ESTABLISHMENT OF AN ELECTRONIC GRANTS MANAGEMENT SYSTEM AT KAMUZU UNIVERSITY OF HEALTH SCIENCES: INCREASING RESEARCH ADMINISTRATION EFFICIENCY AND PROMOTING RESEARCH VISIBILITY

by

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Abstract

The conduct of research has undergone a significant change over the years, and the idea of an isolated scientist making discoveries is now a far-fetched notion. The current societal problems require a multidisciplinary approach, and scientists are often employees of organizations and not mere enthusiasts. Research funding is mainly from the government or companies with shareholders. The agency relationship exists in these institutions and makes officers tasked with managing these institutions risk-averse due to fiduciary duty. They are held accountable for decisions they make on behalf of their principals, who always require transparency. Electronic project management tools allow researchers and institutions to manage these complex and often competing requirements.

This paper discussed considerations for selecting an electronic research administration system in a resource-constrained setting. The reviewed considerations were necessary because such systems were costly to develop, procure and implement. The alternative proposed was web-based project management systems with flexible pricing options, highly configurable, and easy to use.
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Abbreviations

CoM - College of Medicine

eRA – electronic Research Administration

ERM – Enterprise Resource Management

KUHeS – Kamuzu University of Health Sciences

MCDC – Malaria Capacity Development Consortium

MoH – Ministry of Health

NoA – Notice of Award

RMSS – Research Management Systems Strengthening
Glossary

Administrative Requirements
The general business management practices that are common to the administration of all grants such as financial accountability, reporting, equipment management, and retention of records. Uniform administrative requirements for grants are found in OMB Circular A-102 and OMB Circular A-110 (now found at 2 CFR Part 215).

Allowable Cost
A cost incurred by a recipient that is: (1) reasonable for the performance of the award; (2) allocable; (3) in conformance with any limitations or exclusions set forth in the Federal cost principles applicable to the organization incurring the cost or in the NoA as to the type or amount of cost; (4) consistent with regulations, policies, and procedures of the recipient that are applied uniformly to both federally supported and other activities of the organization; (5) accorded consistent treatment as a direct or indirect cost; (6) determined in accordance with generally accepted accounting principles; and (7) not included as a cost in any other federally supported award (unless specifically authorized by statute).

Approved Budget
The financial expenditure plan for the grant-supported project or activity, including revisions approved by NIH as well as permissible revisions made by the grantee. The approved budget consists of Federal (grant) funds and, if required by the terms and conditions of the award, non-Federal participation in the form of matching or cost sharing. The approved budget specified in the Notice of Grant Award may be shown in detailed budget categories or as total costs without a categorical breakout. Expenditures charged to an approved budget that consists of both Federal and non-Federal shares are deemed to be borne by the grantee in the same proportion as the percentage of Federal/non-Federal participation in the overall budget.

Award
The provision of funds by NIH, based on an approved application and budget or progress report, to an organizational entity or an individual to carry out a project or activity.

eRA
The NIH’s [or any other institution’s] infrastructure for conducting interactive electronic transactions for the receipt, review, monitoring, and administration of NIH [or any other] grant awards to biomedical and behavioral investigators worldwide.

Funding Opportunity Announcement
A publicly available document by which a Federal Agency makes known its intentions to award discretionary grants or cooperative agreements, usually as a result of competition for funds. Funding opportunity announcements may be known as program announcements, requests for applications, notices of funding availability, solicitations, or other names depending on the Agency and type of program.

Grant
A legal instrument of financial assistance between a Federal awarding agency or pass-through entity and a non-Federal entity that, consistent with 31 USC 6302, 6304.

Notice of Award
The official, legally binding document, signed (or the electronic equivalent of signature) by a Grants Management Officer that: notifies the recipient of the award of a grant; contains or references all the terms and conditions of the grant and Federal funding limits and obligations; and, provides the documentary basis for recording the obligation of Federal funds in the NIH accounting system.
Chapter 1: Introduction

1.1. Background
Universities across the world have a significant role to play in the development of economies. They contribute by producing a knowledgeable workforce, generate knowledge and innovation and through their existence promote industries that provide the universities and their staff with goods and services. Universities have traditionally played the teaching role and have had to adapt to remain relevant and take a more prominent place in society. Universities are no longer channels of knowledge distribution, but more creators of knowledge, and centers of innovation to deal with societies numerous challenges, and this is a move away from the ivory tower view.

The prominence of universities as centers for knowledge generation grew after World War II in the United States. The government heavily funded research as a key to national competitiveness—the existence of a single scientist tinkering in a lab with funding from some benefactors was fading. Governments realized industrialization and other technological advances as strategies in winning the next war. The universities, home of the professors, were the apparent avenue through which governments could achieve their goals.

Nuclear science and space exploration was also an area where countries wanted dominance, and there was significant funding in this area. The superpowers in that era were Russia and the United States of America, and though out history, we see their race for technological dominance. Sputnik was a space project where Russia was racing with the USA to be the first to send a man into space, and this made the USA government increase spending on research.¹

¹ (Neal, Smith, and McCormick 2008, 386)
Consequently, the increased funding by the government in research brought about several issues that have shaped how research is conducted and managed in universities across the world. Ethical, transparency and accountability issues arose from the use of public funds. Over the years, people have questioned the rationale of continued support of university research with public funds. The main arguments have always been the unquestioned support of research by the government.2

The concerns were addressed in a report to President Franklin Roosevelt in 1945 by Vannevar Bush, the Director of the Office of Scientific Research and Development, who noted that science was crucial to national development. The report was the blueprint for American Science Policy, especially guiding the public and policymakers on the importance of science to a nation.3 A report prepared much later in 1986 by the Office of Technology Assessment demonstrated a correlation between research and development (R & R&D) investment and economic growth. The report indicated 20% in private gains and 40% in social gains as returns from R&D investment.4 R&D was a huge industry and a significant part of most economies. The US government spent $156 billion on R&D for the financial year 2020, which was a significant portion of the annual budget.

This level of spending has brought in much criticism on how universities conduct research, especially as most universities have administrative and facilities costs covering almost 50% of research budgets. Most universities conduct basic research in pursuit of knowledge, not specifically for commercial gain through product discovery. Even if the products are developed

2 (Neal, Smith, and McCormick 2008, 386)
3 (Development, Bush, and Societies 1945, 220)
4 (States and States 1986, 80)
and marketed, conflicts arise as public funds should benefit most people and not just the industrialists that develop these products.

Most universities cannot develop products; they collaborate with industries through university-industry partnerships and transfer intellectual property (IP) to be exploited by industry. The generation of funds comes through patenting of the IP, but the patenting process is complex, so most universities end up not exploiting the results generated from their research. Further, the government funds numerous institutions across the country through its federal funding agencies. In the USA, the Department of Defense and National Institutes of Health receives most of the funding.

Safeguarding the public interest in all these activities was crucial in maintaining the balance and goodwill from the policymakers and citizenry. There was a need to ensure that research benefits the most people. The mandate of funding research by the government that promoted the safety and competitiveness of the USA should be met (export controls, industrial espionage, funding terrorism). Safeguarding public interest also meant funds never supported the conduct of unethical research or funding unlawful activities (for example, the Tuskegee Study or funding abortion-related activities when current laws were against it). Furthermore, recipients of funds implement approved activities with due consideration to prescribed standards.

