IT Strategic Planning and Process Framework for Ethiopian Higher Educational Institution

Mary Charlemaine A. ABAS
University of San Agustin

Patrick D. CERNA
Federal Technological University

Abstract: Ethiopian Higher Educational Institution (EHEI) established an ICT Directorate office for each public universities, colleges and institute, with the same supervisory level as Dean of Colleges, Faculty and Institute to implement and integrates ICT in all aspects of educational system from teaching, learning and research. It has been established a university wide ICT Infrastructure and built capacity to serve the University core processes and outreach the external community with required ICT consultancy services and other research/development requirements. However, to date based on the existing literature and in the case of TVETI, there has been no common and uniform IT manual of policies for each above-mentioned department in ICT Directorate and up to today it has not been assimilated in Senate Legislation of each EHEI. This research study focus on effective IT strategy for the ICT Directorate aligned to the strategic targets and management of Ethiopian Higher Educational Institution (EHEI). The propose IT strategic plan will be included to the existing EHEI goals, objectives and action plan that will be given priority not only as a supporting services but important role in educational decision making and planning. The study aims at designing a IT strategic plan based on the framework as proposed by Alex Cullen and Marc Cecere. SWOT, Critical Success Factors (CSF) and IT Balanced Scorecard will be adopted to analyze the needs of IT in EHEI. This IT master plan will serve as a road map and ICT strategic development plan that will serves as guiding model strategic plan for the adoption, implementation, monitoring, and evaluation of ICT services under ICT Directorate office of EHEI particular TVETI.

Keywords: IT strategic planning, Process framework, CSF, Balance scorecard

Introduction

The role of IT, based on technological advances of the mid-twentieth century, migrated from a technology provider to a strategic partner, adopting administrative models of information structure, which necessarily lead to the modification of the form of action of its professionals, incorporating new knowledge of their processes, in order to promote the generation and dissemination of knowledge between teams [1]. Furthermore, IT contributes to adding value through two specific ways: greater assertiveness in the decision-making process due to increased information quality; and agility in their production, optimizing business processes, contributing to its efficiency [2]. Its impact on education transform not only integrates emerging tools that we have today like eLearning, Machine Learning, Big Data and Internet of Things (IoT) but even integrates IT Usage, Migration and Policies in University Legislation. Educational systems around the world are under increasing pressure to use the new Information and Communication Technologies (ICTs) [3].

According to Moges [4], the adoption and use of ICTs in Ethiopian education have a positive impact on teaching, learning and research. ICT can affect the delivery of education and enable wider access to the same. In addition, it will increase flexibility so that students can access the education regardless of time and geographical barriers. It can influence the way students are taught and how they learn. It would provide the rich environment and motivation for teaching-learning process which seems to have a profound impact on the process of learning in education by offering new possibilities for students and teachers. He then recommends the government of Ethiopia should pass a bill at the national assembly on the use of sophisticated ICT facilities in the educational

system by provision of adequate fund, securing of ICT experts in institutions and schools and ensuring that these facilities are monitored from time to time [4].

Addis Ababa Technical and Vocational Education and Training Institute (TVETI) is an Ethiopian Higher Learning Institution (EHEI) that were established in 2011 by The Council of Ministers Proclamation 245/2011 to produce highly professional and technically efficient TVET teachers and leaders. The driving force for establishing TVETI, among other things , was that there were no institution to train competent and sufficient technical and vocational teachers and leaders based on the outcome based system and occupational standards. At the time of its inception, the institute ran degree programs in 5 occupational sectors namely: automotive, construction, electronics/electrical, information and communication technology and manufacturing technology, and two years later railways and surveying technology departments were opened. Those programs embraced ten specializations, namely, Automotive, Building, Road, Water, ICT, Electrical and Control, Electronics and communications, Manufacturing, Rolling Stock and Surveying. Its mission aims at producing competent, innovative and resourceful Technical and Vocational Education and Training teachers and leaders through the provisions of quality short and long term training, demand based research, technology and consultancy services in support of micro and small scale enterprises.

