Using Enterprise Resource Planning (ERP) Software in Contract Management in Times of COVID-19: A Case Study of Mau Mau Roads Lot 1B-Kiambu County, Kenya.

Samuel IrunguGitimu (PE)[1], Gideon GitongaRwamba (PE)[2], George Gakure [3], Monica Muthoni Michu[3]

[1]APEC Consortium, P.O. Box 75936-0200, Nairobi.
[2]MaceYMR, PO Box 2403-00606, Nairobi.
[3]KeNHA, P.O Box 49712-00100, Nairobi.

On April 6th 2020 the Kenyan government,imposed restriction of movement in and out of the Nairobi metropolis and Mombasa. The restriction of movement, caused a huge challenge in the management of the Mau Mau Roads Lot 1B project which had commenced on 18th June 2020.This was further complicated by the fact the inception/planning of the project had not incorporated an off–site friendly project management system in the Conditions of Contract (CoC). This paper aims to explore the process of identifying a sufficient Enterprise Resource Planning (ERP) system for the management of Mau Mau Roads Lot 1B. It seeks to guide the engineer in appreciating the dynamics involved in adopting an ERP system sufficient to the engineer's unique needs, especially where no provisions exist in the CoC. The paper explores the subject in the named thematic areas; 1) differential analysis of select ERP systems, 2) cloud backup, 3) multi-user interface, 4) integration with reporting tools, and 5) data integrity. The method applied involved review of secondary data, focus group discussion and experience of contract management systems by the author. The paper will be useful in lowering the barrier for adoption of cloud-based project management.
Keywords: Contract Management,COVID-19, ERP, Off-site,Applications.

I. Introduction

This paper looks at how ERP software can be customized to serve project management needs in the context of the responsibilities of the engineer. The analysis is given a contractual setting by reference to the FIDIC® Conditions of Contract for Construction; For Building and Engineering Works Designed by The Employer published by FIDIC, otherwise known as the Red Book Second Edition 2007. Reference was also made to *Conditions of particular application for contract no; KeNHA/RD/D/3018/2020,Construction of Mau Mau Road Lot 1b: Kiambu County Section*

Computer/web-based project management systems are not recent entrants in the project management spectrum. For instance, Microsoft pm 1984,Oracle Primavera Unifier 1983, and BIM 360 Docs. 2015 have been utilized in various industries for several years now.

One of the major barriers for utilizing computer/web-based project management systems,especially for small projects, is the initial cost. For example, Microsoft Project and Portfolio Management cost $800 PP Per Annum, Autodesk BIM 360 $1700 PP per Annum, while Oracle Primavera Unifier costs $2,000 PP Per Annum.

Kenya has not been left behind in the adoption of project management applications: The Request for Proposal (RFP) for the Nairobi Expressway project:KeNHA/PPP/2316/2020:Section 2: ITC 14.1 (9), allows for the 'Provision of $46,000 for a document management system'.

ERP's are typically used as sales management systems but not for project management. The experience obtained by the engineers in tailor making the application to perform project management tasks within a budget $66-$200 as described here would be a useful guide to project managers seeking to follow a similar path.

II. Materials and Methods used

The paper wasprepared through review of secondary data, focus group discussion and observation by the authors. Secondary data involved assessment of the various ERP software systems offered in the market,and checking whether they were suitable as an efficient project management tool. It also entailed conducting an analysis of the various aspects provided by the systems. These aspects are such as cloud back up, multi user interface, integration with reporting tools and data integrity.

The focus group discussions entaileddeliberation on the various options that were considered based on the results given and assessment on the choice selected and whether it was able to cater for all project management needs.

The authors made observations while searching for a viable system and beta testing the systems which were deemed to suit the intended criteria.

III. Results

Differential analysis of select ERP systems

Differential analysis is an important aspect to consider when determining the ERP system to choose to assist in contract management of a project.