Most universities get a large portion of their funding for research from government agencies that are accountable to the general. What the government agencies have done was to give fiduciary responsibility to the universities. There were federal laws, agency regulations that ensured recipients of federal funds for research were held accountable. Compliance and monitoring mechanisms required recipients to report at intervals or whenever a reportable issue
arose. The universities allow access to their premises and records to officers from the Office of Inspector General to carry out routine or investigative work.

Complying with all these requirements has made the field of research administration shape into what it is today. Universities have opted to set up a system that aligns with federal requirements as standard, even when they receive other funding from other sources. It would be too costly to operate several systems with different requirements depending on the sponsor. Universities have structures in place to support research at the level required by federal funding agencies. Such requirements are complex as they are many and constantly changing, so great investments must be made in the system to keep track.

Complexities in research administration have led to the advent of electronic research administration (eRA), where institutions have invested millions of dollars in systems that ensure compliance with federal requirements. These costs are justified because non-compliance costs more than penalties (returning funds to the sponsor) and sanctions (freeze in future funding). The increasing requirements have also meant increased reporting and, therefore, administrative duties for researchers.

The researchers have support from research administrators, but each grant awarded to a researcher is the responsibility of that researcher to the sponsor and employer. So, it is still a heavy burden on the researcher. The Federal Demonstration Partnership study indicated that researchers spend almost 42% of their time carrying out administrative duties.5 The effort attributed to administrative work was not ideal as public funds put in research keeping in mind public trust. That cannot be achieved when the researcher is not fully engaged in science but buried in paperwork to meet requirements.

5 (Rockwell 2009, 29–44)
ERA aims to keep on top of federal requirements and allow the institution to comply with all the required regulations. Nevertheless, there is also an element of bringing efficiency for researchers and the institution to work smarter and achieve more with less.

1.2. Statement of the Problem
Africa produces less than one percent of global research output. Most African countries spend less than 1% GDP of their budgets on R&D. Most African counties fall below the poverty line and face many socioeconomic challenges. Low research investment and minimal output meant solutions to emerging problems flowed down from research-intensive nations. The imported knowledge may not fit local conditions and sufficiently sustain. Research could have the potential to change both societal as well as economic landscape. Significant investments pumped in to build the capacity of the researchers saw the number of research grants awarded to such institutions increase.

1.3. Project Question
Challenges still exist in the environment supporting the research, and as seen with additional funding come stricter requirements for accountability and a heavier administrative burden on the scientists. The paper would like to explore whether electronic research administration could enhance the research enterprise of the university.

1.4. Project Objectives
Learning from the many years in developments in the research administration field had the potential for African countries, especially the Kamuzu University of Health Sciences in Malawi, to leverage electronic research administration to streamline its research. Subsequently, achieve several benefits in competing for and implementing research projects and reporting on research outputs.

It would utilize eRA to record and keep a database of all available research funding opportunities and access by interested faculty members. It would provide the structures to apply
for funding opportunities and record all submission attempts made. It would record all successful funding and track the implementation of these funded projects. It would also make available all research outputs to policymakers, students, other researchers, and the community.

1.5. Significance

Having an electronic research administration system would encourage the use of evidence for decision-making by various stakeholders. Internal stakeholders would use the system to track metrics suitable to inform faculty skills based on successful application trends. They would be able to see which departments are active in research and which departments require further support.

It would be an essential system to show time efforts toward research by various faculty members and strategies devised from the information on how to support them. The system would also assess the workloads of research administrators and accounting staff, ensuring that they have manageable workloads to provide quality support to all stakeholders.

On a day-to-day basis, the system would support tracking compliance issues such as reporting that is due. Such tools are essential for maintaining external relationships and meeting all requirements to avoid penalties and manage relations and provide a platform for future studies building on the generated knowledge.

The electronic research management system would enhance the research environment and facilitate the conduct of high-quality research. Additionally, it would promote sustainable relationships with the funding community and other collaborating institutions and interface with the community to access research outputs and reach out to experts.

Improved research outputs are one of the essential building blocks of economic development. This paper would blueprint other universities intending to leverage technology to improve research support service delivery.
1.6. Exclusions and Limitations

The paper only looked at the Kamuzu University of Health Sciences, where the researcher worked. A broader review of other institutions would have required more time, which would not have been allowed for the requirements of this paper.
Chapter 2. Literature Review

2.1. Overview of Literature Review

Online databases such as Academic Search Ultimate and Google Scholar provided access to books and articles related to the topic of electronic research administration. The information obtained from these sources provided a background on the environment university research exists in and its link to economic development. Research Management Review (RMR) is the journal for the National Council of University Research Administrators. The Society of Research Administrators International Journal offered unique insights into universities researching the world, with relevant information regarding electronic platforms.

2.2. Details of Review

The literature review was in three parts, 1) background of research administration, including the structure of research administration, 2) electronic research administration and how technology promotes efficiency in public institutions, 3) examples of electronic research administration in universities. This literature provided perspectives on the setup of research administration and its importance to organizations, how automation would bring advantages and how other institutions approached the exercise, what methods they used, and what successes and challenges were faced.

2.2.1. Background of research administration

Research and publication bring prestige to the researcher and institution, so Higher Education Institutions (HEIs) link academic promotions to research outputs (publications in peer review journals). Institutions display information about their research activities, the value of grants awarded, or research expenditure as this attracts faculty and students and enhances the institution’s visibility and ranking. Research then becomes a critical part of university operations and academic life. Review of concept for research proposal funding done in most funding
agencies also gives weight to researchers and institutions with a track record. So institutions need to build the capacity of faculty and upgrade infrastructure in order to compete.

Research capacity building requires significant investment by an institution in personnel and facilities. Over the years, highly flexible structures evolved to support the ever-growing arena of research environment support. The Federal Demonstration Partnership, a forum of selected universities and funding agencies, was aware of the increasing demands on the researcher. They published a report in 2014 indicating that a researcher spends on average 42% of their effort fulfilling administrative needs.6

Hansen and Moreland discussed in their article the Janus face of research administration the reliance of research administration to build from the past, but a pressing need to adapt to changing times and look ahead. They note that principles that guided research administration from many years ago when research administration was “unencumbered by external factors” were past.7 The role itself has evolved from being additional work placed on an individual to a specialized position. Kulakowski further noted that the research administration function in some large organizations parallels the institutions existing structures.8

Minnema has noted that significant events in the history of America have impacted research funding, indicating that most influences are external. Some of the key events included the 9/11 terror attacks that saw a spike in government spending in research to counterterrorism. Even in periods of recession, governments can spend on research to boost the economy.9

6 (Rockwell 2009, 29–44)
7 (Hansen and Moreland 2004, 43–53)
8 (Kulakowski and Chronister 2206)
9 (Minnema 2011, 31–41)
This spending is not without controversy; Preuss attempted to review how Return on Investment (the monetary benefit arising from the investment in research) was measured.\textsuperscript{10} Measuring Return on Investment was more manageable in a profit-making setup as most grants look more into social impact than returns. It is, of course, easier to carry out such an assessment on an institution to value the impact of research funding but harder to assess community benefit.

Preuss conducted a systematic review of research management literature from 5 research management journals from 1982 to 2013 and noted that few articles discussed institution grant readiness. The author lamented the lack of such knowledge as it meant there were no methodologies for benchmarking institutions regardless of context.\textsuperscript{11} What was promoted in the article was for an evidence-based assessment with context-independent factors on an institutional grant implementation capacity. Such assessment would allow institutions to develop faster as they could base their improvements on some minimal thresholds set by the assessment.

