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# CONTENTS

Sr. No.	TITLE & NAME OF THE AUTHOR (S)	Page No.
1.	<b>AN EXPLORATORY STUDY OF THE POTENTIAL OF 'KatSRS SYSTEM' AS AN EDUCATIONAL TECHNOLOGY IN FACILITATING LEARNERS' ENGAGEMENT AND FEEDBACK: A CASE STUDY OF BOTHO UNIVERSITY</b> <i>WILLIAM NKOMO, BONOLO E. SAMSON-ZULU &amp; RODRECK CHIRAU</i>	1
2.	<b>MEASURES FOR ACTIVITY BASED COSTING SUCCESS: A REVIEW</b> <i>SHAFEQ HAMOUD M. AL-SAIDI &amp; H. NANJE GOWDA</i>	10
3.	<b>ICT &amp; WOMEN</b> <i>S. S. PATHAK &amp; SHUBHADA GALA</i>	13
4.	<b>A STUDY ON LABOUR WELFARE MEASURES WITH REFERENCE TO TEXTILE INDUSTRIES</b> <i>DR. P. GURUSAMY, J. PRINCY &amp; P.MANOCHITHRA</i>	16
5.	<b>AN ANALYSIS AND EVALUATION OF A UNIVERSITY'S E-COMMERCE READINESS: A CASE STUDY OF BOTHO UNIVERSITY</b> <i>TERESSA TJWAKINNA CHIKOHORA &amp; RODRECK CHIRAU</i>	21
6.	<b>SUSTAINABILITY OF THE WASTE MANAGEMENT PRACTICES IN TOURIST DESTINATIONS OF NAGALAND: A CRITICAL REVIEW</b> <i>AIENLA &amp; DR. T. R. SARMA</i>	28
7.	<b>DETERMINANTS OF INTERNAL BRANDING FOR CUSTOMER-ORIENTATION</b> <i>JASMINE SIMI</i>	33
8.	<b>A CONCEPTUAL STUDY ON RETAIL BANKING</b> <i>BHARAT N BASRANI &amp; CHANDRESH B. MEHTA</i>	38
9.	<b>IMPACT OF CELEBRITY ENDORSEMENT ON CONSUMER'S BUYING BEHAVIOUR</b> <i>SUPREET KAUR</i>	42
10.	<b>A STUDY ON THE FACTORS INFLUENCING CUSTOMER'S CHOICE OF RETAIL STORES</b> <i>ANUPAMA SUNDAR D</i>	46
11.	<b>GLOBALISATION, SEX INDUSTRY AND SEX MYTH: A COMPARATIVE STUDY OF SEX MYTH AMONG ADULT MEN AND WOMEN IN CHHATTISGARH &amp; WEST BENGAL</b> <i>SIDDHARTHA CHATTERJEE &amp; BIBHAS RANA</i>	51
12.	<b>APPLICATION OF RESTRICTED LEAST SQUARES TO ECONOMETRIC DATA</b> <i>IBRAHEEM, A. G, ADEMUYIWA, J. A &amp; ADETUNJI, A. A</i>	55
13.	<b>EFFECTIVENESS OF INTERNAL CONTROL SYSTEM OF ETHIOPIAN PUBLIC UNIVERSITIES: THE CASE OF JIMMA UNIVERSITY</b> <i>KENENISA LEMIE &amp; MATEWOS KEBEDE</i>	59
14.	<b>THE IMPACT OF CORPORATE SOCIAL RESPONSIBILITY - INITIATIVES ON CONSUMER PSYCHOLOGY</b> <i>PURTI BATRA</i>	66
15.	<b>INVESTIGATION OF CUSTOMERS' PRODUCT AWARENESS AND TRANSACTION GAP IN LIFE INSURANCE CORPORATION OF INDIA</b> <i>PARTHA SARATHI CHOUDHURI</i>	69
	<b>REQUEST FOR FEEDBACK &amp; DISCLAIMER</b>	72

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# AN ANALYSIS AND EVALUATION OF A UNIVERSITY'S E-COMMERCE READINESS: A CASE STUDY OF BOTHO UNIVERSITY

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## ABSTRACT

*Most businesses are considering implementing e-commerce systems to gain competitive advantage. Various models have been developed for assessing organisation's e-readiness and some of them involve very complex calculations. An organization that meets the e-readiness criteria specified in the model is said to be ready to implement an e-commerce system. The readiness may be measured on the basis of the resources that the organization has compared to what is required to implement an e-commerce system. The study therefore measures the preparedness of a university to implement an e-commerce system and suggests an architecture that may be adopted in the occasion that the institution decides to implement an e-commerce system.*

## KEYWORDS

assessment, e-commerce, e-commerce readiness, ROI.