After discussionswith various industry practitioners on the most popular and suitable ERP systems in the market, five system providers were shortlisted to be compared using differential analysis. This was based on the services they offered and the suitability of their features to the needs of an Engineer. These systems were; Quip, Tresorit, Spider Oak, Bitrix 24, and Resilio Connect. The differential analysis conducted was based on cost implication and features offered against that cost. On features offered, various parameters were considered such as number of users and storage capacity. All the software had three package options to cater for small, medium and large enterprises.

Cost was a major variable in the differential, as the system had not been provided for in the Conditions of Contract (CoC). The Resident Engineer (RE) had instructed an expense of an amount not exceeding 3.75%($1000), under Bill of Quantities (BoQ) item 1.15: Resident Engineer's miscellaneous account. The item was capped at $8M for the 36 months contract period.

The option results were as follows:

For Quip, the charge for the small team package was $10 per user per month. This resulted to a total of $120 pp per annum. For large and complex teams, the cost was $25 per user per month; amounting to $300 pp per annum. Its final package was for very large teams which cost $75 per user per month amounting to $900 pp per annum.

For Tresorit, there were three options available in which there was a business standard account which was $15 per user per month which resulted to a total of $180 pp per annum. For large and complex teams, the package known as the business plus package had a cost of $20 per user per month; amounting to $240 pp per annum. Its final package, enterprise, was for very large teams costing $24 per user per month amounting to $288 pp per annum.

For Spider Oak, the packages were based on size of storage space and were charged annually unlike the rest which were monthly. The charge for the first package was $69 pp per annum for 150 GB of storage space. For the second package providing 2 TB of storage space to users, the cost was KES $149 pp per annum. The 5 TB storage space package, the company's highest offering cost KES $320 pp per annum.

For Bitrix 24, the charge for the small team package of upto 5 users was $39 per month. This resulted to a total of $468per annum. For growing teams of a maximum of 50 users, the cost was $66 per month; amounting to $792 per annum. Its final package was the professional package with unlimited users. It was meant for medium and large teams which cost $199 per month amounting to $2,388 per annum.

For Resilio Connect, the charge for the small team package was $6 per user per month. This resulted to a total of $72 pp per annum. For the medium team package, the cost was $10 per user per month; amounting to $120 pp per annum. Its final package was for large teams which cost $12 per user per month amounting to $144 per user per annum.

Cloud backup

As tools that are used to connect and manage teams in different areas and on different platforms through the use of the internet, cloud backup is at the forefront of the feature sets offered for all of the five aforementioned ERP systems.

Quip was not found to offer any out-of-the-box cloud backup feature.

Tresorit offers a strongly secured cloud backup feature that allows only authenticated users to access files that they have been granted access to. Their backup tool allows users to organize their data into files and folders, while also allowing them to easily define the storage structure similar to how it is structured on their local storage. Open files are saved in the cloud in real-time after each edit. Their cloud backup feature provides access to previous versions of a file and supports access to any file deleted accidentally or because of ransomware.

Spider Oak provides cloud backup with their security focused One Backup storage option. Documents are encrypted locally before they are uploaded onto the cloud servers. There is also support for data recovery in the case that files are affected by a malware.

Bitrix 24 offers cloud backup through their own cloud-based storage in the Bitrix24 cloud, private cloud or on client's own servers. Users can take advantage of Bitrix24.Drive cloud storage to backup files and documents and have granular control over who has rights and permissions to carry out different actions on these files and their folders.

ResilioConnect's cloud backup option allows clients to choose the storage of their choice by having an interface that supports third-party connections. The User Datagram Protocol (UDP) which utilizes the Wide Area Network (WAN) infrastructure already in place results in maximum performance.

Multi user interface

Mau Mau lot IB,Kiambu County: Contract No. KENHA/RD/D/3018/2020, is structured to have eight departments, Namely: Structural/Hydrology Design, Highway Design, Inspectorate: Structures, Inspectorate: pavement and earthworks, Surveying, Material Testing and Research, Administration, Contractor's liaison. The application selected needed to have a fluid interface for ease of interaction of the departments

Most of the software offered multi user interfaces. These types of interfaces allow clients to access the software from different devices running different operating systems.