Ethiopian Higher Educational Institution (EHEI) established an ICT Directorate office for each public universities, colleges and institute, with the same supervisory level as Dean of Colleges, Faculty and Institute to implement and integrates ICT in all aspects of educational system from teaching, learning and research. It has been established a university wide ICT Infrastructure and built capacity to serve the University core processes and outreach the external community with required ICT consultancy services and other research/development requirements. Like most other EHEI, Addis Ababa TVETI ICT Directorate composed of five-sub department namely Network Infrastructure and Services, Teaching -Learning Technology, Business Application Administration & Development, Maintenance & Support Service, Training and Consultancy. It was established in the year 2016 and restructured in July 2018, following the Business process reengineering (BPR) and new structure from Ministry of Education applied to support the core mandates of the Ethiopian Higher Educational Institution. TVETI has recognized the role of ICT as an enabler for the attainment of its goals and strategic objectives directly reporting and accountable to the Director General of the institute. Its mission is to effectively conceive, develop, implement, utilize, and manage appropriate information systems in order to provide integrated, coordinated and customer focused quality ICT services to TVETI in line with its vision, mission and objectives.

Problem Background

EHEI embrace Business Process Re-Engineering (BPR), and many studies have been done focusing on reengineering and implementing BPR in EHEI's. According to Ranganathan & Dhaliwal [5], BPR is a popular management tool for dealing with rapid technological and business changes. Business process reengineering (BPR) is a dramatic change that represents the overhaul of organizational structures, management systems, employee responsibilities and empowerment, performance measurements, incentive systems, skills development, and the use of information technology. A strategy is a plan, a direction, for organizations to develop and achieve their future goals. It is seen as a way to take and defend a unique position in the market, which generates competitive advantage for the organization [6]. Integrating the concept of strategy in IT, it can be defines as a set of decisions taken by the IT management that allow the realization of business strategy. It involves more than technology and infrastructure, the technological options to support the business strategy [7].

In a baseline survey conducted by the MOE [8], it shown that most universities and institutions of higher education in Ethiopia have computers. However, these computers are few and, therefore, shared at a student-computer ratio of 10:1 in most cases. The study also showed that despite the presence of computers, most of the universities lack a network infrastructure and have limited connectivity. The instructors are yet to adopt ICT as a teaching-learning tool, and only a small number of students use computers and the Internet as a learning resource. Moreover, instructors in Adama Science and Technology University seem not to have been exposed to integrate ICT into teaching-learning process. The Ministry of Capacity Building donated ICTs in universities that were mainly used for administrative purposes, thus many instructors may not have realized that computer technology is very useful for instructional purposes in education [9].

While some EHEI currently have developed IT plans or are in the processes, there is little systematic study of the merit of IT strategic planning. Moreover, there has been little emphasis on IT Strategic Planning nor Manual of Policies that guides the implementation, transformation and monitoring of ICT services adopted by EHEI. It

is therefore proposed that several institutions that have developed and implemented IT strategic plans, including most of the standard planning components, be intensively studied to document the outcomes that have resulted from these efforts on a number of criteria. In a similar manner, the status of IT operations should be examined to determine outcomes that have been achieved using the same criteria.

Problem

In EHEI, some instructors have never had an opportunity to use computers for educational purposes nor have received any training in this regard. Although some instructors have recently been exposed to ICT through furthering their studies at higher learning institutions, it appears that the vast majority of instructors are unable to successfully integrate ICT into pedagogy/teaching-learning process [9]. Further, ICT is available in many universities, but there is limited evidence that it has been integrated into the pedagogy/teaching-learning process [10]. According to Parker, Bianchi and Cheah [11], integration is defined as "the process of totally integrating the use of ICT resources such as internet, e-mail, word processing, database, digital scanners, educational software package and the printer into the existing teaching-learning process through learning activities that address the course-area objectives". It appears that the primary reason for the lack of integration is that instructors' knowledge, skills and attitudes in Information Communication Technology (ICT) are inadequate, not only in terms of generic ICT competence, but specifically in integrating it into the pedagogy/teaching-learning process [12].