## INTRODUCTION

E-commerce is growing at a record pace and this has seen many organisations setting up e-Commerce systems to assist them in their operations. Ahmed et al (2010) described the adoption of e-commerce as an approach for enhancing the effectiveness of business practices. Universities may adopt e-Commerce from the communication and business process perspectives. The communication perspective involves the delivery of information and/or services over computer networks whilst the business process perspective involves the application of technology in automating the business transactions. In organisations, e-commerce has been adopted to integrate part or the entire business processes depending on the technology requirements and the organisation's capability to avail the resources. For Botho University, an e-commerce system may be focused on the education business process, as a way of facilitating the exchange of information within the different university faculties as well as with other stakeholders particularly the students and prospective students over computer networks. This paper tends to identify and evaluate the University's resources against the components that have been identified as necessary for the implementation of an e-Commerce system. It is important to measure how far an organisation is from meeting the requirements for a successful implementation. In cases where the resources are not available, the e-commerce initiative becomes difficult to accomplish and may be delayed until the organisation becomes ready so that a high return on investment may be realised. The need to place Botho University in-line with other universities in the region has led to this study.

## BACKGROUND

The organization under study is a privately owned university operating in Botswana, from three major centres spread across the country. Botho University has a staff compliment of over 400 including the non-academic personnel. The enrolment is over 1000 students comprising of both full and part time students of which the majority are Botswana citizens. In the country, it is the centre of excellence in terms of Information Technology courses and the implementation of the latest technologies in the computer laboratories and teaching platforms, the latest being the adoption of Blackboard to facilitate blended learning. Every student has access to their own machine in the laboratories and may access the internet from anywhere in the campus through the wireless configurations. These are some of the attributes that have seen Botho University grow from a small college to a university over the years; the first privately owned in Botswana. The main activities in the organization are centred on learning, teaching and assessment of students who apply for admission and if they meet the entry criteria are mainly enrolled for courses in Accounting, Business Management and Information Technology (IT). Some of the courses offered are franchise courses from partner universities in the world. In this case, students are tutored from Botswana by approved tutors and their assessments handled by the awarding institutions. Both the students and university authorities manage these through communication over the internet, hence the unlimited access to the internet. Apart from the external communications, the different departments use e-mail as the major mode of communication with forms to support various day to day activities. These forms are available from any of the centres through a portal designed in-house for this purpose. The management has invested a lot in ensuring that communication is effective and one investment is on the employee laptops. Every employee is given a laptop to use, running away from the traditional desktop computers.

## REVIEW OF LITERATURE

In-order to make an informed decision, it was necessary to gather information from literature. Zakaria and Janom (2011) developed a conceptual framework that can be used to assess the preparedness of an organization in adopting Business to Business (B2B) e-commerce. The framework included eight aspects related to individuals, organization and environment and indicators for each aspect were defined. Experts, being representatives of the beneficiaries or stakeholders (Menou, 2011) were selected to evaluate whether the identified aspects and indicators were appropriate in evaluating an organisation's preparedness and readiness. The framework involved experts in each area to validate and assess how far an organization is from implementing an e-commerce system based on the aspects and indicators defined. The framework seems valuable because the experts involved were selected from various size and types of organizations with lots of working experience. The major setback however is that the weight of criticality of each indicator on how the evaluation sessions will be conducted and the stage at which these indicators may be used was not defined. These limitations make it difficult to adopt the framework in accessing Botho University's e-commerce readiness.

In a bid to develop an ICT Readiness Assessment Model for Public and Private Organizations, Chanyagorn and Kungwannarongkum (2011) proposed a model which comprised of indicators for the four main ICT factors which contain 16 sub factors, making a total of 38 indicators.