Another vital issue coming from benchmarking is the management of workloads, as addressed by Preuss. Tabakakis noted in the survey conducted across three continents that burnout was common amongst research administrators. The burnout was correlated to the demanding work environment and recommended that institutions provide better working conditions for staff.\textsuperscript{12}

One way to look at this was to review how research administration is set up and governed. Leyland studied The Office of Grants and Contracts in the University of Pittsburgh’s

\textsuperscript{10} (Preuss 2016, 1–26)
\textsuperscript{11} (Preuss 2015, 1–18)
\textsuperscript{12} (Tabakakis et al. 2020, no. 1)
Department of Psychiatry which reorganized and set up a centralized support function.\textsuperscript{13} The case study demonstrated improvements in processes, and the model developed could be used by other centers regardless of size and volumes of transactions. The model would serve best to identify critical roles and responsibilities and essential services.

Zink conducted a similar exercise and came up with a General Research Support Administrative Program design to standardize the research support system to provide a consistent and reliable service to researchers within the department.\textsuperscript{14} Kerridge noted that research administration as a profession has different maturities across the world. The US has the most significant number of research administrators with well-defined roles instead of other regions of the world.\textsuperscript{15}

However, research administration has become global; institutions collaborate with institutions outside their countries, which brings challenges. Chu mentions two compliance risks concerning dealing with foreign entities: transfer of intellectual property and research and non-disclosure of foreign sponsorship.\textsuperscript{16} Varying capacity issues raised by Kerridge, and some of the risk management strategies proposed included training, monitoring, and auditing and including foreign entity collaborators in conflict of interest and responsible conduct of research programs.

What can be seen is the transfer of administrative burden from the researcher to a research administrator. However, this administrative burden is further passed on to collaborators as they must comply with specific requirements placed on the prime recipients. Since Africa

\textsuperscript{13} (Leyland et al. 2020, no. 1)
\textsuperscript{14} (Zink 2018, 1–16)
\textsuperscript{15} (Kerridge and Scott 2018, 1–34)
\textsuperscript{16} (Chu 2020, no. 1)
hardly funds its research, it will rely on collaborating with institutions from the USA and other high-income countries to improve its research output.

Okonji observed that “structures for the efficient coordination and strong research governance are nascent within many Sub-Saharan African universities.”\textsuperscript{17} The findings of Okonji’s study indicated that developments were taking place, and the universities were developing their policies and structures to align with international standards.

2.2.2. Electronic Research Administration

Killoren emphasized the need for electronic processing within the research management function, noting Penn State University managed $250 million a year. The number of urgent submission proposals (those due for submission within the day received) grew from 35% to 85% between 1989 and 1993. The increase in workload and requirement for quicker turnaround made the writer of the article conclude that:

Research administration needs to stay lean and mean if it is to survive in today’s world. This means constantly adapting our systems to meet demands within the constraints of organizational resources. A study investigates how The Pennsylvania State University is examining its evolving research administration infrastructure and considering new ways of doing business given the opportunities offered by electronic research administration (ERA).\textsuperscript{18}

In the same year, the writer published another article propagating electronic media for the transmittal of research documents, claiming portable document format files like pdfs were the only practical way to keep with the increasing demands. Of course, selection of an electronic media platform has proved to be more complicated.

\textsuperscript{17} (Okonji et al. 2018, 1–10)

\textsuperscript{18} (Killoren and Eyerly 1997, 25)
Saas reviewed the ecosystem around research administration technologies and observed a need for broad consultation as there was a misalignment between what universities thought they needed and how vendors and developers viewed the role of research administration. The paper suggested three possible reasons why this was the case: there was a mismatch in institutional priorities. There was no market maturity for the needed functionalities. The vendor did not see the institution’s vision and why the system and functionalities are essential.

What was proposed was asking a series of questions listed below whose answers would determine system requirements:

Have all your PIs completed their mandatory training requirements? Have they complied with all requirements associated with their proposals? How many proposals did your HEI submit last year? To whom? By whom? For how much? What was the effective F&A rate on those proposals? How did any waivers granted impact the finances of departments, schools, or the institution overall? How many of those proposals resulted in awards? What was the success rate? What departments appear to be growing their research revenues at the institution? Which ones are shrinking? Are the faculty in those departments looking for alternate sources of funding? Do they need more assistance in identifying funding? Are there any unusual terms and conditions in awards that have been accepted? Are copies of grants, contracts, and cooperative agreements readily available? How many awards are pending setup? How long have they been pending? What issues need to be resolved to complete account setup? What is the average cycle time for award processing? What is the burn rate on individual grants? Is it reasonable? Is it within budget? If there’s an overdraft, are we expecting additional funding? If there is outstanding A/R, how old is it? What’s the collection history? Have expenditures been reimbursed? Have they been reported? Are there any outstanding financial status reports? What’s the detail behind expenditures? If prior approval was required, was it requested?19

Lankford addressed another critical issue related to the implementation of eRA, notably that cultural diversity amongst institutions plays a role. Well-resourced institutions can implement electronic systems without many challenges as they do not have to struggle to get support. The image they present makes it a challenge when less-resourced institutions attempt to

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19 (Saas and Kemp 2017, 1–13)
implement similar structures. They would not have their leadership support initiatives as funds are scarce but still encouraged the need to get buy-in from senior administrators from the university and have a convincing argument why eRA is a must for a modern institution.20

Wining executive support has appeared to be a critical factor in successfully implementing an ERA project. Virginia Commonwealth University (VCU) over 11 years assessed the need for an ERA, reviewed research administration structure, identified potential suppliers, created a needs list, requested information from vendors and compared systems, and selected appropriate vendor with senior management support and implemented the system.21 The paper offered a detailed description of steps to establish an electronic research administration system at a university.

2.2.3. Real-world scenarios of eRA in universities

According to Lintz, adaptive research administration has six cornerstones in its conceptual framework; mission, information, communication, collaboration, transition or transformation, and outcomes. The stakeholders’ wants and needs, what strategies are in place and what is working, and the best way to disseminate information and services addressed the cornerstones.22 How to meet stakeholder needs in a changing high-paced world would be successful through technology.

2.3. Applicability of Literature Review

The literature reviewed was relevant as it provided information that the author in this paper has used as the foundation for assumptions drawn. The literature supported the relevance of electronic systems in promoting conducive environments for researchers. It also provided

\[\text{\footnotesize{\cite*{Zuzolo and Lankford 1998, 25–33}}}
\]
\[\text{\footnotesize{\cite*{Ballance and Chermside 2000, 13}}}
\]
\[\text{\footnotesize{\cite*{Lintz 2008, 68–80}}}
\]
structure and processes used by other institutions in similar attempts to use technology to promote efficient research management. There were also shortfalls in other literature on the dependence on technology, the high cost of establishing electronic systems, and the human side of such projects. This information was critical in guiding the author’s research best practices and designing a system to meet world standards.
Chapter 3. Need(s) Assessment

3.1. Need(s) Assessment

There has been a steady increase in administrative requirements on grants due to public outcry for heightened accountability and transparency from those entrusted with public funds. It is a great responsibility for those making funds available for research to ensure that the funds are used efficiently for the intended purpose. Many frameworks provide safeguards to the public trust, featuring in agreements based on set principles and guidelines. Accepting funds means institutions have agreed to abide by these rules, which at times may not be uniform across the array of different funders.