To date based on the existing literature and in the case of TVETI, there has been no common and uniform IT manual of policies for each above-mentioned department in ICT Directorate and up to today it has not been assimilated in Senate Legislation of each EHEI. This research was to propose an effective IT strategy for the ICT Directorate aligned to the strategic targets and management of Ethiopian Higher Educational Institution (EHEI). The propose IT strategic plan will be included to the existing EHEI goals, objectives and action plan that will be given priority not only as a supporting services but important role in educational decision making and planning. The absence of IT Strategic Plan will cause the use of IT resources on the management of academic activities and support of other management processes will not run perfectly and organized. The main objective in this research are to analyzed critical factors that can be used to develop IT strategic planning in EHEI to produce an IT blueprint that be a guiding model and recommend strategic action for ICT Directorate.

Proposed Solutions

This study aims to design IT strategic plan based on the framework as proposed by Alex Cullen and Marc Cecere [13]. SWOT, Critical Success Factors (CSF) and IT Balanced Scorecard will be adopted to analyze the needs of IT in EHEI. The results of this study are recommended strategic steps to optimize the implementation of IT in TVETI and EHEI in general to improve the performance from ICT Directorate to obtain the benefits by implementing IT in education system in Ethiopia and to form IT Blueprint, which is part of the development plan of TVETI.

IT strategic planning should include six components: (A) Application systems: describes the company business functions; (B) Application development: discussing plans for new systems implementation, and how they should be acquired; (c) Infrastructure: provides information about physical IT assets in the company; (D) Maintenance: provides support and maintenance strategy for application components, and infrastructure; (E) Operations: includes personnel, quality control, user training and support, data center and disaster recovery; (F) Security: involves internal and external security policies, accesses privileges, firewall, and spam procedure of emails and virus protection [14]. These merely coincide with the first five (5) important department/units of ICT Directorate in EHEI with the last function as information security and assurance which allocated to all units and its respective ICT services. The IT environment should empower students, faculty, and staff as they conduct teaching, learning, research, scholarly activities, and effective operation of the University. Adopting the ITSP Framework of Cullen and Cecere [13], a proposed ITSP for EHEI is formulated as deflected in Figure 1, and elaborated in Table 2.
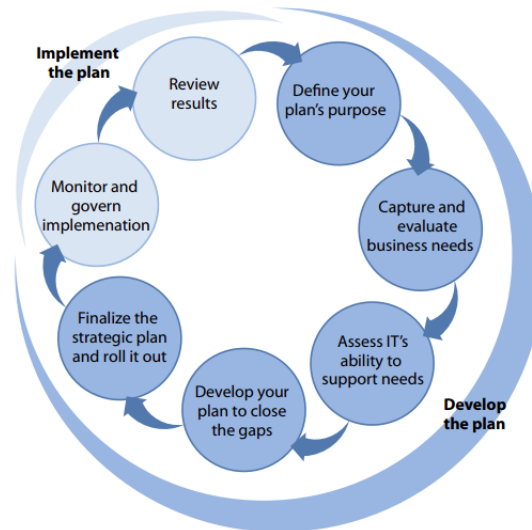
Figure 1: Phases of IT Strategic Planning [13]

This ITSP consists of five phases, with their distinct activities, followed by the ongoing activities of monitoring and governing and reviewing results following rollout [13].

Table 1. Activities of IT Strategic Planning [13]

No	Phases	Description
1	Defines your Plans Purpose	Identify the company (vision, mission, and its state), purpose, scope and stakeholder of strategic planning.
2	Capture and Evaluate Business Needs	Capture and evaluate business needs; in this step, identify the source of business needs, gather and information and analyze it using SWOT analysis
3	Assess IT's ability to support needs	Assess IT's ability to support needs; in this step, do some assessment in IT Division (structure, process and state).
4	Develop your plan to close the Gaps	Develop your plan to close the gaps; in this step, develop strategic IT principles, mapping those strategies identify gap closing and describe IT for company in the future
5	Finalize the strategic plan and roll it out	Finalize the strategic plan and roll it out; in this step, finalize the strategic plan by explain it to Board of Director and approve it, make implementation plan and budgeting,