Quip is accessible on desktops, laptops, mobile phones and tablets. The desktop software runs on both Windows and Mac. The mobile and tablet version of the software runs on Android and iOS platforms. The software supports online and offline use, allowing for seamless work flow management with or without an Internet connection. Quip also offers Rest APIs (Application Programming Interface) that clients can rework into their own environment and use on any platform that they wish to, for example the web.

Tresorit is accessible on desktops, laptops and mobile phones. The software is able to run on both Windows and Mac operating systems. As for the mobile version, Tresorit provides support for Android, iOS, Windows Phone and Blackberry operating systems.

Spider Oak provides support for desktop and laptop devices on Windows, Mac, and the vast array of Linux-based operating systems. On mobile, Spider Oak has applications for both Android and iOS platforms.

Bitrix24 provides multi user interfaces through the use of either desktop, mobile applications or APIs. The desktop software is available for both Windows and Mac. The mobile application is accessible on Android and iOS platforms. Through the use of APIs, clients also have the ability to define the interface they will access the platform features with.

Resilio Connect supports Windows, Mac, Linux and Android platforms. The software installs easily on all these platforms and provides a simple user interface that users can use to manage and organize their data. Resilio Connect also provides APIs for its clients so that they can create an interface according to their liking.

Integration with reporting tools

Daily/Weekly/Monthly progress report, Design/Design appraisal reports, Requests for Inspection (RFIs) and related correspondenceswere identified to be the critical reports for the running of the project and they needed to be integrated in the application chosen.

Reporting tools allow project managers and other users to easily filter their data and access it in a palatable format as it allows users to focus on the data and metrics that they are concerned about.

Tresorit and Spider Oak do not offer any out-of-the-box reporting tools or the ability to integrate to third-party reporting tools.

Quip contains an in-built reporting tool that allows a document to be easily converted into a report with the addition or removal of data. The tool also allows users to visually represent their data by converting related data into a chart as per the user's criteria.

Bitrix24 also contains an in-built reporting tool that supports process automation, thus allowing reports to be generated at a certain time continuously without any involvement from the user. Work and task reports can be easily created. These reports can then be shared to those in charge after they are generated.

Resilio Connect provides tools for report generation in real-time. Users are able to generate trouble-shooting reports which are used in the case that the software has a problem, and would like to identify the cause of the problem so as to fix it.

Data integrity

With respect to Public Procurement and Asset Disposal Act (PPADA) 2015, section 67(1)(d) and 67 (2) a Procuring Entity (PE) or its agent is required to safeguard data relating to project implementation.

Data integrity assures that data is protected and remains accurate and consistent throughout its existence on a storage device. The ERP systems are required to ensure that the latest data accessed by users meets this criterion because of the sensitivity of the data stored and processed on these systems.

Quip enforces a permissions system that allows only authenticated users to make changes to data. Their disaster recovery feature also allows data to be returned to its previous and desired state in case of any

corruption due to a malware. A strong encryption algorithm (AES-256 bit) and external link sharing monitoring provide an extra layer of security because unauthorized third parties cannot easily access and tamper with data.

Tresorit builds upon zero-knowledge systems, encryption, permission management and activity tracking to enforce data integrity. A zero-knowledge system ensures that the provider of the software does not hold and know any information in regard to their client thus keeping the data safe from internal changes from the side of the software provider. Users can also use permissions to control which users have access to which data, and activity tracking to track file changes and easily revert to a previous version if necessary.

Spider Oak also uses encryption to secure files against unwanted changes from hackers. Users have the ability to define their own team policies and thus can control access to files and data based on this policy. Through a distributed ledger policy, whereby different parts of the same file are stored in different devices connected to The Internet, files are provided with integrity because not all parts of a file can be tampered with.

Bitrix24 provides activity tracking, document locking, permission control, and document approval. Document locking ensures that a file is not changed after it has been locked. Permission control allows project managers to have granular control over the actions that other users can perform on files. After a file has been finished, document approval ensures that the contents of the document are what was required.