Therefore, it is the responsibility of those receiving the funds to have structures that meet the requirements of all funding received. These compliance requirements are more complicated as the institution would also have its policies. At times, it may have to deal with contractors and third parties whose regulations and even regulatory environment are different. This complexity is challenging to manually keep track of requirements as it would require a lot of coordination, workforce, and therefore more costly. A system designed to bring efficiencies in such an environment is critical to avoid losing the institution and the public, who would have benefitted from completing the funded research.

3.1.1. Assessment of the Need

The Liverpool School of Tropical Medicine’s Capacity Research Unit looked at Research Management Support Systems (RMSS) in partner institutions of the Malaria Capacity Development Consortium. The assessment objective was “to conduct a baseline needs
assessment and use the results to identify and document opportunities for the strengthening research support systems and structures within MCDC partner institutions.”23

The RMSS report was comprehensive and reviewed the existing research capacities, and came up with nine recommendations as listed below:

Section 2: Research Strategies and Policies
2a. Develop and implement an institutional research strategy; consider including cross cutting research interest groups and a strategic business plan to support salaries and services based on income from project overheads
2b. Ensure appropriate representation on the Boards of each affiliate, review the mutuality of affiliate relationships and prioritise opportunities for further capacity strengthening between the institutions.

Section 3: Institutional Support Services and Infrastructure
3a. The remit of the RSC should be reviewed and aligned with the capacity and number of staff within the team.
3b. All the support services (ICT, finance, HR, RSC, procurement, laboratories) need to ensure clear communication and equity of service provision to senior and junior research staff, project funded staff and PhD students.
3c. It is recommended that a strategy for laboratories to meet both research and teaching needs is developed.
3d. The development of an electronic grant management system that meets the needs of the RSC, COMREC and provides information to finance would greatly improve efficiency and allow evidence based decision making on the future of research within the institution. CoM may wish to consider additional external expertise to facilitate the specification of the system.

Section 4: Supporting Funding Applications
4a. Support service staff (ICT, procurement, finance, HR, labs) should be routinely used in proposal development to ensure that proposals are realistically budgeted according to research design requirements; consider offering multi-disciplinary training for proposal budget development.
4b. Mentorship and training should be provided for fledgling researchers and further guidance and encouragement should be given to younger staff regarding the small grant initiative.

Section 5: Project Management and Control
5a. The RSC should work closely with finance staff, existing project staff and PIs to work out roles and responsibilities in contract review and grant management; this should be reflected in a more ‘user friendly’ 2010 Guidelines handbook focussed on a step by step process
5b. The financial systems for management and control for research projects need to be visibly improved in particular with regard to budgetary management and reporting
5c. The procurement process needs to be visibly improved whether through efficiency improvements, contractual routes or addressing workload
5d. The provision of research administrators should be increased

Section 6: Human Resource Management for Research
6a. A clear career pathway and promotion policy for research support staff should be developed.
6b. Enhance current plans for a post doctorate programme for the College

Section 7: Human Resource Development for Research
7a. Develop a comprehensive competency based capacity building programme for researchers using the training needs assessment results, personal development planning and mentorship initiatives.
7b. Training needs for support staff should be analysed and training and induction provided.

Section 8: External Promotion of Research
8a. Consider formulating a research uptake strategy to include enhancement of the planned Knowledge Management Unit and better visibility of research activities on the website

Section 9: National Research Engagement
9a. Strategic engagement of researchers with MoH, national TWGs and research bodies should be maximised; simple systems to feedback and record engagement and policy influence should be established

3.2. Metrics
The needs mentioned above from the 2014 report, based on observations by the author of this paper, were still applicable—the challenges faced within the research support structures depicted by several metrics. The frequency of reminders from sponsors for due reports was one metric that the author has observed. The institution was unable to comply with the requirement for timely reporting. Another metric observed was the frequency and severity of queries raised on reports by sponsors, which indicated that the reports were not complete or accurate. Late submission of applications, failure to submit applications, and the number of unfunded applications indicated challenges in the capacity of both faculty and support environment in the pre-award phase. The frequency of requests for routing information from various stakeholders also showed there was an appetite for information but limited access.

Other metrics looked at the staff’s knowledge of the services provided by the research support structures. The number of research outputs available in any institutional repository was also limited. The number of researchers who updated their profiles and research work on the institutional researcher profile pages.

3.3. Sources
The author has attended several meetings with senior institutional representatives discussing improvement in the research support capacity of the university. The discussions emphasized the need for a more coordinated and efficient support service. The RMSS report mentioned above also provided recommendations that they took as documented needs. Recently
the author also conducted an online survey to gauge attitudes of senior finance staff on issues related to grants management, and the findings were critical in determining needs.

3.4. Committees

There were no committees established to review the research question.
Chapter 4. Project Description

4.1. Discussion of project elements.

Evolutions in the research administration environment due to increased regulation and an ever-increasing need for transparency and accountability have meant that institutions have had to reflect on how they manage sponsored programs. The risk of non-compliance of federally funded projects has increased exponentially with the myriad of regulations that have emerged. Furthermore, the mounting pressure to reduce administrative costs means universities must have lean structures but produce exceptional results.

Technology can assist universities in becoming more productive, as experienced in the manufacturing industry. Manufacturing has benefitted from robotics, and the research administration environment requires different tools. Project management tools have been in use in the past but have proved ineffective as they needed trained project management professionals to manage them. However, project management was not just for project management professionals but also everyone involved in the project24.

A report by Forrester Consulting found that 1) we are in a disruptive digital age, 2) projects are failing due to challenges across culture, technology, and process, and 3) Collaborative work management (CWM) solutions help organizations overcome top project management challenges. They concluded that “collaborative work management (CWM) solutions help organizations overcome top project management challenges25.”

The report was significant as universities struggle to remain competitive and relevant in an ever-evolving world. Society has challenged the traditional notions that universities were the sole centers of knowledge. Leaner and more effective research centers have attracted more

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24 (Forrester-Consulting 2018)

25 (Forrester-Consulting 2018)
government and private funding for research. Universities have had to adapt to these changes and invest more in technology supporting research.

However, not all institutions are equal in size, complexity, and available resources. Low-cost, highly customizable online applications could be an alternative to homegrown custom build solutions. The project reviews the literature available on what universities are doing to establish electronic research administration systems.

There is limited literature on establishing such systems, especially in resource-limited settings like Sub Saharan African Universities. However, the available literature showed vital considerations when setting up an eRA within institutions. Online sources also provided opportunities to compare various systems in terms of costs and functionality.

A survey obtained opinions from stakeholders and users of the information system. Due to limited time, the target population was heads of research and administration as key beneficiaries of this system. They were the custodians of processes that would be automated and, as such vital contributors. The literature reviewed also indicated that such system implementation projects could never be successful without buy-in from senior management.
Chapter 5. Methodology

5.1. Methodology Overview.

Literature provided evidence that increased complexity and skills required to manage sponsored research and traditional methods no longer applied. Electronic platforms were vital in addressing the modern challenges as they offered several benefits. Electronic systems provided opportunities for collaborative work, real-time monitoring of work, shared resources, and automation of activities bringing in improved efficiency and reduction of errors.

A survey of opinions from key stakeholders gauged user expectations and needs. Due to time limitations, these stakeholders were representative of the population. They included research heads representing researchers, administrative heads of various departments involved with the research enterprise, and executive heads representing the various support departments.

