if, it occurs causes a negative or positive effect on at least one of the projects objective such as time, cost, quality or scope.” Risk management and success of a project are intertwined. Better approaches to project risk management tend to increase chances of software project success in terms of achieving scope, quality, schedule and cost constraints (Bhoola, Hiremath, & Mallik, 2014). Risk management is considered to be an important component of software project management. However, in spite of its importance it’s the least practiced (Mnkandla, 2012).

Risk management process was introduced in software development as an explicit process in 1980(Wallmüller, Wiczorek, Naujoks, & Bartlett, 2002). Barry Boehm is known as the father of risk management in software engineering. Software project risk management is the process of identifying, analysing, managing and controlling issues and risks that may arise during the software project life cycle. The first step is identifying all the risks and adding them to the list of possible risks. After identification, the risks are analysed and prioritised both in terms of likelihood of it happening and the impact it might have on the project. The third step is the management or planning of the software risks which involves risk response strategies; the process of responding to risk factors. The most common response strategies are acceptance, mitigation, transfer or avoidance. The last step is risk control which involves monitoring of the status of the risks and the actions taken against them.

There can be many risks in creating quality software systems. They cannot be completely eliminated but project managers can reduce these risks and their impact on software products by



calculating these risks. Increases in project size and complexity in return increases the risks. The software industry is one of the largest industries in the world. To achieve a successful outcome, project leadership must identify, assess, prioritize, and manage all of the major risks. Tom Gilb put it as “If you don’t actively attack the risks, the risks will attack you.”

The software management study showed that industry wide, only 16.2% of software projects are on time and on budget. The rest, 52.7% are delivered with reduced functionality and 31.1% are cancelled before completion (international, 2013). The main reason stated for this large amount of less quality software and failure of software projects is the lack of proper software risk management (Dedolph, 2003). Many projects with all the ingredients for success fails. It happens when stakeholders, managers and project teams are not used to evaluating the uncertainties, risks and complexities involved beforehand, and fail to adapt their management style to the situation (Shenhar & Dvir, 2007). Uncertainty has no independent existence, it is not something that can be identified and eliminated in the same way that a bug which invades a project can. The uncertainty arises naturally from complex situations (Cleden, 2009).

The Standish Group 2004 Report indicated that the main reason for project failure in developed countries is not the absence of general resources or financial resources, but the lack of project management capability (Berg & Karlsen, 2007). According to (Jekale, 2004), projects in developing countries are highly influenced by their external environment. The project environment in many developing countries is unstable and characterized by rapid change of markets, shift of funding sources, frequent change of government policies and the business environment.

In Kenya, the county governments were introduced through the promulgated constitution of Kenya in 2010. The implementation was carried out in the 2013 general election whereby 47 county governments were enacted. Like many other developing countries, the software development in Kenya is a fast developing and rapidly growing industry that is facing a lot of challenges. It is seen as a solution to issues that are facing the society, and the automation of a lot of processes within different organisations especially the government institutions. The county governments are still at its’ early stages of growth meaning that they face a lot of challenges in software project management such as delays, underperformance, cost overrun, incomplete or volatile software requirements, employees’ turnover, poor schedule, complex projects, lack of skills and lack of formal risk management practices (Kipyegen, Mwangi, & Kimani, 2012).

According to the County Integrated Development Plan (2013-2017), the projects that were to be undertaken by the County Government of Nakuru were: Automation of revenue collection, Automation of county operations, Website Design and Development, Purchase of ICT equipment, Networking, Telephone Communication Systems, Media Centre, Security Systems, Digital villages and ICT Centres (Nakuru County Integrated Development Plan 2013-2017, 2013).

The county government of Nakuru through the ICT department, has plans to come up with innovating ways to improve systems and processes within the county. It believes that ICT has the capacity to transform the county government into an effective system. Those plans include



improving Wireless Access Networks within all Sub-County offices; install CCTV surveillance systems within urban centres; establishing digital information; establishing Wi-Fi zones within Sub-County headquarters; creating online portals to effect online payments and service access as well as developing ICT solutions and platforms to facilitate ease of doing business with and accessing services from the County Government of Nakuru (Kimani, 2017). For these projects to be successful, there need to a risk management plan in place.

