Towards an Enterprise Model for the Academic Researcher

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ABSTRACT

We are in an age where there are several societal and scientific challenges that are facing humanity. The academic researcher is not left out of this entire dilemma. The same researcher who is expected to be active in research within the university system is also expected to be committed to teaching and service assignments. The research task itself requires a lot of processes scattered around various work, culture, people and structure such as writing proposals, liaising with the research department, looking for materials in the library, learning appropriate applications with the Information Technology (IT) department etc.

The study is based on a case study of the University of Botswana. It uses the Nadler-Tushman Congruence Framework to perform a gap analysis on the current system. The outcome from the study is a proposed model to help align work, culture, people and structure. The blueprint provided by the model will allow one to see the real impact of change, identifying where gaps and opportunities exist, and understand how and where things can be improved for the benefit of all stakeholders. The paper also proposes that a more detailed model can be achieved using The Open Group Architecture Framework (TOGAF) architecture model.

Keywords: Academic Researcher; University; Botswana; Nadler-Tushman Congruence Framework; TOGAF

1 Introduction

Research is and continues to be an important part of any higher education institution’s faculty. An academic’s reputation and career path is often based on the quality of their research [1,2,3]. Academic research also influences societal issues such as informing policy as illustrated by [4]. It has also been shown that research contributes to economic growth through the creation of new knowledge, production, licensing and patenting of industry linked artefacts [5]. The benefits accrued from these activities include financial gain, enhanced reputation, and visibility to both the academic and home institution. Additionally the literature abounds with tools that have been generated from academic research related activities including portals and platforms targeted towards community use such as health patient portals and education websites [6,7]. Furthermore quality research has been found to have a positive impact on teaching [8,9].

Despite the observed importance of quality research output, it has become apparent that faculty in many higher education institutions are faced with numerous barriers that prevent them from fully engaging in the activity. As noted by [10] and [11] one of the most common barriers is the extra workload imposed
on researchers due to inefficient institutional tools and services intended to support the research life cycle. An inefficient support service often means that faculty spend time performing non-research tasks such as finding information on funding, collaboration opportunities, repetitively completing several forms, and tracking applications. This has potential to negatively impact time spent on performing meaningful research. It thus follows that for institutions to enhance quality of research, faculty should be afforded efficient services that will enable them to dedicate more time to research activities as opposed to administrative tasks.

This paper uses the University of Botswana (UB) as a case study to highlight the processes an academic researcher goes through in order to carry out a research. UB is a public academic university, which was established on 1st July 1982 by an Act of Parliament. There are seven faculties at the University of Botswana: Faculties of Business, Humanities, Science and Social Science, Education, Engineering & Technology and Health Sciences. The university also has several non-academic units. Being the national university of Botswana, it fulfils an important purpose: advancing knowledge in the country and through it improving economic and social conditions of the nation [12].

The aim of this research is therefore to establish the perceived gaps based on the process of academic research in the university. The study is initiated as part of progress towards providing a model to identify opportunities for improvement in research services at the university. In section 2 we introduce the UB research process, Section 3 discusses the challenges in the research process. In Section 4 we analyse the UB research process using the Nadler-Tushman framework and discuss findings in Section 5. We propose a new system in Section 6. Section 7 is the Conclusion.

2 The UB Research Process

There are several descriptions of the research process, however, for the purpose of this research we adapt descriptions from [13] and [14] and come up with a four stage workflow that closely relates to what currently follows the process used at the UB. In this case, the process is perceived to be a four (4) stage process as depicted in Figure 1, comprising idea development/literature review, identification and application for research funding, conducting research and disseminating findings.
3 Challenges in the Research Process

Research and information emanating from research has become one of the most important undertakings in universities worldwide. Appropriate management of the process and results from research is essential, without which the researcher will be frustrated and the benefits from research not achieved. According to [15], there are still numerous issues and challenges that stifle higher education institutions from reaping the benefits of research, some of the highlighted issues include: high volume of research information and lack of tools; technical challenges; lack of institutional policies; ethical or social cultural challenges and lack of funds. Another study by [16] revealed that some of the challenges encountered by academic researchers were in getting adequate support for data analysis tasks, problems in publishing researches, time problems with researches, problems with collaborative works as well as difficulties in reaching international resources. It can thus be surmised that most of these challenges since they are administrative can be resolved with better management and coordination of organizational activities.