The author selected this approach based on experience gained from working with the institution and establishing an electronic grants management system (EGMS) that the institution tried to implement. Challenges from the mentioned project were crucial in the approach taken in the methodological approach for this proposal to establish an eRA.

5.2. Project Design and Discussion.

EGMS was a system the institution worked on for several years to build an in-house automated system that covered all phases of the grant life cycle. The project was donor-sponsored and required a speedy turnaround time. The University engaged an external consultant to develop a system, test, pilot, and train users within several months.

The project extended beyond the donor funding and, years later, has still not been successfully implemented. The diagram below shows the EGMS establishment process events that the current project would want to learn.
The diagram attempted to demonstrate the existing process and challenges met during the project that had difficulties to succeed. Deviations were resulting in the EGMS’ failure to launch, but always revert to proposal refinement and seeking more funding. What was clear was that the user requirements were not well defined to the consultant, and as such, feedback always required extensive reworking. The agreement with the consultant again was not concise on the implementation aspects of the project.

The user brought in numerous additional requirements after project initiation, and the consultant also kept bringing in newer versions of the product each time of reengagement. The end product was something more than what the users initially proposed. There were issues of buy-in from senior management and the ICT department of the institution. Senior management was very accepting of the idea of an automated system. However, it was not eager to use the system to replace other functionalities that the institution had already invested in through other system developments. Due to security concerns, the management and ICT were also not content to have the system integrate with other existing systems.
Groups formed with the office supporting sponsored programs championing the EGMS, and the rest of the institution as coming on as onlookers. The development consultancy agreement stipulated that the final product goes to the ICT department for implementation and support. However, the ICT was unwilling to take over the system as they were not satisfied with the consultants’ technology and approach. This background was influential in the design of the new project as it provided lessons for future activities. The following procedures were vital in the methodology used in the project:

1. Specific requirements clarified – the proposed system will initially tackle particular aspects of research administration. The first phase targeted grants compliance through all the phases of a funded project. The system aligned with NIH requirements as they are the most robust, but the system would allow configuration to mean additional needs.

2. User engagement – users engaged early on to specify requirements and preferences. That was important to raise awareness and demonstrate collective decision-making that promoted buy-in at the senior level.

3. Make versus buy decision – previous experience with the effort and cost of developing an in-house system influenced the buy decision. There were possibilities of having bespoke off-the-shelf products as the online systems were highly configurable. Depending on the product and package selected, there were offers for configuration support to automate institutional processes on the existing online platforms. The offers also included training allowing the institution to have the flexibility to use the system and make numerous other configurations later to meet evolving needs. Other benefits included Single sign-on, cloud storage, and
integration with other existing systems. The other element explored was the cost of making the system versus buying licenses.

The researcher used the following framework to establish an eRA within a low-resourced university.

![Diagram of eRA Establishment Process Flow]

**Figure 2: eRA Establishment Process Flow**

5.3. **Discussion of Questionnaire.**

Solicitation of information from key stakeholders through a questionnaire also informed critical offices of the development of an eRA for the institution. It played an essential role as it offered opportunities to discuss issues around the system that were not on the questionnaire. It
garnered interest in the system by the officers, who would later make decisions to develop the system further and enforce its use within the various departments.

The questionnaire was short, having six questions, three multiple-choice questions requiring an interviewee to select one option from a list of possible answers. The remaining three questions were open-ended as they aimed to solicit opinions and requirements. The questions were general and targeted respondents’ views on the use of electronic web-based platforms. The researcher saw the questions requiring text input as critical because the importance of a system is in its usability and the willingness of intended beneficiaries to use it.

The questionnaire was planned to be administered online via google forms to the sample population. Responses would be anonymous and analyzed to show trends in use and critical expectations that came out the most. Due to time constraints, the questionnaire presented in the appendix was not approved by an IRB and, therefore, not administered. It has been added as a critical element of any future related work.
Chapter 6. Project Results and Discussion

Key user perception through a survey to determine preferences specially to understand level of knowledge, adaptability, and flexibility to use new systems. The information defines the implementation requirements as user acceptance and training requirements are outlined.

There were products on the market built to meet the needs of universities. Two notable applications were Kuali and Converis, and Kuali stood out as the approach to development involved the universities as partners in developing the products. The Kuali products reflected this, and below is an image as advertised on their website.

![Kuali Products](image)

"Kuali Sponsored Programs software guides and supports you through the ever-changing landscape of government regulations, institutional policies, and evolving guidelines to successfully win research awards and manage ongoing research projects."26

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26 (kuali n.d.)
Kuali’s working model in figure 4, high user engagement is critical in their process, going as far as informing clients of future trends. Kuali was an American product aimed at American universities that received funding from the government. The emphasis on America was evident in the type of modules present in the research product. There were modules for sponsored programs linked mainly to federal funding requirements, and there were also compliance modules and export controls modules geared towards responding to US Government regulations.

Figure 4: Kuali SAAS Industry Insight Infographic

The author earlier stated that the US Government regulations were robust and best practices to develop systems aligned to those structures. The modular approach also allowed institutions not requiring specific items to opt for only those relevant to their setting. Kuali, a
leader in higher education software, also offered guidelines to follow when selecting an
electronic research administration software\textsuperscript{27}.

Top 10 things to consider when selecting an eRA
1. Current and Future Needs - Can it grow and adapt as your needs change?
2. User Experience - Does it have an intuitive interface that guides administrators, researchers, and leadership?
3. Platform - Is it hosted on-premises or in the Cloud? Are all modules built with shared architecture? Is it SOC 2 compliant?
4. Configuration & Customization - Does it allow extensive configurability to meet the unique needs of the institution and users?
5. Flexibility in Scope - Does it allow you to select only elements you need?
6. Implementation - Does the vendor have a successful track record implementing on-time, on-budget, and across all types and sizes of institutions?
7. Features & Capabilities - Does it provide everything your team needs to manage, analyze, and report on awards and compliance?
8. Integration - Will it use APIs and data imports to integrate with all your key systems, like HR, Finance, Training, etc?
9. Cost - Does it provide superior value that respects your institution’s budget constraints?
10. Ongoing Support - Will you receive exceptional 24x7 customer service with support from user groups and forums?

An internet search only showed one African university using Kuali and not for research but finance. However, a search for Converis software use in African universities returned more results. Notably, the University of Botswana and the University of Cape Town (UCT) used Converis.

UCT envisioned the implementation of the system to take two years. “Improved strategic understanding of all research; improved ability to track research impact and collaborations; reduced financial risk through improved financial controls; improved support for researchers, including proposal development; and better management of data, analytics, and reporting to support strategic decision-making and control.” \textsuperscript{28}

\textsuperscript{27} (kuali n.d.)
\textsuperscript{28} (Visser 2016)
Another critical feature was the phased approach taken in the development process, which institutions planning to undertake an exercise to establish an eRA would follow. They initiated the development process by harvesting the research from publisher databases. They moved on to developing a pre-award system, post award system, advanced research reporting and analytics, intellectual property management, and monitoring collaboration and partnerships.
The process at UCT started with harvesting for publications, and the application Converis was ideal as its strengths lean towards monitoring research outputs and research visibility. It is more of a Research Information Management System, with elements included to make it more usable as a research management system. It had product features, as presented in figure 7.