A. *Phase 1 – Defines your Plans Purpose*

The first phase is to define the plan's purpose by considering the TVETI mission and vision integrating within it the ICT Directorate own mission and vision. By emphasizing the development of this IT blueprint will guide, give optimal direction, and solve issues relating to utilizing and monitoring of ICT within the educational sector. As presented in Figure 2, it interrogates and aligned the IT Strategic Planning within both TVETI mission/vision and ICT Directorate mission/vision and its respective stakeholders like Director General, Deputy Director General for Academics, Deputy Director General for Administrator, Deputy Directory General for Research, Technology Transfer and Community Services, Director of ICT Directorate, ICT Units/Department Head and Team Leaders, and Finance/Procurement Director.
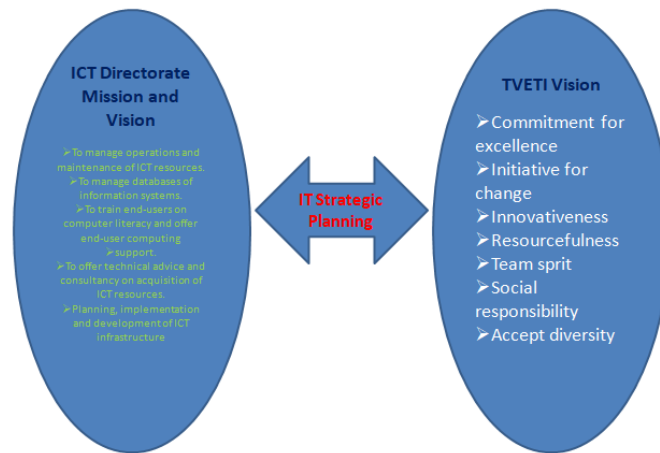
Figure 2. IT Strategic Plan must aligned ICT Directorate Mission to TVETI Vision

B. *Phase 2 – Capture and Evaluate Business Needs*

Towards the coordination of each units/departments of ICT directorate, a requirements gathering is employed to each of academic departments, faculty and colleges, administrative office like human resource, finance, student services, medical services, among others. In SWOT Analysis, examining the elements in its environment while environmental opportunities identifies strong and weak aspects of an organization and threats are determined by examining the elements outside its environment. In this sense SWOT Analysis is a strategic planning tool used to evaluate the strengths, weaknesses, opportunities and threats of an organization. It provides information that is helpful in matching the organization's resources and capabilities to the competitive environment in which it operates [15]. Figure 3 represents the SWOT Analysis of the current ICT Directorate in EHEI identifying its strengths, weakness, opportunity and threats. From SWOT analysis, TVETI current IT plan emphasize huge market opportunity but it need to consolidate, doing improvement, and eliminate the problems to gain competitive advantage and stay away from threats. The result of this analysis is used to determine the strategic system and information technology for TVETI.
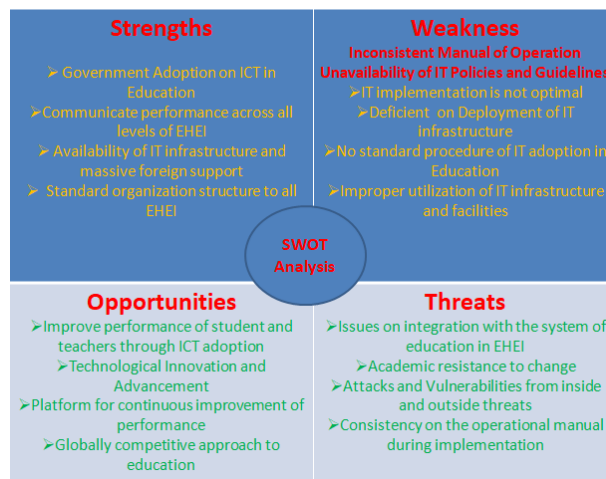