An organisation's documents may be reviewed, combined with observations and interviews to get the indicators which would be measured and rated using defined criteria. To get the overall readiness level, Chanyagorn and Kungwannarongkum (2011) suggested that the formula below be used:

ICT Readiness level =  $D_i + D_h + H + D_s + S + D_p + P$

Where:

- D<sub>i</sub>** = Developing factor of ICT infrastructure factor  
**I** = Average of ICT infrastructure score  
**D<sub>h</sub>** = Developing factor of ICT hardware factor  
**H** = Average of ICT hardware score  
**D<sub>s</sub>** = Developing factor of software and information system factor  
**S** = Average of software and information system score  
**D<sub>p</sub>** = Developing factor of people factor  
**P** = Average of people score

Chanyagorn and Kungwannarongkum (2011) also defined guidelines for interpreting the readiness levels, how the different indicators were related and how they could be analysed. The model is ideal for small to medium organizations in developing countries, like Botho University. It seeks to evaluate the main factors which are hardware, people, software and the infrastructure. In this study, some of the documentation is not readily available for review, such that calculating the readiness level may be a mammoth task. It is because of the scores for the indicators that may not be easy to calculate, that this assessment tool becomes difficult to adopt for the Botho University case.

Ahmed and Ibrahim (2010) in their study of e-commerce adoption strategies for Libyan government mentioned that adoption of e-commerce enhances the effectiveness of business practices helping an organization to gain competitive advantage, reduce transaction costs and enhance productivity. Twelve steps were identified as the effective way of implementing e-commerce in the Libyan government. Ahmed and Ibrahim (2010) define different types of e-commerce and they identified the function of B2B which matches the objectives of the e-commerce initiative at Botho University. Fox and Bayat (2007) argued from another category of e-commerce perspective and defined B2C as a process involving customers who gather information through electronically linked network. In their research, they identified important and relevant resources for the implementation of e-commerce systems as the Internet, policy, infrastructure, people skills as well as provision of incentives.

Mata et al (1995) developed a Resource –Based View (RBV) model that identified e-commerce resources, managerial e-commerce skills and business networks as indicators of an organisation's capability to implement an e-commerce system. They explained what each indicator entails but were silent on how they are measured in order to understand whether an organization is ready or not. Of course the indicators may be easy to identify in Botho University but there is no way stated in this model of how they may be evaluated to inform the decision.

Wokosin (n.d.) in their work differentiated the e-commerce business into back-end and front-end. Some of the back-end components were described as the security of products, order fulfilment and customer service whilst the front-end components may include a database, dynamic HTML, DOM, security and payment processing. All these components were described clearly stating their purpose and how they relate to back-end components as well as how the front-end components relate to the back-end components. Wokosin's work is related to this study because it states the basic components of e-commerce which may be used in assessing Botho University's e-commerce readiness. The availability of the components would indicate that this organization is ready to adopt e-commerce. However the decision would not be well informed because there are no measures or indicating levels to define what is acceptable. The reason why Wokosin's suggestion may not work on its own is because there is no measure although the components may be used at the early stages of evaluation.

Machkasova (2002) identified the basic components of an e-commerce system as access gateways, database interfaces, network and communication interfaces, application interfaces, network and application services, middle tier logic and application execution services. An organisation's e-commerce readiness is determined by the extent of availability and configuration of these components. An organisation that has these components may be regarded as prepared to adopt an e-commerce system.

Chan and Swatman (1999) described how e-commerce was implemented at BHP Steel. In their work, they described what was required to implement e-commerce, the factors affecting its implementation and the results of the implementation. According to Chan and Swatman (1999), implementation may be in three different stages each with its set of objectives and implementation to achieve the defined objectives. Like most projects, implementing e-commerce was hindered by the high cost of the Internet, security, speed and timing of delivery amongst others. The complete implementation of e-commerce at BHP Steel is described in this paper, including the experiences learned. From the case study, 3 main groups of issues being technology, management and business issues were identified and considered as critical in implementing e-commerce. This work is relevant to this study as it gives an idea of how e-commerce may be implemented at Botho University, given that it is the early stages of an implementation where technological issues seem to dominate the process (Chan and Swatman, 1999).