The product features had elements like tracking media hits, and linking to products like ORCID, so the tool was important for measuring and reporting research impact. UCT
demonstrated a complete utilization of modules including pre and post-award management, publication management, research portal, research analytics, and graduate student management modules.

*Figure 7: Converis product features*

We found that the University of Botswana, a low and middle-income country university, also used Converis mainly as a platform for improving their faculty and research (figure 8). Botswana is a country within the Southern Africa Development Community, as a reasonable comparison to Malawi, even though their economy is fairing better and moving towards middle-income status. There was little other evidence of use of the system similar to what UCT had done, and it was unlikely that the University of Botswana utilized all modules. Many factors could have influenced a university not fully benefit from the tailored products offered.
A research facility in an African university failed to implement the transition to a product that many the United Kingdom-based universities used. The total cost of the enterprise resource planning (ERP) was close to seventy thousand pounds per year for an off-shelf system. The product cost was GBP49,750, annual support was GBP10,945, and implementation costs to support system configuration were GBP15,300 (including training).

The system runs on the cloud, but the institution opted for a server-mounted system due to security concerns. Server configuration challenges led to additional support costs, and the vendor had concerns that the hosting environment had issues supporting the system. The user interfaces and process flows were also different from what was typically used, making user satisfaction and use a challenge. The development of the system emphasized a different accounting methodology (cash basis versus accrual basis). The scenario presented above is an example of challenges faced by African universities when they try to configure off-the-shelf systems.
The primary factor was the cost of implementation and the cost of the product. In the case presented above, the cost mentioned of GBP70,000 was just for the finance module and not for other project management modules available with the vendor.

However, the market had similar products, such as project management tools for tracking and coordinating activities. These applications relied on forms, dashboards, and workload views, mirroring everyday applications used in Microsoft applications or other social media platforms. The familiar user interface made them easier to relate to by various users.

Deeper analysis indicated that such applications were simple process tracking and collaboration tools with an additional benefit of storage and real-time reporting. They were not built for universities or with research administration in mind. However, their high flexibility allowed easy configuration to meet any requirements. Users could easily map workflows, dependencies, and relationships without any development requirement, and end-users could easily do the structure and workflows.

Technical support with the product launch, including help with configuration done with the client for 10 hours at the cost of approximately two thousand Dollars. The client presented a list of requirements, and they would work with an account manager and a technical expert to configure the system and have it running in less than three months.

GanntPRO made the comparison provided in figure 9, and it helped compare three leading applications. The three applications were Smartsheet, Monday, and GanttPRO, and looked at user satisfaction surveys, an overview of each application, pricing and pricing plans available, and some key features.
An internet search showed that the University of Western Cape in South Africa had Smartsheet. “From managing budgeting to mitigating risks, Smartsheet provided the University with one centralized platform to standardize procedures and build team cohesion.” Smartsheet had similar functionality with Monday, both boasting of automation, improved work visibility, collaboration, and teamwork. Pricing was also flexible, allowing teams of five and more and could be monthly licensing or annual fees. Further research by the author indicated that an enterprise package for a minimum of 25 licenses with added features could cost about $10,000 per annum.

Figure 9: GanttPRO analysis of similar project management applications

<table>
<thead>
<tr>
<th>SOLUTION</th>
<th>99%</th>
<th>95%</th>
<th>100%</th>
</tr>
</thead>
<tbody>
<tr>
<td>User satisfaction score according to FinancesOnline</td>
<td>4.4 (1426)</td>
<td>4.6 (46)</td>
<td>4.7 (158)</td>
</tr>
<tr>
<td>User satisfaction score according to Optimizely</td>
<td>4.3 (1910)</td>
<td>4.7 (793)</td>
<td>4.7 (158)</td>
</tr>
</tbody>
</table>

Figure 10: GanttPRO analysis of similar application showing product overview and pricing

Figure 10: GanttPRO analysis of similar application showing product overview and pricing
The case of automating the Internal Review Board (IRB) processes at the author’s institution was an example of an in-house developed product. The ICT department developed an online review system for research protocols with an agreed cost of $10,000 over three months. The IRB administrator provided requirements for the development work.

Another case reviewed was an external developer engaged in developing an electronic grants management system. The office of sponsored research provided system requirements. Development and implementation was one month and a value of $8,000.00. The list below represents an extract from the developer indicating the modules proposed for development.

<table>
<thead>
<tr>
<th>System Name</th>
<th>Modules Functions</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grants Management</td>
<td>Administration</td>
<td>This is the administrator module which manages users, and all system settings.</td>
</tr>
<tr>
<td>Grants Management</td>
<td>Scientific Review workflow</td>
<td>manages workflow for Scientific review</td>
</tr>
<tr>
<td>Grants Management</td>
<td>Grants Review workflow</td>
<td>manages workflow for Grants review</td>
</tr>
<tr>
<td>Grants Management</td>
<td>Contract review</td>
<td>Manages workflow for Contract review</td>
</tr>
<tr>
<td>Grants Management</td>
<td>RSC [Research Support Center] + COMREC [College of Medicine Research Ethics Committee] Database Integration</td>
<td>COMREC and RSC will use one source of Information and changes will be visible to both parties</td>
</tr>
<tr>
<td>Grants Management</td>
<td>Stores Management</td>
<td>Keeps records of what goes in and out of stores and produces reports.</td>
</tr>
<tr>
<td>Grants Management</td>
<td>Accounts Management</td>
<td>Shows balances in all project’s accounts. This is a necessary tool for managing Grants. The systems send messages if balances in accounts go below preset minimum amounts.</td>
</tr>
<tr>
<td>Grants Management</td>
<td>Post Installation Support (90 days)</td>
<td>Getting feedback from users and making changes to the systems accordingly. This includes helping users when they have problems in the use of the System.</td>
</tr>
<tr>
<td>Grants Management</td>
<td>User Training (30 days)</td>
<td>Training technical users and normal users of the system. Training will be conducted in groups for a week and users can request additional one on one training within 30 days after Installation</td>
</tr>
</tbody>
</table>

Table 1: Electronic grants management system proposed modules

We saw that cost had several elements to consider, including implementation costs, once-off product costs, support costs, and opportunity cost (loss of benefit from choosing one product instead of another). Other considerations were costs for developing systems in-house and those related to paying vendors for products and services.

<table>
<thead>
<tr>
<th>Description</th>
<th>Internal/In-house costs</th>
<th>External/purchase costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Product development</td>
<td>Use existing staff, reassign tasks, may need additional hands, may need to reskill and train in specific areas</td>
<td>Off-shelf price, the cost for upgrades/newer versions</td>
</tr>
<tr>
<td>Implementation</td>
<td>Dedicate internal team for implementation</td>
<td>Once off cost for implementation support</td>
</tr>
<tr>
<td>Hardware</td>
<td>Need to consider additional hardware infrastructure for development and hosting application</td>
<td>No hardware consideration (hosted on the cloud)</td>
</tr>
<tr>
<td>Cloud</td>
<td>Consider hosting on the cloud and related expenses</td>
<td>Part of package</td>
</tr>
<tr>
<td>Support</td>
<td>Reassign individuals and train to support with the new application</td>
<td>Annual payment part of the package with some offering 24/7 support</td>
</tr>
</tbody>
</table>