Risk management is very important especially in software and IT projects because they can be vehicles of delivering organisational change, so achieving the business objectives can be dependent on their success.

## 2. Problem Statement

Software development projects have an increased rate of failure and, like other businesses, software development involves technical and expensive resources. The success of software development depends on the criteria: functionality, quality and timelines. These are the three major constraints to a project success. Software is developed to perform a specific function. If the software does not perform intended function effectively, then the purpose of the software will be defeated. Software development organisations suffer problems from delayed and over budget projects. Risk can occur in any project and can harm the final product and its functionality. For reducing or avoiding risks, project managers should take appropriate countermeasures. If there are no proper risk management techniques, the failure of a large-scale system can affect the stakeholders of that software. Failure of the final product can waste the budget and time of its customers, employees and organization. The failure can reduce the profits of the business or an organisation.

### 1. Objectives

1. To survey the number and types of software projects that have been undertaken by the County Government of Nakuru since inception.
2. To determine the structures, practices and personnel for software project management in the County Government of Nakuru.
3. To establish the challenges and related outcomes associated with software projects in the County Government of Nakuru.
4. To determine the software risk management practices undertaken by the County Government of Nakuru during their software development projects.

## 2. Literature review

### 2.1 *Software risk management practices*

The ever increasingly competitive markets, business and enterprises have led to reliance in information technology systems to achieve effectiveness and efficiency. Project management is concerned with the application of tools, skills, knowledge and techniques to achieve effectiveness and efficiency to survive in competitive market (PMI, 2000). The dynamic nature of the IT industry makes it hard to manage software projects (Maniuk, 2017). For the project managers, it is not enough to have knowledge of project management practices, but also be up to date with the latest trends in the software industry. There are several practices and as a project manager, one has to be conversant with all of them to be able to choose best practices for the project.



Seven risk management principles (Rathod, Chim, & Chawan, 2012) have been identified to be important to achieve the objectives of risk prevention, mitigation, correction and safe system failure:

*Product vision:* Product vision is based on the common purpose, ownership, and collective commitment; it focuses on product results.

*Teamwork:* No single person can anticipate all the risks that face a project. Risk management requires that project members find, analyse, and work on potential risks together. For this to be effective communication skill is needed.

*Global perspective:* Potential impacts of adverse effects, such as cost overrun, time delays, or failure to meet product specifications are included.

*Future view:* This principle develops the ability to look into the future, beyond today's crisis and into the likely consequences and impacts of current decisions on future options. It thinks about the risks that may arise in the future and try to minimize them as early as possible.

*Communication skills:* It defines and improves formal and informal communication. Communication with all stakeholders through meetings is of great value to the project.

*Integrated management:* This principle helps to assure that risk management processes, paperwork, and discipline are consistent with established project culture and practice. Ensures the habit of using risk management methods and tools in project development process.

*Continuity:* Continuous process requires sustaining constant vigilance, identifying and managing risks routinely throughout all phases of the projects' life cycle. The processes must be part of daily, weekly, monthly, and quarterly project management.

## *2.2 Software risk management challenges*

According to ProofHub, (@proofhub, 2017) only 2.5% of companies successfully complete their projects. This is a very disappointing figure. This low percentage is because beside being able to plan, manage resources and meet deadlines, one must be able to foresee the challenges that may derail the progress of the overall project.

Despite availability and existence of software development risk management tools, risks are still prevalent. Risks that are common in software development are incomplete requirements or requirements that keep changing, under skilled employees, tight timelines, insufficient resources, poor schedule, and complexity of the project, poor design, cost estimates and lack of formal risk management approach. (Kipyegen, Mwangi, & Kimani, 2012). The main objective of risk management is to reduce the impact and probability of the effects and increasing the impact and probability of opportunities. All projects have a certain degree of risk, so risk management is an important activity in project management. Risk management is a process that involves software risk identification, analysis, planning, monitoring and control.