## REQUIREMENTS OF AN EFFECTIVE SYSTEM

The analysis was done by checking and verifying whether the basic components identified by Wokosin (n.d.) and Zakaria and Janon (2011) were available in the organization. Wokosin (n.d.); Chan and Swatman (1999) mentioned that at an early stage, the technological issues are the most important means to judge whether the university is ready or not. An e-commerce system must be properly configured if it is to add value to the organization. To implement the system, the basic components include a database, interface, encryption and security, payment processing and java servlets and cookies. Each of these components is discussed here:

### DATABASE

A database, which is a collection of information, is required to store all the information that the prospective students and other stakeholders would access. The information about students, courses and every piece of information displayed on the website will be stored on a database. In cases where students have access to the information, a record of what they would have accessed must be kept so that it may be used for support services if need be. The other information that may be stored is the fees payment details, enquiries and frequently asked questions.

### INTERFACE

The users of an e-commerce system access the database component through applications and a website. The interface allows the user to perform transactions and communicate with the organizational information. This is where the users can see and select the products and services available (Wokosin, n.d.).

### ENCRYPTION AND SECURITY

Dhillon et al (2001) mentioned that there is so much data that is collected in e-commerce and the technologies implemented make it very easy to access such data hence the need to configure security for e-commerce systems. There are various levels of securing information over the internet and for an organization using the internet for communication, it is important to configure security at each and every level.

### PAYMENT PROCESSING

Payments are a part of the buying and selling process and when a payment is made, the transaction is committed. The most commonly used payments in e-commerce are electronic given that the majority of customers are geographically dispersed. Some of the e-payments systems include electronic Fund transfer, payment cards, credit cards, online payments and e-wallets. If Botho University is to implement an e-commerce system, it has to consider e-payment systems to cater for the different customers that may be geographically dispersed. It will also reduce cases where students convert fees to their own use when sent by parents to pay. The parents may instead make payments through e-payment system.

### JAVA SERVLETS AND COOKIES

The electronic forms that are often used for e-commerce must reach the customer in their correct format, in a secure and timely manner. The servlets and cookies are a necessary technology in e-commerce systems because they facilitate the transfer of digital forms to the application safely and in their correct format. Information on the computer is translated by software programs into a standard format and the servlets ensure that these formats are readable using different browsers for example. Cookies on the other hand are important as they improve the speed or rate at which the forms are accessed by the customers. It



is general knowledge that they keep a path to where the forms are such that when they try to access a form they have previously accessed, it will be displayed faster than one that they have not accessed before.

In addition to the components described, analysed above, the internet is an important resource for the implementation.

### CONCLUDING REMARK ON LITERATURE REVIEW

Having considered the related work done by other authors, Botho University's preparedness for e-commerce shall be ascertained by evaluating its technological resources using the guidelines mentioned by Wokosin (n.d.). The measures and tools that have been defined by different authors will be integrated and used in evaluating Botho University's e-commerce readiness. This approach suggests a design of the Internet Architecture and security and evaluates the system costs and return on investment (ROI). This evaluation will be the basis of stating whether the organization is now prepared to implement an e-commerce system, if not then the gap will be identified.

The availability of these resources will mean that the university is at least able to implement an e-commerce system. Chan and Swatman (1999) suggested that the technological issues are the ones that are important at the early stage hence the decision to access readiness based on the availability of the technological components. However the extent of preparedness will remain an area for further study, where a model may be adopted to measure it. For the sake of this study, as long as the components are available, the University is prepared to implement the system.

### IMPORTANCE OF THE STUDY

The purpose of this study is to assess how ready Botho University is to implement an e-commerce system that will reach out to the students and prospective students the world over. The results of this study may be used to make a decision on whether to implement an e-commerce system or not given that it is Botho University's goal to extend its operations to other countries in Africa (for a start) and beyond.

### STATEMENT OF THE PROBLEM

In the ever changing IT environment, most universities around the world have been able to implement e-commerce systems. Their students use these systems to even take up assessments from wherever they are. Botho University has some of the resources required to implement an e-commerce system although they have not been evaluated to measure whether they are enough or not for the implementation of an e-commerce system. The e-commerce initiative will help improve customer service because students may be able to access their course information from anywhere anytime as long as there is internet connectivity. This study is aimed at helping Botho University to implement an e-commerce system whose objectives may include the following:

1. To reach students from anywhere even outside Botswana, one of the strategic goals for the next 5 years.
2. To provide easy access to business information that the targeted students would need without physically visiting the institution. For example information about enrolment, the courses offered, the fees and learning materials may also be accessed through this e-commerce system thereby improving some business processes.
3. To enable students to access their course material from anywhere, anytime thus improving customer service which has been limited to the office hours.
4. To provide a way of paying fees online and reduce the paper handling costs
5. To match the standards of other universities in the region and in the world and gain competitive advantage over competing universities in Botswana for a start.
6. To maintain and keep updated information at all times.

