Appropriate IT Infrastructure and Services for Higher Education *in Rural Area in Myanmar*

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Abstract— Higher education plays a fundamental part in encouraging the capacity for innovation and creativity in the development of a country. In rural area, there are lack of basic infrastructures, especially, electricity, teaching aids, knowledges, skillful technical experts and human resources. There are also many requirements to establish the campus network infrastructure. In this paper, the appropriate IT infrastructure and services for higher education in rural area in Myanmar are proposed to fulfill these requirements in an effective manner. With the proposed infrastructure design, how much effectiveness and its advantages are also described in conclusion.

Keywords— Higher Education, IT Infrastructure, IT Services, Rural Area, Cloud Computing, VPN

I. INTRODUCTION

In higher education, Information Technology (IT) is an essential and important facility in teaching and learning to catch up the rapid technological changes in every field. In the other hand, it provides many supports and be so helpful in the development of a country in term of every field and sector such as defense, health, education, agriculture, science and arts etc. In rural areas in developing countries, there is a big issue in the limitation of budget to establish a campus network infrastructure and lack of human skills to maintain it. Today, cloud computing is very useful and popular technology. The services from cloud computing can be accessible from anywhere and anytime. In a university located in the developed area, it is only needed to establish a campus infrastructure with high-specification resources such as servers, network devices and large storage capacity. Using that infrastructure, some useful services can easily be provided for the universities located in rural areas. Examples of useful services for all universities are e-learning, filesharing, e-library and so on. If there is enough infrastructure resources to share the connected universities from the service provided university, it is better to provide infrastructure as a service such as virtual machines to universities located in rural areas.

Another issue in rural areas is electricity problem. In some places, electricity is only available one or two hours per day. In such case, it is useless even if there is its own campus network infrastructure. Rural areas have low population density and fewer infrastructures. [1] Comparing the cost and benefits establishing its own, it may not be effective resource utilization on that infrastructure.

Nowadays, our society refers to as 'Information society'. It is evident that global changes are forcing a change in the traditional role of teaching and are redefining the part played by universities or higher education. The most important changes in higher education should be performed as follows:

- Information and communication technologies must be fully integrated into university teaching methods.
- The teaching methodologies must encourage students to learn to work, do research, invent, create and not limit them to continue memorizing theories and facts. In the other words, complementing knowledge is based on the acquisition of information with selflearning.

In order to do that, universities must prepare and support the teaching and learning environments for self-training, self-education and self-assessment. Within the limited budget in developing countries, universities can implement such kinds of environments using cloud computing technology in the cost effective way. By this way, students must learn not only to memorize but also to use all means of information available to them, whether this is through libraries, national and international databases, the radio, the cinema, television or Internet.

The vision of education means profound changes in the work of teachers and their initial and continued training. It is vital to strengthen research and teaching sills, to develop interdisciplinary mechanisms, to make academic structures more flexible and to introduce lifelong learning as a leitmotiv among teachers, members of the academic community, and students. In the other hand, ministry and government support not only the proper teaching aids but also the strong coordination and cooperation among universities in urban and rural areas.

In this paper, an effective IT infrastructure design and IT services for higher education development in rural areas in Myanmar is proposed. In section II, the related works are discussed. In section III, some issues and challenges in rural areas are pointed out. The appropriated IT infrastructure and services for higher education in rural areas in Myanmar are proposed in section IV. In section V, the expected result described with the effectiveness in higher education and deployment plan. Section VI concludes this paper.

II. RELATED WORKS

The authors in [2] mentioned that higher education institutions today face financial challenges that threaten to diminish their potential for long-term success and continued organizational growth. However, feeling the pressure of strained finances should never distract higher education institutions from their core purposes, aspirations and customers' needs. They proposed a shared services model for higher educational institutions to meet their missions and, ultimately, new efficiencies. Shared services are a way of organizing service optimize cost-effectiveness, delivery to flexibility and reliability services. In Reference [3], Budget constraints coupled with efficiency demands have caused many higher education administrators to consider new modes of operations. Many have tried to adapt management tools used successfully in the corporate world to their own organizations. Shared services are one such tool documented to increase efficiencies and reduce costs in the business world that is now gaining traction in higher education. They also realize new efficiencies in the sharing of administrative services and IT is being coordinated to effectively manage to eliminate unnecessary redundancies in the operations.

III.SOME ISSUES AND CHALLENGES IN RURAL AREA

There are some issues and challenges in rural areas as follows:

A. Electricity

It is one of the basic and important issues. In most areas, electricity distribution is timely manner. It can be available one or two hours per day.

B. Lack of IT Specialist and skillful human capacity

It is also an important fact to rural development required properly trained IT professional and skillful teaching staffs with a global view of the problems affecting rural areas. With the help of online teaching and learning, it can be solved. Another important fact is to reform in teaching methods. These reforms concern the teaching materials and the harmonization of the new program with the main national and international developments and tendencies.