A model that is often adopted in the literature to study and rectify organizational inefficiencies and performance issues is Gap Analysis [17]. In [18] the model is used to measure perceived versus expected service quality in an effort to improve airport service quality and [19] use the model towards the optimization of surgical operating room usage. While several frameworks exist for this model [17] including McKinsey 7Ss, SWOT, PESTEL and Fishbone our study utilizes the Nadler-Tushman framework. The model was selected because it considers characteristics of modern organizations as well as individuals, groups, and systems within these organizations [20].

The Congruence Model was first developed in the early 1980s by David A. Nadler and Michael L. Tushman [20]. The model is based on the premise that an organization is made up of interdependent components. The model further emphasis that for an organisation to be effective there should be congruency between the various components [21]. The organisation is in this case also viewed as a system capable of transforming input factors such as the internal and external environment, human, capital and information resources, history, behavioural patterns, as well as organisational strategies into useful outputs. The inputs are converted to useful outputs through system components comprising the tasks, informal organisational arrangements, formal organizational arrangement and individuals. The outputs from this transformation process are the resulting products and services, as well as the performance and effectiveness of the organisation [21]. As a diagnostic tool the model has been used in various business applications to identify problem areas within companies and processes.
In a review of the Jamaican Courts System’s initiative to produce data towards homicides and intra-family/family indicators, [22] use the Congruence model to explain the court system as an open social system and identify its inadequacies in the production of detailed information and reports which were found to be limited to aggregate or summary statistics.

Another study [23] applied the congruence model to identify and illustrate operational inefficiencies of a Cardiac Catheterization laboratory. By using the model, the study was able to show how to achieve operational efficiency through cost saving measures and strategies. Furthermore Standardized metrics of Catheterization laboratory efficiency are derived and proposed as a result of the study.

In another study by [24], the congruence model was used to provide an overview of primary care organizations as open systems. From the illustration areas of potential incongruences between organizational elements due to newly introduced requirement changes are identified and examined. A listing of the problem areas was further provided against which other organisations can assess their systems.

4 Analysis using Nadler-Tushman Congruence Model

4.1 The Research Process using Nadler-Tushman Congruence Model

In this study, the research process is portrayed as an open system comprising inputs, throughputs and outputs. In terms of research, a critical input in this model would be the researcher strategy defining the purpose of the research which should include key success factors. The other input is the capability of the researcher to perform the research and skill set to carry out other research related activities. The environment provided to the researcher is also an essential input to the system. This can be in terms of office space, technology, time and workload. The outputs include quality research work, scholarly impact of published work, and usable artefacts and products.

The throughputs are components that can transform the inputs into outputs and these include work, human, structure and culture elements as shown in Figure 3. With these components a gap analysis can be performed to assess how outputs closely align to the organization strategy and how inputs can be varied to achieve this.
4.2 Work Elements

Several tasks need to be performed as part of the research process as shown in Figure 1. These include putting into practice sound scientific methods that have been tried and tested. In addition researchers have to evaluate and select which of the methods are most applicable to their research. Identification of relevant and authoritative resources is also essential in a research. In the digital age these activities often require knowledge on how to access and use online services. Finally, for research to have impact, results should be disseminated and shared with the wider community. To this extent the researcher should engage in visibility promoting activities such as attending conferences and publishing work in reputable journals. Within the system to attend a conference requires the researcher to present their work at a departmental seminar and apply for travel support which involves writing letter of application, proving invitation to conference, looking for quotations on flights and/or accommodation, submitting and following up on this activity.
4.3 Organizational Elements