The need to implement an e-commerce system that will achieve the objectives stated above is the major motivation for this study. There is need for measuring the University's preparedness to implementing an e-commerce system. This study will focus on evaluating the resources available at Botho University and measuring how far they are from meeting the requirements for implementing an e-commerce system.

### OBJECTIVES

The main objectives of this study are:

1. To evaluate whether the infrastructure, hardware, software and people resources currently available are enough to successfully implement an e-commerce system
2. To identify the technological requirements for a successful implementation
3. To map the architecture that may be used for the proposed system.

### SCOPE OF THE STUDY

In this study, technological factors are used in evaluating the University's e-readiness. Their availability will indicate the readiness. However the extent of their availability will not be covered in this study and is proposed for further work. The study is limited to the identification of the e-readiness factors and uses them to evaluate the readiness. If factors are in place, then University is e-ready. The extent of preparedness is not part of this study.

### RESEARCH METHODOLOGY

Data Collection is an important aspect of any type of research study. This section of the paper seeks to explain how information used in this research was gathered, what was gathered as well as the different sources of the information. Various data gathering techniques including documents review, observations, interviews and questionnaires were used to understand Botho University's preparedness. Rosenzweig and Roth (2007) stated that literature review helps in understanding the concept and provides theoretical ground for research. Literature review was used to identify the critical components for the implementation of e-commerce.

#### INTERVIEWS

Face-to-face interviews were conducted with the various heads of departments who had a role in the e-commerce system implementation. These key people include: IT team, Human resources administrator, Student services manager, marketing representative and the centre's education manager were the people interviewed. An interview guide for each department with unique set of questions was created.

#### OBSERVATIONS

Another data gathering method adopted was observations, which was aimed at checking the actual performance of the resources at peak hours. Employees were observed as they accessed the internet to do their different tasks with the aim of establishing its speed. A visit to the computer server room helped see the technological components available as well as their utilization levels to evaluate whether they could be expanded to accommodate the e-commerce.

#### QUESTIONNAIRES

A questionnaire was given to members of the technical team at one centre to complete. The set of questions included ticking whether a stated component was available in the organization, if available, they were expected to indicate how reliable it is and whether they thought it would be able to sustain extended usage in its current state.

### RESULTS & DISCUSSION

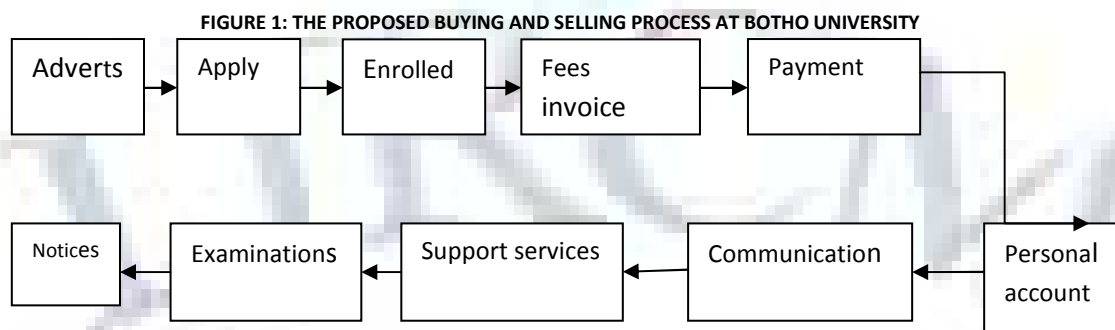
From the interviews, it was established that there was a database server located at the main campus which is accessible over a network from other centres. These high capacity servers, keep updated information because the setup is such that updates are synchronized at the time of committing a transaction with the

delay being the network speed. This means that the server keeps up to date information and is kind of real-time in terms of its access. Botho University in terms of the database component of an e-commerce system has the resource which when properly integrated and configured would be a valuable part of the system