Table 2: Analysis of cost elements for setting up an eRA

Regarding ranking costs, the two systems built specifically for research management (Kuali and Converis) are the most expensive as they were institution-wide. They also took the longest to implement, which meant additional institutional costs related to the implementation. $10,000 for developing an IRB online system and $8,000 for developing an eRA within a month were both ambitious. However, the amounts charged may be equated to the capacity to create and implement such projects. The flexible pricing options of the online project management tools made them attractive as an option for institutions with limited resources. The table below summarises the cost of the various eRA options available.
<table>
<thead>
<tr>
<th><strong>eRA System</strong></th>
<th><strong>Description of cost</strong></th>
<th><strong>Cost</strong></th>
<th><strong>Considerations by a resource-constrained institution</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Kuali</td>
<td>Annual licensing, configuration costs, Implementation costs</td>
<td>Costs not publicly available</td>
<td>Advantage – ready for implementation Disadvantage - enterprise-wide, preconfigured, expensive</td>
</tr>
<tr>
<td>Converis</td>
<td>Annual licensing, configuration costs, Implementation costs</td>
<td>Costs not publicly available</td>
<td>Advantage – ready for implementation Disadvantage - enterprise-wide, preconfigured, expensive</td>
</tr>
<tr>
<td>AGRESSO</td>
<td>Annual licensing, configuration costs</td>
<td>Once off set up cost (GBP15,300), annual support (GBP10,945), and once-off product cost (GBP49,750)</td>
<td>Advantage – ready for implementation Disadvantage - enterprise-wide, preconfigured, expensive</td>
</tr>
<tr>
<td>Smartsheet</td>
<td>Annual licensing, configuration costs</td>
<td>$25/license with a minimum of 25 users for an enterprise package per month, $2,000 for 10 hours of configuration support.</td>
<td>Advantage – Scalable, configurable, reasonably priced Disadvantage - Need extensive configuration</td>
</tr>
<tr>
<td>Monday.com</td>
<td>Annual licensing</td>
<td>15 licenses for $1800 per month</td>
<td>Advantage – Scalable, configurable, reasonably priced Disadvantage - Need extensive configuration</td>
</tr>
<tr>
<td>Inhouse developed</td>
<td>Development costs, hardware (servers), training, validation, and user testing</td>
<td>Developer costs ($8,000), server ($6,690), training ($1,200), user validation exercises ($2,000)</td>
<td>Advantage – meets expectations within the available budget Disadvantage – complex implementation and management</td>
</tr>
</tbody>
</table>

**Table 3: eRA Cost Analysis**

**6.4. Project Result 2. Make Versus Buy Capabilities Considerations.**

An institution developing a homegrown system has limited benefits. The institution may not have the capacity to implement projects to build and continuously upgrade software systems as businesses set up specifically for software development. Unexpensive developers engaged in
developing systems for institutions may also face similar challenges in that they could not provide services at the same standard as more giant corporations.

An institution would have to but the right mix of people to support such projects, ensure the trained individuals available to support the project. There are no economies of scale in such an endeavor. It made more economic sense for software development businesses to make such investments as the costs reduced as the same pool of highly skilled individuals serves numerous projects.

Institutions buying software stood a better chance to benefit from current developments as upgrades are made available freely with annual licensing. Upgrading a homegrown system would require more development costs.
Chapter 7. Recommendations and Discussion

7.1. Introduction

Universities had to put mechanisms in place to reduce the risk of damaging their image, maintain public trust, and avoid penalties. The universities had to have responsive and dynamic systems with capabilities of monitoring and reporting various aspects of their operations. Increased scrutiny in how universities managed funds meant universities had to put mechanisms to capture information to track expenses accurately, including people’s time efforts across several activities.

Systems were required to capture and report indirect costs related to research. These costs were crucial as they were used to negotiate facilities and administration rates with the government. The public has a significant interest in this rate as it averages 50% for some universities, and most citizens feel it is too high. Salary caps and negotiated fringe benefits rates were mechanisms to ensure universities’ conservative use of public funds.

The events of September 9/11 meant restrictions and reporting requirements were put in place to ensure government funds do not trickle down and fund terrorism. Stricter controls were as such placed on the vetting of subcontracts. Due to unethical behavior in past studies, more restrictions brought new requirements for responsible conduct of research and human subjects protection that universities had to follow. Governments funded research to increase knowledge economy and national competitiveness. Export controls were further restrictions that universities had to keep in mind.

The example provided was some elements present in the complex compliance environment that university research management exists in. These requirements were independent of institution size as the compliance requirements were universal, extending to subcontracts.
Research is essential for universities as it promotes the institutions’ ranking; research-intensive universities could attract a higher caliber of staff, use research funds to have state-of-the-art facilities, increase the institution’s visibility through publications and conferences. Moreover, universities have realized the commercial value of research by exploiting intellectual property and commercialization.

Therefore, with the demonstrable role of research in universities, universities needed a thorough and coordinated approach to address the compliance requirements to preserve a positive public image, maintain the public and donor trust and remain competitive.

7.2. Recommendations

Electronic Research Administration (eRA) had come out to solve the complex obligations universities found themselves in when engaging in sponsored research. eRA provided means to roll out innovations across the institution instantaneously in response to any new requirements. It could store records and reports in real-time, providing crucial information for decision-making and reporting requirements. eRA improved efficiency through collaborative work as most systems shared resources across different departments that historically operated in silos.

An eRA has a positive impact on an institution’s research management performance. Exploring the various solutions further noted that there was no one size fits all, as institutions had different requirements based on their funding environment. Budgets were also a factor to consider as other solutions came at different prices.

7.2.1. Recommendation 1

We found that understanding the stakeholder requirements was critical in developing an eRA. Vendors like Kuali automatically updated their software packages in response to new guidelines by the US Government. Having such a responsive package would be an added advantage to an institution. They would spend less time reconfiguring an in-house built system
or another off-shelf system to align with new regulations. The systems are also functional
because of the people using them. A system developed for USA or UK universities may not be
the right fit for an African university.

The table below represents grants the college has managed over the past 15 years to 2020.
We see that there is quite an even spread of grants received from major economies across the
globe. The foundations and private funding include organizations like Bill and Melinda Gates
Foundation (USA), Wellcome Trust (UK), private companies like Glaxo Kline Smith and Pfizer
from different continents. An off-the-shelf solution that meets all these other requirements is
most unlikely.

![Figure 11: Fifteen-Year data on grants received at the College of Medicine](image)

7.2.2. Recommendation 2

As mentioned in the recommendation above, both the outright purchase price and annual
licensing and implementation costs for enterprise-wide solutions requiring several years of
implementation were costly. Home-built solutions were cheaper as a consultant engaged based
on the available budget. Nevertheless, we saw institutions might try to do a lot with the little they have, too many requirements, in a short period at a minimal cost.

Another option was the configurable online project management systems to meet eRA requirements. These systems had flexible pricing with enterprise solutions more expensive with added features. A university with limited resources would opt for the solution with flexible pricing.

7.2.3. Recommendation 3
The capacity to develop in-house eRA was also a challenge as many institutions would not always have the right mix of required skills or the correct number of people committed to implementing the project. These skills are available with the vendors as they had numerous projects simultaneously requiring these skills. So the cost of having such a skills mix was spread across several projects and made system development cheaper and more practical than if a university attempted the same. The skills are made available to clients through implementation agreements. There were no system development activities required for off-the-shelf systems.

7.2.4. Recommendation 4
Therefore, the Kamuzu University of Health Sciences would opt for online project management systems like Smartsheet or Monday.com as an eRA solution for two main reasons.