Resilio Connect relies on end-to-end encrypted connection to transfer files thus ensuring that data is not changed during a transfer process. Permissions are also granted according to roles. Therefore, users are only allowed to access and work with the data that they only have access to.

IV. Discussion

Bitrix24 was found to have the fairest pricing because while the competing ERP systems priced their offerings per user, Bitrix24 priced theirs per team size. There were limits to small and medium teams, but the large teams package had unlimited users, making it suitable for an organization to plan and collaborate efficiently. It was also found to have various advantages that would suit the organization needs.

Cloud backup was a key consideration as it allows project managers and their team members to continuously and regularly backup their work in storage devices connected to The Internet from within the ERP system itself. This ensures that in case of any damage to the data stored locally, the team still has access to a copy of the data stored on the cloud. Bixrit24 has the superior cloud backup options as it provides accessibility through third party integrations to other cloud backup storage options. This is in addition to its own solution, Bitrix24.Drive. Clients therefore have options and can structure their backup options according to their own preference. The availability of permissions for the files on the cloud also results in increased security of the data.

With more devices being able to connect to The Internet and work being done remotely, multi user interfaces was a make or break feature. The ability to support existing devices from the get-go was important because it helped to reduce costs. A multi user interface will allow team members to also work from anywhere through access to the software using the carefully orchestrated and functional mobile applications without skipping a beat. With the addition of APIs over some of its counterparts, Bitrix24 ensures that clients can use the different ERP features in a system of their liking. For example, clients have the freedom to create their own software which runs on the different platforms in the market such as Windows, Linux, Mac, Android, iOS or the web. This flexibility thus means that in case of an addition of a new platform, clients can easily create their own software with ERP capabilities acquired from Bitrix24 without having to wait for the provider to create a software for this new platform.

Project managers and team members will require access to well and ready-made reports that will assist them to view only relevant data on the project. Reporting results in business intelligence for the client as quantitative data on the project is converted into meaningful data used to make decisions through business analytics. Through data visualization, time is also used more effectively and efficiently as the team can gain key insights on the project without having to discern what the processed but raw data means. The presence of automated report generation within Bitrix24 means that these reports, and in result the insights that they provide are constantly available with or without user interaction.

Collaboration will be common with the use of these tools and thus the importance of ensuring that the data is accurate cannot be underplayed. Bitrix24 provides an efficient data sharing platform which ensures data can be shared securely and efficiently within departments. Data integrity will ensure that users view and work on the correct versions of documents, as the data involved is sensitive and drives the work. The granular control that Bitrix24 provides over its competing ERP systems ensures that data integrity is upheld. Data integrity is also "one of the key pillars of data security in the cloud storage environment." (Wei et al., 2020).

V.   Conclusions

Bitrix24 provided the most advantages and richest feature set for use as a project management tool. The availability of multiple cloud backup storage options means that the client has freedom of choice concerning which solution they are going to use from the multitude of options in the market. Therefore, clients can integrate the fastest and most secure cloud backup solutions to their Bitrix24 software and seamlessly backup their data without having to leave the software. APIs also support their business philosophy of flexibility by allowing clients to access ready-made features and use it within their own software running on their chosen platform. Data is not tied to the APIs (*What Is a RESTful API?,* n.d.) and thus clients can structure their own data according to their own use cases, and only share what they need to with Bitrix24 so as to access additional features.

Bitrix24 also offers multiple features within its software that all ease communication and collaborative working among team members. These features include chat and videoconferencing for communication, polling that allows opinions to be acquired from the team members easily, sharing of tasks, generation of reports, and process automation to reduce repetitive tasks. Through the use of task management tools, project managers are able to precisely observe task progress and allocate human resources as required so as to meet targets. Reports are also interactive meaning that "data is transformed into knowledge, allowing visualization andanalysis through various types of reports and graphics designed to be used as decision support." (Tutunea& Rus, 2012, pp. 867).

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