- The questionnaire collected evidence that the centre need expansion and proper configuration to successfully implement an e-commerce system. There are adequate resources in all centres which need to be properly configured for optimal performance.
- Botho University has made a huge investment on the internet which is available to all employees and students through the cable and wireless connections. There are no restrictions in terms of duration of access for all within the organization although the speed tends to be slow at the satellite centres. There is need to improve the speed for a successful implementation of an ecommerce system because the Internet is the medium of communication for most ecommerce systems
- It was established that the information about all the business processes is centralized at the main campus with centres accessing it over the Internet. Although this has brought about flexible access, the Senior Technician explained that problems are experienced when there are connectivity issues. He however mentioned that it is good because all the information kept is at its updated state every time that it is accessed.
- Although skills are important in the success of an e-commerce system, it was found out that currently, there are very few employees with the prerequisite skills. Training the current staff will be appropriate to avoid extra costs of contracting support for the e-commerce system.
- Botho University in terms of the database component of an e-commerce system has the resource which when properly integrated and configured would be a valuable part of the system. There are various applications for different purposes that are already working at Botho University. An ERP system has been rolled out for some of the business processes thereby addressing the issue of redundant data that was caused by the various subsystems storing almost the same data.
- Website (a requirement of the interface for an e-commerce system) and is already available at the Botho University. All the employees and students already have access to this site from anywhere and anytime because it is available over the internet. A list of the courses offered is available on the site although there is no feature to apply online, an issue that the e-commerce initiative may address. The website displays some special effects and roll over pictures which may be a good thing to attract customers. Java script has been used to implement these effects. However, the website needs to be further evaluated to establish whether it has appropriate components for use as an interface to the e-commerce system.
- To address security issues, there is some kind of Virtual Private Network that has been created to ensure that only those devices with the certificate may access the systems.. This does not impact on the security alone but also on the accessibility of the centralized database. It has seen an improvement in the communication speed. Security must be configured to secure the payments that may be made electronically. It is important to mention that, there are some security flaws that may be further exposed by the e-commerce system, where many users may try to access the website using different browsers and web server applications. There is therefore need to configure the Secure Socket Layer protocol to secure communications over the Internet as suggested by Wokosin (n.d.). On this component, further developments are required for a secure e-commerce system.
- To complete the buying and selling process, customers should be able to make payments without a physical visit to the campus hence the need to explore the implementation of e-payment. Currently, students may pay their fees to a cashier at any of the campuses, manual payment system. If Botho University is to implement an e-commerce system, then security must be configured to secure the payments that may be made electronically.
- Botho University has introduced a number of new courses, expanding the number of online products that the institution may offer to prospective students. The e-commerce system will be useful in reaching the geographically spaced customers.
- The new ERP system has a Customer Relationship Management (CRM) function that may be used to support before and after sales services. However this function has not been fully rolled out with user training being a main focus area.
- Java servlets and cookies are available and configured at Botho University because the data that is sent through the various internal systems is maintained in correct formats. However, with the implementation of e-commerce, more electronic forms will be designed and the servlets must be able to cater for the increase.
- From evaluating the organisation’s technological resources against the recommended components of an e-commerce system, Botho University needs to make investments in a few issues in order to be completely ready for an implementation. Resources are available but need to be correctly configured and integrated, of course with modifications especially on the payment processing and security. Technology readiness indicators used to measure Botho University’s readiness indicate that the university is to a greater extent ready to implement an e-commerce system with a few modifications in the specified areas.

**FINDINGS**

The system according to the centre head would consist of a website where adverts would be placed for different courses offered at the university, allow prospective students to apply and once approved, a fees invoice will be printed and they can pay their fees even through the e-payment methods. When fees are cleared, the students would be given personal accounts to access their course materials, communicate with their tutors and fellow students and also access different support services like the exam centre over the internet. The Figure 1 below summarises what the education manager described and can be adopted as the buying and selling process.



The table below summarises the status of Botho University in terms of the technological factors stated by Wokosin (n.d.) and Zakaria and Janom (2011). They identified factors that could be used to assess whether an organisation is ready or not to implement an e-commerce system to support the business processes defined in Figure 1, above.