Various departments exist to assist the researcher at the various stages of research as shown in Figure 5. For instance training on how to use relevant tools is offered by the education development unit and the training unit of the Information and Technology department. The library offers information location services and provides computer services. The department of computer science offers data management and analytics support through provision of advanced computing infrastructure. The office of research and development whose role is to provide information and assistance on locating internal and external grants and ensuring that the research follows stipulated legal and ethical guidelines. The researcher’s home department and faculty involved in the application for funding as well as the finance department that manages the university’s finances.
| Academic development/learning to use relevant tools | • Education development unit  
• Training Section – IT unit |
|---------------------------------------------------|------------------------------------------------------------------|
| Locating relevant information                      | • Use of Computer Equipment in which both hardware and software is serviced by the Information and Technology department  
• Use of Library services  
• Reaching international resources |
| Internal and External Funding                       | • Application for internal funding via Research and Development Unit  
• Searching for external funding and processing application |
| Legal requirements                                  | • Ethical approval permit through the Research and Development unit  
• Ethical approval through various ministries  
• Legal clearance if needed |
| Data analysis through help from relevant department(s) | • Department of statistics  
• Department of Computer Science  
• etc. |
| Collaboration                                       | • Other Universities  
• Colleagues in other departments  
• etc |
| Writing                                            | • Learning to follow writing rules for the conference/journal  
• Use of editing services to assist with writing |
| Conference application procedure                   | • Collecting flight booking invoice  
• Filling necessary forms and filling application  
• Fulfilling basic requirements like presenting locally  
• Paying conference fees, booking, accommodation etc  
• Filling and applying for conference leave |
| Journal publishing                                 | • Looking for the relevant journal  
• Payment where necessary |

**Figure 5: The Researcher and Organizational Elements**
4.4 Human Elements

The researcher gets to interact with several individuals as she/he undertakes their research. These are key individuals whose skills and capabilities are essential to a researcher attaining their research goal as implied in the strategy. At the inception of the research the researcher requires the services of a subject librarian to assist with the location of information resources and the office of research and development personnel to seek internal and external grants and to ensure that their research follows ethical guidelines. While conducting research technical experts are required to assist with training on the necessary tools such as for data analytics. On research completion the work can either be published or presented at local/regional/international conferences. Where necessary the researcher may apply for funding to publish or attend a conference. Individuals at the phase include the supervisor who has to approve the intent to apply for funding, the conference fund committees at departmental and faculty level that have to approve the application for funding, and the dean who has to authorize funding to be released to the applicant and grant conference leave.

4.5 Cultural Elements

As part of a society that has been observed to have poor work ethic [25, 26] the various research support structures are often plagued by casual and lax attitude towards time management. This often leads to researchers choosing to do work on their own instead of using services available hence impacting their time that could have been spent on research related activities. Communication issues also exist in terms of feedback on the status of grants and fund applications. Unnecessarily long and redundant bureaucratic
processes also exist which tend to hamper the work and progress of researchers. For instance the application for grants and funding has to go through several approval stages both manually and electronically. Also in some cases, academics who are busy are also the ones put in the responsibility of performing administrative task for other researchers. This can sometimes lead to delays in the process. There is generally lack of motivating factors in terms of providing enough funding [27] and resources for research and travel. Interdisciplinary collaboration is also low limiting creativity and innovativeness of research products.

5 Discussion

A summary of the analysis from the bottle necks highlighted from the model suggest that there exist major problem areas between Work, Organizational, People and the cultural elements.

The organizational structure calls for intervention of several offices during the various phases of research. For instance at the inception of the research, the researcher has to contend with having to locate information and learn various tools available for research as well as to know what is more applicable for a particular area. This involves the utilization of the library and training units within the university. They also have to coordinate with the office of research and development to learn guidelines for ethical research and locate grant opportunities. At the analytics stage the researcher may require the use of infrastructure from a different department which might not have the resources such as specific software applicable to their area. Similarly at the pre-dissemination state the finance office might be required to avail funds for the purpose of travelling to a conference. Navigating all these structures can be frustrating and time consuming for the researcher. In addition since the structures are independent there is large amount of paper work some of which is a duplication that goes into communicating with the structures. Bureaucracy can be a major obstacle to undertaking quality research work. The bureaucratic delays incurred in getting a grant to finance a study are most likely to account for researchers opting for less quality projects that require less investment on time and equipment resources. In the same way delays in getting travel support can demoralize researchers from participating in international conferences potentially limiting access to new information and technological advances.