Figure 3: SWOT Analysis of IT Services for TVETI ICT Directorate

C. *Phase 3 – Assess IT's ability to support needs*

In this phase, the need to formulate and develop a IT Service and Maintenance level Documentation that will initiate, process, monitor and evaluate each services of ICT Directorate in TVETI. For the ICT Technical Support and Maintenance, a computer repair work/service order form is necessary to identify, record and monitor its services as shown in Figure 4. Starting from computer hardware and software installation, upgrades, reconfiguration, troubleshooting, back up and recovery of files, regular preventive and corrective maintenance, etc. should be documented with proper evaluation and monitoring. Moreover, an inventory of all IT equipment, tools and materials/consumables should be conducted religiously for each academic departments labs and offices, administrative offices, support technology office including network devices and network layout. An

information system for inventory purpose using open source technologies, out-of-the-shelf package or in-house development with barcode reader or RFID can be desirable.

Figure 4. A sample request form for technical support and computer maintenance

In the case of ICT Business Application Development units/department, a software documentation is ideal that encompasses all written documents and materials dealing with a software product's development and use. For the ICT Teaching-Learning technology adopted a open source technologies for each eLearning Managements, Digital Library and Repository, Thesis and Project Repository, Research Grant Submission and Management System in most EHEI including TVETI. Open source technologies like moodle, DSpace, Koha and Open Journal System were the chosen for this purpose. However, there was no monitoring and evaluation in the usefulness, effectiveness, critical issues and problems concern. A proper documentation on version upgrades, features upgrades and degrades, expansion, problems encountered and solution, and finally backup and recovery. All software development products, whether created by a small team or a large corporation, require some related documentation. Figure 5 shows the different documentation need in building a software application to ensure that developers and stakeholders are headed in the same direction to accomplish the objectives of the project. Several software tools can be used to make software documentation like Microsoft Project Management, Microsoft Visio, Paradigm UML, HP Unified Functional Testing, among others.
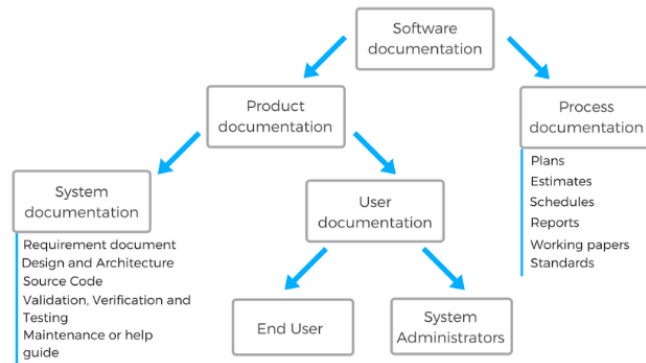

Figure 5.Software development documentation

In ICT Network Infrastructure and Data Center, large percentage of vendors provide either poor documentation on their products or material that appears to be useful, but then have no step by step process on how to install and configure their devices and/or software, which in turn, that documentation is so important to the daily

efficient running of your data center and storage environment. Among those necessary documentation that can help system/network administrator in monitoring and evaluation data center and network infrastructure performance are: (A) Rack elevation documentation, (B) Cable management for both network and power connections, (C) Power and energy management and (D) Automated data center documentation with auto-discovery and REST APIs. According to TechExact [16], possessing the right set of Data Center Documentation is as vital as the systems, active components and redundancies implanted in the data center. Developing Data Center Manuals at the operational level, service level, mechanical, cooling, power, security and structural level; indexing and archiving a full set of data center active and passive components, warranties, support procedures, references, codes and certifications are a glimpse of what needs to be properly developed and organized for any operational data center in an efficient and referenceable data center manual [16]. Hence, several software tools can assist the formulation of this software like Microsoft Vision, Cisco Packet Tracer, Device42, among others.

While ICT Training and Consultancy unit is task arrange training for campus users and staff about newly implemented and developed applications. However, there has been no documentation and monitoring of the training needs assessment, conducted training, and the evaluation of its outcome in TVETI. In Most EHEI, this ICT unit/department the evaluation of effectiveness and its impact to ICT usage and literacy has not been evaluated and documented. There a need to assess the impact of ICT training under this unit/department, using models like Critical Success Factors (CSF), Balance Scorecard and SWOT Analysis. Finally, part of the IT Strategic Planning is a detailed and critical plan for Information Security adoption and implementation. Among information security model in the existing literature, ISO/IEC 27001 is the best-known standard in the family providing requirements for an information security management system (ISMS) [17]. An Information Security Management System concentrates policies, procedures, guidelines, and resources for joint management, on the protection of information assets of organizations. In addition, ISMS consolidates a systematic approach for establishing, implementing, operating, monitoring, revising and improving information security, in line with strategic business goals [18].