Technological tools free the university from limitations of time and space. The traditional class consists of placing a group of students and a teacher in the same place at the same time. Today it is possible to organize class activities in different places and at different times.

The role of the teacher is no longer the same, and society's expectations in this respect are increasingly numerous and complex. The teacher is the main agent of the transformation of the educational system; he or she must train the citizens of tomorrow and make them acquire scientific and IT knowledge.

C. Lack of the teaching aids and basic network infrastructure

It is some weakness in quality control for undergraduate program because there is lack of the teaching aids, laboratory equipments and facilities. As a consequence, there are lack of knowledge; how to learn, how to make selfimprovement and creative thinking.

IV. APPROPRIATE IT INFRASTRUCTURE AND SERVICES

The proposed IT infrastructure for higher education in rural area is depicted in Figure 1. In the proposed IT infrastructure design, there are two solutions to solve the budgetary constraint for establishing campus network and electricity outage in rural area.

First, using virtual private network (VPN) technology, the universities located in rural areas will connect to the university located in urban area which will provide IT services. In that case, the ministry and government do not need to support many equipments to each university for campus network infrastructure. They only support the high specification equipments to the service provided university and a few network equipments such as VPN routers to Universities in rural area. In other words, in the universities which are located in rural area, there is only needed a few equipments or devices in their campus backbone to connect or subscribe the provided services from the universities in urban. The university campus network design in rural area is depicted in Figure 2.

In the services provided university side, they need to prepare off-line e-learning courses by teaching experts. In some universities which are the members of Asean Cyber Unversities (ACU) project, they have created e-learning courses. By using VPN connectivity, they can share their own created e-learning courses to the another universities. In the side of the universities in rural area, by accessing e-learning materials, IT services and infrastructures which are provided by these Universities, the requirement of technicians and the costs of physical equipments can be reduced.

By this way, the supported budget can be reduced to establish the required basic infrastructure in each university. In the other hand, handheld devices, tablets, laptops instead of personal computers should be supported to universities in rural areas because handheld devices can easily be rechargeable by solar energy system. Even the outage of electricity, such kinds of handheld devices can be effectively used in teaching and learning environments.

To be a successful implementation of the proposed IT infrastructure and services design, the better and easiest way is to forester the coordinating and cooperation all of Universities by ministry and government.

V. EXPECTED RESULT

In almost computer universities and IT related universities, the internect connection is available. So, VPN connectivity among IT related universities can be easily implemented. In the case of computer universities, it is divided into five zone based on their location. One of university in each zone is at least located in the developed region or near urban area. For example, in Zone V, in shan state, there are 5 computer universities. Among them, University of Computer Studies (Taunggyi) – UCS(TGI) is in urban region. Instead of setting up IT infrastructure and services in each university, a high specification infrastructure like a small data center will be set up in UCS(TGI). The rest four universities will access IT services from UCS(TGI) by VPN. If so, the budget for setting up IT infrastructure may be saved 4/5 times of the initial budget. In the other hand, the technical experts requirement in each university can be solved. The sample connectivity design among universities in Zone V is shown in Figure 3.

A. Effectiveness

There is an efficient resource-utilization because of shared campus infrastructure resources among Universities which are located in urban and rural areas. As a result, it may help to reduce the budget and the costs of administrative operations in developing countries while improving the quality of services provided. Moreover, it can also reduce the digital divide in rural areas. The students have a chance and get an experience to learn the latest infrastructure technology.

B. Deployment Plan

In Myanmar, there are about 163 higher education universities which are also located in the same cities where the Computer Universities exist. As a first step, it focuses on Computer Universities to implement the VPN connectivity according to Zone. Based on the cloud network infrastructure by Computer Universities, all other universities in science and arts, medical, engineering, agricultural, forestry and so on can be easily connected via Computer Universities's VPN. By this way, IT services can be applied and extended to all universities in the whole nation. In the other words, it will be helpful to foster the telecommunication framework for ICT higher education institutes by supporting to establish the broadband network deployment of cloud based virtual learning and IT services in Myanmar.



Other Universities located in rural area

Figure 1 -Proposed IT infrastructure and services for Higher Education in Rural area in Myanmar



Figure 2 - University Campus Network Design in Rural Area



Figure 3 - Sample Connectivity Design among Universities in Zone V

VI. CONCLUSION

The proposed IT infrastructure design aims to narrow the digital divide in the information and communication technology (ICT) development in every region and promote the enhancement and expansion of advanced ICT education in collaboration among all universities for the sustainable social and economic development of Myanmar. Moreover, the ICT research experiences and knowledge can be easily shared between universities in urban and rural areas in terms of cost effectiveness and efficient resource utilization. It is also helpful to easily perform research collaboration among universities because of VPN connectivity. Finally, the universities in rural area can achieve the learning and teaching facilities in the same as urban area without establishing the actual equipment and required infrastructure using the proposed design.

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