IT projects are risk-prone, and it's not due to technological failure but mainly due to its' complexity (M. Marinho, S. Sampaio, Lima, & Moura, 2014). One of the major reasons that a software project can fail is due to weak risk management. Others being lack of senior management, unclear project objectives, scope creep, gaps in communication and lack of visibility of all projects. (Abbasi, Wajid, Z. Iqbal, & Zafar, 2014).

## *2.3 Software risk management approaches*

There are three main approaches to software risk management (Otniel, Nicolae, & Claudiu, N.d); evaluation, contingency and management approaches.

### *Evaluation approach to IT/software project risk management*



According to this approach, the process of risk management is an analysis for determining the risk factors and causes of project failure. It aims to learn from past projects, by evaluating risks that have already occurred. The evaluation may result in modifying the use of previous framework of risk management or even changing the framework. The contribution of the evaluation approach of risk management to project success is indirect, as the information gathered is used in future projects (Bakker, Boonstra, & Wortmann, 2010).

This approach answers the question what causes projects to fail. It assumes that it is likely that knowledge of the risks and their causes will have a positive impact on the project outcome. The aim of this approach is to create project predictability in new projects by using information regarding risks and causes of project failure gathered from previous projects.

#### *Management approach to IT/software project risk management*

Management approach answers the question how to deal with risks in order to prevent project failure. This approach to risk management has processes based on rational decision making. It focuses on identifying the events and situations specific to projects that can interfere with the original plan and developing measures to keep the current project on track. The contribution of the management approach of risk management to project success is direct, as it focuses on the relevant and specific risks of the current project.

#### *Contingency approach to IT/software project risk management*

The contingency approach to risk management considers project success to be dependent on how well the project as a whole is able to deal with uncertainties in the project environment (Jun, Quizhen, & Qingguo, 2011) as project uncertainty is negatively associated with project success. According to the contingency approach, risk management is not considered to be a separate management process. Instead it is embedded in the various processes and procedures of the project.

Regardless of the approach, a standard method for identifying, assessing, and responding to risks should be included in any project as this influences the outcome of the project.

#### *4.4 Nakuru County Government*

Nakuru County lies within the Great Rift Valley and borders eight other counties namely; Kericho and Bomet to the west, Baringo and Laikipia to the north, Nyandarua to the east, Narok to the south-west and Kajiado and Kiambu to the south. The county covers an area of 7,495.1 Km<sup>2</sup> and is located between Longitude 35 ° 28` and 35° 36` East and Latitude 0 ° 13 and 1° 10` South. The county headquarter is Nakuru town.

The county is divided into nine administrative Sub-Counties namely; Naivasha, Gilgil, Nakuru, Rongai, Nakuru North, Subukia, Njoro, Molo, and Kuresoi. Njoro and Kuresoi were hived off from Molo Sub-County, Gilgil from Naivasha, Rongai from Nakuru Town, and Subukia from Nakuru North. The county is divided into 11 constituencies namely; Naivasha, Gilgil, Nakuru town West, Nakuru Town East, Rongai, Bahati, Subukia, Njoro, Molo, and Kuresoi North and Kuresoi South. In total Nakuru County has 55 electoral county wards (Nakuru County Government ICT Roadmap (2015-2020), 2015).

The ICT and E-government is under the Ministry of Education, ICT and E-government, which was established to deliver services to the citizens of the county government of Nakuru. A CEC Member heads the ministry. He is supported by the Chief Officer. Under the ICT department, there is a Director and a County ICT manager. The County ICT Manager is the one to oversee the projects being undertaken.