According to ISO [17], ISO/IEC 27001 specifies the requirements for establishing, implementing, maintaining and continually improving an information security management system (ISMS). The ISMS presents a systematic approach to keep sensitive information secure. It manages people, processes and IT systems through applying risk management processes. It is implementation it composed six (6) important steps namely: (A) Define information security policy, (B) Define information security policy, (C) Perform a risk assessment, (D) Manage the identified risk, (E) Select controls to be implemented, and (F) Implement controls. BPR is the Process Reengineering Life Cycle (PRLC). It is a six-stage methodology akin to others in the industry for companies to follow during BPR projects. The six sequential stages include (A) Envision new processes, (B) Initiate change, (C) Process diagnosis, (D) Process redesign, (E) Reconstruction and (F) Process monitoring.
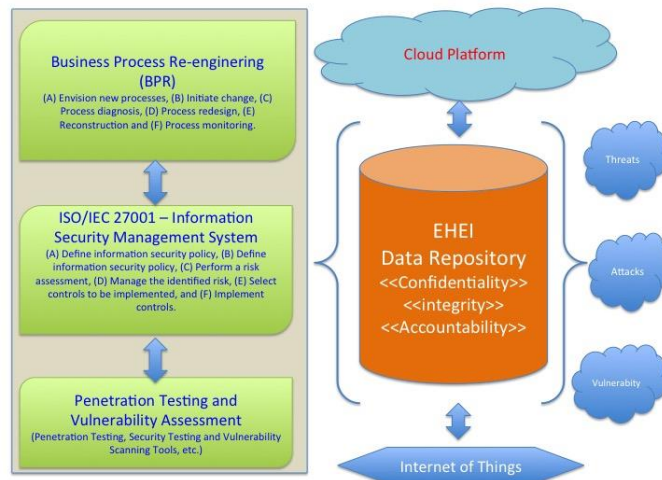

Figure 6. Information Security Model for EHEI

Figure 6 shows the IT Security Model for EHEI. It integrates the phases of BPR and stages of ISO/IEC 27001 aligned together to meet the universities mission and vision as described in Table 1. Vulnerability Assessment and Penetration Testing mechanism is incorporated into the model presenting the tools for practical security application. External application from the cloud and the Internet of things are also considered as it poses threats, attacks, and vulnerabilities not only in internally but also an external source. Confidentiality, integrity, and

availability are basic requirements for business information security and provide the maintenance requirements of the business thereby it is necessary to be considered in the development of the framework.

D. Phase 4 – Develop your plan's to close the gaps

In the fourth step, plan should be develop to close the gaps between the issues and problems encountered by all units/department of ICT Directorate based on there IT services, maintenance, monitoring and evaluation. There are several well known IT services evaluation tool from the existing literature that can be adopted like Balance Scorecard and CSF. The Balanced Scorecard, introduced by Kaplan and Norton in the early 1990s, is a framework for organizations to use to translate their missions and strategies into a comprehensive set of performance measures that enable them to assess how much of their strategies they have achieved and how they can move towards their goals [19]. These measures are normally known as key performance indicators. The conceptualization of the BSC was done with an underlying goal of linking business activities with the strategy, all directed towards achieving the ultimate end result, which is organizational performance [19]. CSFs can be defined as- "those things that must be done if a company is to be successful". CSFs must be few in quantity; quantifiable and manageable [20]. Determining the CSFs have great practical significance as the project manager or any other concerned authority can utilize these factors for the realization of their project. CSFs can be used by actual practitioners wanting to improve their projects success or by fellow researchers studying factors promoting success in IT/IS projects, thus, factors could have a more important effect in determining success of IT projects than that suggested by our work [20]. Based on the initial assessment and observation based on the checklist of Balance Scorecard and CSF, Table 2 presents the recommended approach on to leverage the problems, issues and concern encountered by the IT services of all the unit of ICT Directorate in TVETI.