Lack of time management by units and individuals that the researcher interacts with often means that the researcher has to follow-up on requests made to these entities and even on occasion complete the tasks themselves. This negatively impacts on the time required for actual research work.

In carrying out research, the researcher has to seek assistance from several units some unrelated to research. In the process they have to deal with several individuals. While the individuals may be competent in terms of skills and service provided the numbers can be daunting to the researcher. Miscommunication is another challenge that may occur as a result of several points of interact. As a result the time taken to resolve issues arising negatively impacts time required for research work.

A report from the World Economic Forum [28] highlights that one of the ways that research culture can be improved include establishing support system that boost morale and enhance a positive research. This they highlight can be accomplished through providing and promoting career counselling, coaching and support services available to staff to reduce pressures within a research environment, which is imperative to staff well-being, which in turn will lead to better quality research.
6 The Proposed Enterprise Research Model

The business of any university cannot be imagined without the use of ICT technologies. It is however imperative that these structures be appropriately coordinated to properly support the mandate behind the university’s business. The structure of UB started out with several units (academic and administrative) working independently. In order to work on some of the challenges this kind of structure brings about, in 2012, the University engaged in a project to improve its efficiency in administration by introducing an Enterprise Resource Planning (ERP) system. The ERP System functions bring together data for: Academic and Student Administration System (ASAS), Human Resources Management System (HRMS) and Financial Management System (FMS). The system however does not have any functionality in regards to the research process. An enterprise must have a clear, integrated vision between its business and IT. One of the core businesses of a University is research. It is therefore essential to control IT complexity in order to achieve alignment between research lifecycle and IT. The Proposed model highlights how the various research supporting components can be integrated to achieve this goal. Figure 7 gives a broad view of the proposed model.

In this proposed model, the academic researcher is still in the midst of all the activities going on but they are not disjointed. In this setup the researcher is able to perform all activities from their office desk while communicating with systems that are co-ordinated. The model also provides for a single point through which a researcher can request assistance from the various units of the system. From this point they can trigger actions to get assistance for example from the library in getting information on resources needed for the research. This will require re-engineering of library services, ensuring that subject librarians are
conversant with ICT tools and are able to assist the researcher with relevant information needed as well as useful tools for the research. In the same manner the research and development unit should be able to provide single point of access to information on available funding, legal requirements, and related applications e.g. for journal publishing. Beyond the single point of access the various units should be able to provide support for the entire research process without the researcher necessarily having to leave their desk. An efficient way of achieving this will be to eliminate or minimise the human factor where necessary. For example, the whole process of applying for a conference travel funding could be carried by someone else other than the researcher or be fully automated from initial application to the disbursement of funds. Similarly the Educational technology unit can relieve the researcher by assisting with data analysis as well as training in the tools needed by the researcher. Editing and formatting services can also be provided by this unit. The processes described will relieve the researcher from doing so many things, he/she is then able to focus of the actual research and writing the results, which will increase productivity.

7 Conclusion

According to the Congruence model [21], the best strategies towards an effective organization are in identifying components and organizing them in a way that can support your organizational strategy. In this study we analysed the research process and identified components essential to achieving the desirable output of generating a quality research product. A general overview of an ideal system towards this goal was proposed illustrating envisioned best fit for components essential to a high quality research process. The proposed system seeks to demonstrate what a centrally administered research life cycle should look like. While the model will require re-engineering of the UB research process, it is envisaged that a centrally administered cycle will bring great improvement to research outputs in university. There is still however a need for a more detailed analysis to comprehensively redefine the processes involved in the academic research process and further articulate areas of change and improvement. To this end we plan to deploy the TOGAF data architecture framework to further analyse and describe the process. The blueprint provided by the TOGAF model will allow one to see the real impact of change, identifying where gaps and opportunities exist, and understand how and where things can be improved for the benefit of all stakeholder.

REFERENCES