1. They had flexible pricing solutions with opportunities to scale up depending on the institution’s needs and availability of funds.

2. Flexible (configurable), fully developed, ready-to-use solutions adapted to meet various requirements within the shortest time. Financial people preferred Smartsheet as the user interface resembled excel. Monday.com used a Gantt Chart interface to track work and teams to appeal to programmers. Determining the proper application between the two can be done by identifying the modules to be
implemented, identifying the frequency of use by a specific group of individuals, and user opinions. The user interface would set them apart as Smartsheet and Monday.com matched the other criteria.
Chapter 8. Conclusion

The conduct of research has evolved over the years; funding mechanisms are more formalized mainly through corporations, governments, and foundations. Research also has to respond to a more complex environment that crosses international and academic borders. Researchers have also increased, requiring funding from the same traditional sources. Therefore, universities have had to adapt and implement mechanisms to remain competitive and comply with the ever-increasing regulatory environment.

The research reviewed how universities have tackled these challenges to remain relevant in the research industry. Electronic Research Administration (eRA) has been used to meet the increasing demands of research management in universities. An eRA has many benefits, including improved efficiency by tracking work, managed workloads, and individuals' work visibility to all the team members, allowing addressing bottlenecks. The eRA also stores data and makes reporting more straightforward, especially if reporting tools with links to the database allow access to real-time information. Metrics and dashboards included in the eRA could also enable effective monitoring of crucial deliverables from various stakeholders.

This level of visibility and accountability would ensure a more effective environment, meaning the university would manage research to the standards required by the stakeholders. Improved research management improves the public trust in the institution’s ability to conduct research, increasing the potential for more funding. Efficiencies provided by eRA would also increase research outputs as administrative burdens were entry barriers for upcoming researchers.

Improved research outputs are an essential ingredient for economic development. Research has a significant impact on societies and economies, and there is an immediate impact from job creation from the research work. Moreover, exploitation of the research results also
brings economic benefits to institutions and nations. More importantly, the research could find locally bred solutions to challenges and a potential pathway to improved livelihoods in the African context.

Benefiting from research is maximized if systems manage the research processes to produce high standard results. Adhering to international standards on responsible conduct of research (RCR), accountability, and transparency requirements increases donor confidence: reporting tools aid decision making and visibility of research results immediately used to implement change.

There are numerous solutions available on the market, some custom-built for universities. However, when selecting an eRA, three key considerations have come out from this study. These included the cost of the system, its rightness to fit stakeholder requirements, and capacities to develop and implement within the institutions.

Research administration spanned across the institutional departments and scaling an electronic enterprise-wide resource planning system is costly. Large institutions have made such investments whose results have been significant, and the systems are part and parcel of the research management process. Off-the-shelf systems exist and are costly, but in-house developed systems were expensive, especially considering the time it takes to implement such programs.

Again, we saw that not all institutions could develop such complicated systems. The skills needed to create the software, manage the project, train the staff, and allow the institution to implement such electronic systems are not always available. Attempts at developing eRA systems in resource-limited institutions have failed, and this study discusses the critical challenges.
However, most institutions attempt to develop in-house systems to ensure that their product would meet their institutional requirements. We saw that most of them off-the-shelf research administration systems tried to be flexible to meet institutional needs. Still, the set parameters of the eRA systems meant flexibility was limited. Again, the off-the-shelf eRA system development favored the origin country's requirements. We saw some system developed in the USA that leaned heavily towards the research environment in the USA, to the point that the vendors of the system would regularly make updates to the system based on changes in US research policies.

The value from such initiatives would benefit USA-based universities more than universities on other continents. The system consideration proposed by the paper was web-based project management solutions such as Monday.com or Smartsheet. These solutions had the flexibility to configure and automate the research management processes of the institution. They were also the cheapest option allowing individual licenses, with additional costs for support with the initial configuration.

However, they were developed as everyday applications with formatting like frequently used Microsoft applications, making them easy to use. The configuration also was simple, requiring importing of institutional templates and mapping flows and relationships, meaning they need minimal ICT support in setting up and operationalizing such systems. Such systems would best suit resource-limited institutions but still, provide the value of an eRA system.

The researcher depended on available information on the internet, and future studies could look at actual data from universities across Southern African Universities and see what eRA solutions they have. Further studies would see if the existence or absence of eRA results in changes in research output on the African continent currently pegged at 1% of the global
research output. Some argue that more research work is undertaken on the continent than is reported, but the challenge again is that there are no systems to track and report research outputs in most universities.

In the years to come, universities will have to depend on eRA to remain competitive in research. Industries have bloomed around research universities and how universities have been relied on the world over to inform policy. This research has been vital as it will provide knowledge to smaller universities on how to improve their research output by reducing administrative burdens, tracking and complying with compliance issues, keeping a record of all research output, and showcasing the universities' research impact. Only through this can universities be meaningful partners in providing knowledge for the public good.
Bibliography


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Appendices

Appendix 1. Proposed Sample Questionnaire on System User Opinions

Expert Opinion on the establishment of an eRA

This questionnaire aims to assess the need to establish an electronic award management information system for the university. Managing information and compliance requirements has increasingly become a challenge globally. Many universities have opted for automation and electronic processing for most award-related activities in pre-award, award, and post-award phases. There are significant benefits that such technology can offer. The questions below will help determine the best approach to use to achieve efficiency using electronic platforms. Summarised information is going to be published at the end of the survey. Each question has specific instructions on how to respond.

1. An electronic award information management system is an electronic (primarily web-based) tool that allows users to access and view, maintain and generate specified reports. Would you agree that an electronic award management information system would help meet information management needs and funding agency compliance requirements within our institution?
   Please select one option below

   Mark only one oval.

   ○ Strongly agree
   ○ Agree
   ○ Do not agree
   ○ Don't know

2. What functions would you require such a system as mentioned above to have?
   Please describe in less than 100 words, short points are acceptable.

   ___________________________________________________________
   ___________________________________________________________
   ___________________________________________________________
   ___________________________________________________________
3. Would you be willing to periodically update or make approvals when prompted the system?  
Please select one option below 

*Mark only one oval.*

- ☐ Yes
- ☐ No
- ☐ Maybe

4. What concerns would you have about such a system?  
Please describe in less than 100 words, short points are acceptable.

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

5. Is it acceptable if the system sends reminders when your actions are required using the following methods?  
Please select one option below

*Mark only one oval.*

- ☐ Email
- ☐ Phone message/alert
- ☐ System dashboard alert (can see alerts only when logged into the system)
- ☐ All the above option
6. What related online systems are you using?
Please name the system, and describe how frequently you use it, what you use it for and what you liked/disliked about
Appendix 2. Product design templates

No Product design available.
Appendix 3. Johns Hopkins University Institutional Review Board Approval
No IRB approval was available for the use of the questionnaire.
Appendix 4: Short Bio

Palinji Mungoni received a Bachelor of Business Administration majoring in Accounting from the University of Eastern Africa, Baraton. He is a Grants Compliance Officer in the Research Support Center at the University of Malawi College of Medicine. He has been at the university for ten years and held a previous role as Grants Accountant before being promoted to the current position. He has developed an interest in research administration and is a member of the Southern Africa Research and Innovation Managers Association and the STARS Programme. The program is designed to contribute to promoting research management and the professionalization of research management in Africa. This exposure prompted him to learn more about research administration and enrolled in the Johns Hopkins Master of Science in Research Administration program.