TABLE 1: READINESS SCORES

Technology availability and accessibility concerning	Botho University Status
1. Reliable internet connectivity and speed	Internet available always .Speed needs to be improved at the satellite centres where it is slow sometimes
2. Online internal information system	An ERP system has been rolled out although some of the functions are still under customization.
3. IT technical support (in house or external)	Technical staff available in house qualified but need training in the area to become experts.
4. Appropriate security systems to protect information and online transactions	Available security not enough, need to enhance it.
5. Internal ICT standard that comply with industry quality standards	An IT policy available as organization is ISO 9001 certified.
6. B2B that equip with main e-commerce capability and contents (e-payment, online communities etc )	E-payments not available, to explore this area.
7. B2B systems which are flexible to changes (e.g. growth of customer's data)	Database servers are high capacity may contend with increased amounts of data.
8. B2B system that emphasise on e-service quality (response time, reliability, easy to access and use, market variability, quality information on products etc)	Area to be further investigated because it is still not fully implemented.
9. E-customer relation management to support before and after sales services	The recently rolled out ERP system includes a CRM function though it is not yet fully functional. The communication channel is mainly through the telephone and emails currently.
10. B2B system which can be monitored by trading partners	Organisational policy emphasizes on confidentiality. May be considered to implement e-commerce system successfully.
11. Large quality selection of online products	The institution is growing given the recently awarded University status. High chances of new courses being offered even through distance learning.
12. Database	Currently, there are various systems that are used for the different business processes and each set of information is stored on a separate partition on the same server running in parallel with the recently acquired ERP system.
13. Interface	There are various applications for different purposes that are already working at Botho University; the links to these applications may be provided on a website. All the employees and students already have access to this site from anywhere and anytime because it is available over the internet.
14. Encryption and security	The information gathered shows that the basic security of authentication using passwords is in place as well as the use of digital certificates, particularly personal certificates. To access the website, employees have a username and password that they use and personal certificates have been generated for each computer be it portable or desktop to allow the access to the systems described earlier on. There is some kind of Virtual Private Network that has been created to ensure that only those devices with the certificate may access the systems.
15. Payment Processing	Currently all fees payments are made manually by students to the accounts department. These are not in place at Botho but have to be considered for the successful implementation of the e-commerce system.
16. Java servlets and cookies	Botho University has this component because the data that is sent through the various internal systems is maintained in correct formats. However, with the implementation of e-commerce, more electronic forms will be designed and the servlets must be able to cater for the increase.

Source: Adapted from Zakaria and Janom: 2011

### RECOMMENDATIONS/SUGGESTIONS

From the study, we recommend that the development of an e-commerce system, even through incorporating the resources that are currently available in the institution with modifications though.

- Database to be properly configured to improve the access speeds or alternatively set up servers at the centres that will be frequently synchronised with the server at the main campus.
- Website is already there but more hyperlinks must be added for the different programs and include links for registration. A further evaluation of the website may be done to establish its suitability as an interface to the e-commerce system.
- Internet is available although access must be secured given that users will be accessing the network from different platforms and technologies. A consideration on improving the access speed will be a valuable move for the success of the e-commerce system.
- The details of all the courses offered must be included on the website with brief descriptions and fees details.
- Payment methods to be explored in consideration of the Bank of Botswana regulations.
- Employees in the technical and Customer relations departments to undergo training that will help them become experts in the area of e-commerce so that they may support the e-commerce system effectively.