Table 2. IT Services Strategy and Approaches

No	Units/Department	IT Strategy and Approaches
1	ICT Infrastructure and Data Center	The Data Center can be divided into (3) types of server infrastructure. The first server can act infrastructure server (e.g. main server, database application server, digital data bank server, proxy server, mail server, backup server, etc.). The second server for teaching-learning information system (e.g. eLearning, digital library, data repository, research grant system, etc.). The third server will server the business application system (e.g. Student Registration, Human Resource, Finance System, etc.). In addition, develop contingency plan and disaster recovery schema to anticipate disaster, overcome security system by using firewall and proxy server.
2	ICT Technical Support and Maintenance	Technical support and maintenance to solve IT/IS management must fulfill ISO 9001:2008 requirement we will make server, computer maintenance checklist and schedule, make backup data checklist and schedule, make user computer maintenance checklist and schedule, develop database application to store IT asset management data.
3	ICT Business Application Software and ICT Teaching-Learning Technology	Business application system development and customization of open source software for Teaching-Learning must adopt a database application to cover all business process, we will develop a web application with dynamic workflow to help top management in monitoring IT project development. A helpdesk web or desktop application to assess users on familiarity and solve issues regarding the IT usage and adoption. To solve data leakage, it is recommended store all shared data in new digital data bank server and restricted all user access. Data warehousing is also necessary to integrates databases from different application, merging and integrating to expand the relationship of its repositories and extract meaningful information for competitive advantage.
4	Information Security and Assurance Policy	Adopting the IT security framework using ISO/IEC 27001 will serve as a guiding model for all EHEI particularly public universities including TVETI on how to implement security of their information systems that support both academic and administrative purposes. Vulnerability Assessment and Penetration Testing is an important security mechanism tools every organization should in all IT infrastructure and services.

E. Phase 5 – Finalize the Strategic P2lan and Roll it Out

Finally, implementation plan and budgeting is made based on gap closing and then the data to higher official of EHEI, pertaining to Senate in TVETI will be presented and finalized in form of IT master plan. This master plan will serve as a road map and ICT strategic development plan that will span a period minimum of 5 to a maximum of 10 years. Through the integration of all the phases, components, activities, and approach of this ITSP for EHEI, a process framework as shown in Figure 7 is then formulated that will serves as guiding model strategic plan for the adoption, implementation, monitoring, and evaluation of ICT services under ICT Directorate office of EHEI particular TVETI.
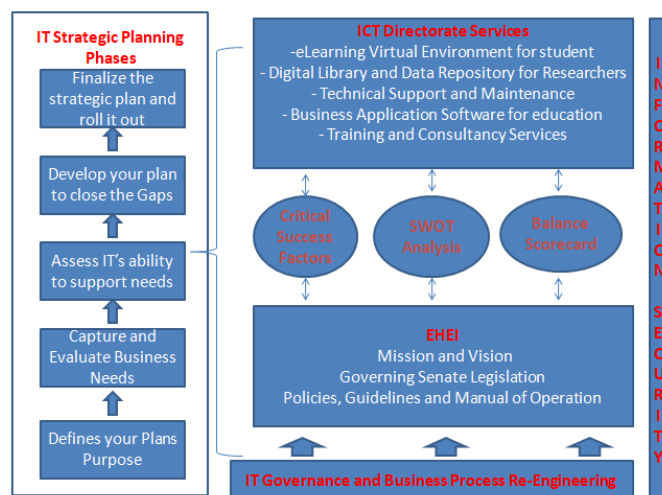

Figure 7. IT Strategic Planning and Process for EHEI

Acknowledgment

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Author Information

Mary Charlemaine A. Abas
Department of Electronics and Communication Engineering
University of San Agustin
Iloilo City, Philippines
Contact E-mail: mcaabas@ieee.org

Patrick D. Cerna
Department of Information and Communication Technology
Federal Technological University
Addis Ababa, Ethiopia