The concept of project success varies from different scholars and practitioners as to what constitute it. In most cases, a project success is measured in terms of three requirements: time, budget and quality. However, (Prabkhar, 2008) argues that the three are measures of project management success and project success be best measured on the overall objectives of the project. In Brazil, a study was conducted where it examined risk management practices among several projects across different industrial sectors and states. The study revealed that adopting best practices in risk management had a significant positive impact on project success (Junior & Carvalho, 2013).

A project management team should learn to deal with and plan for risks as no project is free of risks. Risk management is not a new concept to an experienced project manager. Management experts can judge a project manager based on his/her ability to oversee risks that might creep up in a project anytime. These risks can be incomplete software requirements or volatile requirements, employees' turnover, lack of formal risk management approach, poor schedule, cost estimates, complex projects and lack of skills among others. Risks are not one-time event, one has to constantly manage risks (Kipyegen, Mwangi, & Kimani, 2012). Contingency plans should be in place while planning the risks because ambiguous contingencies can be a huge challenge in risk management. If contingencies are not identified, the entire project can be mixed up in an unexpected set of problems.

### **3. Methodology**

The research is based on collected data which is then analysed and organised to reveal the risk management practices, challenges and approaches in software development at the county level. The primary data collection was through questionnaires and interviews. The questionnaires provide a better way of gathering and recording data while interviews aids to obtain detailed information about personal feelings, perceptions and opinions regarding the issue. It also allows more detailed questions to be asked, yields a high response rate and at the same time, respondents' own words are recorded, ambiguities are clarified and incomplete answers followed up, thus, enabling clarification which gives precise meaning of the asked questions. The questionnaires used in this study were structured and open-ended.

The collected data was due to an expert interview to the County Ict manager who has overseen all the projects done by the county government since its' inception. Nakuru County was chosen as a pilot study to check on software risk management on all counties in the country.

### **4. Results**

#### *4.1 The number and types of software projects that have been undertaken by the County Government of Nakuru since inception.*

The county government has outsourced five software systems from vendors. Most of the software systems acquired are automated process systems to facilitate services provided by the county government to the public. Examples of these systems are; revenue collection system, hospital management system, and lands information management system.

#### *4.2 The structures, practices and personnel for software project management in the County Government of Nakuru.*

Since the organisation outsource all its software projects, the ICT manager is the project manager in charge of all projects. He chooses who participates in the project management team based on experience and their qualifications. The minimum number of staffs involved at a project at a time



is 7 and the maximum is 11. There isn't a standard software project management practice observed in the projects.

### *22.3 The challenges and related outcomes associated with software projects in the County Government of Nakuru.*

The following were found to be the main challenges affecting the software projects at the County Government of Nakuru:

- Budget allocation and approvals.

The County Assembly is the body tasked by the Constitution of Kenya to allocate and approve all the monetary needs of the County Governments. The main challenge with this arrangement is that sometimes the department is not given the amount they requested to acquire the software systems they need. This may result in challenges with acquiring the system that is of high quality they had set their eyes on. Delayed approvals delay the timelines set for the delivery of a software system.

- Lack of capacity

The organisation does not have software developers within the department, forcing them to outsource their software projects. Outsourcing projects might result in cost escalation.

### *22.4 The software risk management practices undertaken by the County Government of Nakuru during their software development projects.*

There isn't a standard or a formal risk management practice. Results from the study showed that some of the respondents are not aware of the existence of formal risk management practices. It was also clear that there is no policy to address risk management practices and policies to govern the processes. There might not be a formal risk management plan, but they do have a response strategy to several risks that may arise.

To avoid some of the risks that arise in software development, the organisation chooses to outsource their projects. The main reason they outsource is lack of capacity within the department. The motivation behind outsourcing is to get products developed faster and also to tap into expert skills from vendors. The process of outsourcing is through tendering. Outsourcing comes with its own challenges and business risks and to deal with the risks they apply the four strategies which are; avoiding, mitigating, transfer of risks and acceptance.