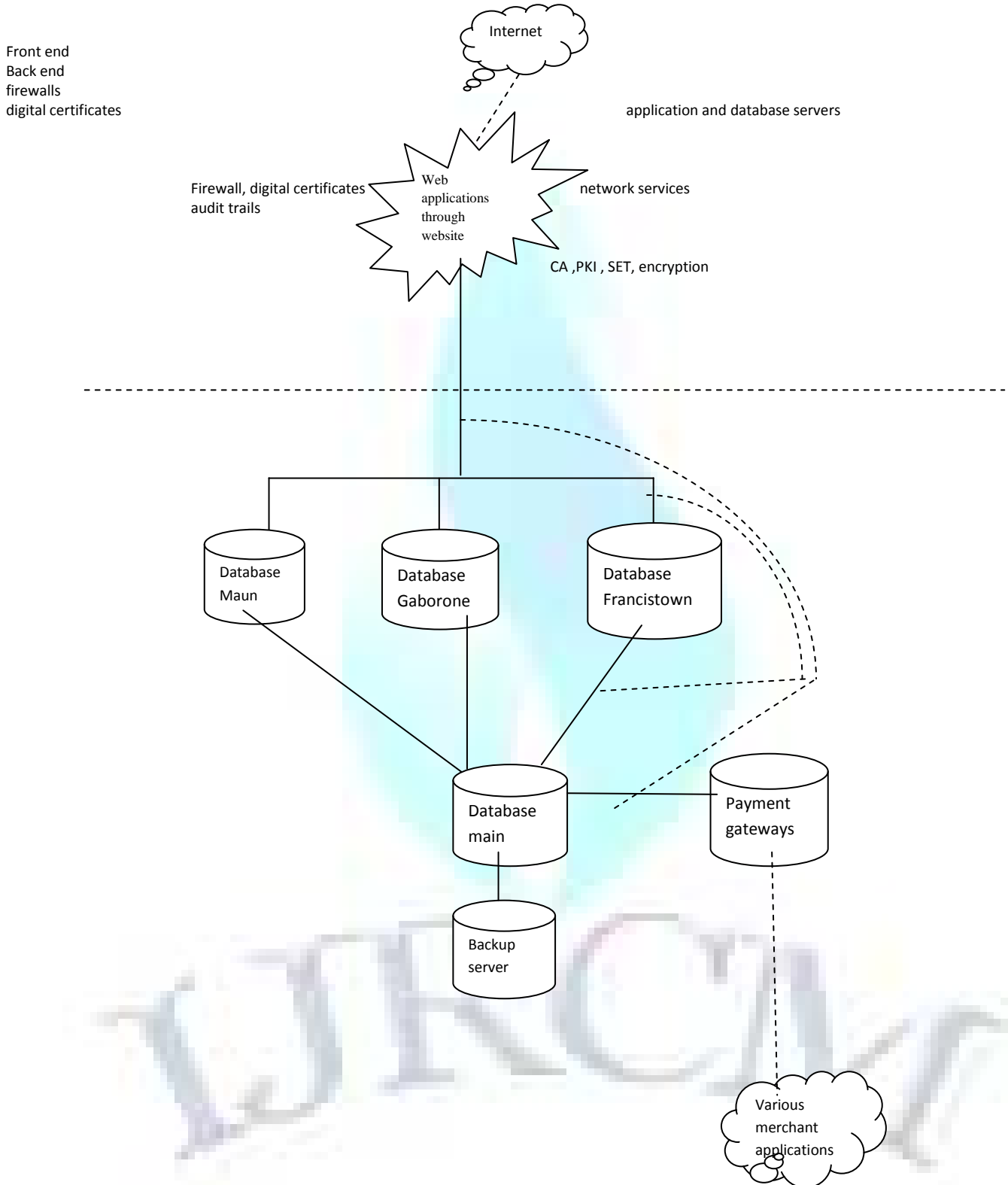
The proposed solution may be centred upon the architecture and security diagram below.

**ARCHITECTURE AND SECURITY DIAGRAM FOR THE PROPOSED E-COMMERCE SYSTEM**

Two-tier architecture, made up of the front- end (presentation logic) and the application servers (business logic) may be implemented at Botho University with the security configurations stated at each tier. The diagram below shows the proposed architecture and security.

Firewall, VPN

**FIGURE 2: CONTENT MANAGEMENT AUTHENTICATION, KERBEROS**



**CONCLUSIONS**

E-commerce an in thing and most businesses are adopting it to incorporate all their business processes. However to benefit from the initiative, the components must be well configured and maintained. Increased marketing opportunities have proved to be the major benefits of implementing e-commerce systems. With the new e-commerce system, Botho University is likely to have more students and introduce new courses and programmes in order to match their competitors. It is important to note that the current infrastructure has already placed Botho ahead of its competitors in the country. However, Botho University needs to make investments in a few issues in order to be completely ready for an implementation. Resources are available but need to be correctly configured and integrated, of course with modifications especially on the payment processing and security. Technology readiness indicators were identified and used to measure Botho University's readiness used the indicators to measure Botho University's readiness with a few modifications.

**SCOPE FOR FURTHER RESEARCH**

In this study, the technological factors that are required for the implementation of an e-commerce system were analysed and measured. Further work may be undertaken to measure how Botho University scores against other factors which are not technological features, such as the resources as well as the ICT Readiness Assessment Model. Although the website is available, its suitability for use as an interface to an e-commerce system is still to be established by considering the components of an e-commerce website.

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