*Avoidance response strategy:* Eliminating activities with a high probability of loss by making it difficult for risk to occur, or by executing the project in a different way which will achieve the same objectives but which insulates the project from the effect of the risk can be termed as risk avoidance (Bhoola, Hiremath, & Mallik, 2014).

It is suggested that the key to managing risks at each stage of the project is to assign an experienced project manager skilled in change management and monitoring progress. This can act as an avoidance strategy to provide risk solutions (Tesch, Timothy, & Mark, 2007).

The business risks that may arise, chosen by the organisation to use this strategy include instances where the project doesn't have a defined project charter, when the project does not have senior management sponsoring, when the metrics of project success are not clear to all stakeholders of the project, when the internal team is not involved in the outsourcing process, when vendor contracts are not adequately detailed. The reason for the decision to choose this strategy on the above instances, given was mostly because it is the technically viable approach.



The other reasons were that it is the most agreeable approach and the only legally acceptable approach.

On management risks, the avoidance strategy will be used on instances when the project manager selected to oversee the project does not have the relevant knowledge and skills, when misunderstandings on the expectations arising from unclear specifications or deliverables, where conflicts are not resolved amicably, and where the stakeholders do not adhere to the project development processes. Similar to the reasons given to avoidance response to the business, the popular reason is that, it is the only viable approach. In the case of conflict resolutions and incompetent project manager with respect to outsourced projects, the reason for avoiding the project was that, it is the convenient approach.

The technological risks like certifications and the relevant experience of the vendor team not being considered during the evaluation process, undefined final functionality of the system, lack of discussion between the vendors and the business team, lack of a quality assurance process and the lack of quality assurance checks during the development process, the organisation choose to use this strategy mainly because it is the most convenient approach. The other reason is because it is the technically viable approach.

*Mitigation response strategy:* This strategy tries to minimise the impact the risk might have on the project. Risk mitigation is one or more reinforcing actions designed to reduce a threat to a project (Bannerman, 2008).

This response strategy was preferred for business risks such as; when some key players in the organisation have been left out of the project, when projects have no quantifiable or verifiable measures of success, when there is no consistent support from stakeholders, when the internal team is not supportive of the outsourcing process, when the vendors' contracts are not strictly enforced or when the vendors are not demonstrating desire to adhere to contracts, when the vendor companies does not understand the organisational goals towards the project. This response was preferred mainly because it is the only technically viable approach. The other reason was, it is the most convenient approach.

Management risks such as unclear deliverables between vendors and the organisation, when the assigned project manager does not have time and resources to perform the duty, miscommunication and misunderstanding on project milestones by stakeholders, communication challenges among the stakeholders, unclear project development processes in use for the project by stakeholders, utilises this strategy response. It is the preferred response for these risks mainly because it is the viable approach and the most agreeable approach.

The technological risks like when inconsideration of ongoing training of the vendor, system handing over modalities are not clearly understood, realization that there hasn't been constant system review during its' development, when requirements creep is not managed, and whereby the vendors expectations are not managed, the mitigation response strategy is preferred because it is the viable approach and the most convenient approach.

## **5. Recommendations**

General recommendations for area of further research include:

- There is need for clear and proper policies and framework to guide in the implementation of formal risk management techniques and approaches.
- Software risk management plan solely for government institutions, like county governments that rely on the county assemblies for budgeting, and that which outsource their projects.





The best framework to adopt in software risk management would be:



This means that the project manager identifies all the risks that might face the project with the help of the team and notes them down. After identification, the team may then classify the risks and strategize on how to react to the risks depending on the impact it might have on the project. Management involves monitoring the risks during the project life's cycle.

## 6. Conclusions

Risk management in software projects is very important and different than in other projects. Formal software risk management process techniques provide multiple benefits to both the project team and the organization and these benefits can only be achieved if all stakeholders become aware of these techniques. Creating policies and awareness of the formal software risk management process techniques and tools is crucial in the software development process. Also, educating young software engineers will not only help improve software projects but can lead to innovation of other better ways of handling risks in the industry. Handling risks will lead to more success in software projects.

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