

THE EFFECTIVENESS OF IMPLEMENTING INFORMATION AND COMMUNICATION TECHNOLOGY ON STUDENT ACADEMIC SERVICES (A Case Study in Bandung Institute of Technology for the 2015-2016 Period)

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First draft received: 25 December 2016

Final proof received: 22 February 2017

Abstract

The implementation of Information and Communication Technology (ICT) in higher education institutions plays an important role in realizing the competitive advantage, especially in the realization of the three pillars of higher education. In order for the implementation of ICT in higher education institutions to be effective, adequate support from infrastructure, human resources, and leader and organizational commitment is needed. The research focuses on and aims to describe the effectiveness of ICT implementation in student academic services, covering ICT policies and programs, ICT implementation strategies, ICT implementation, and the effectiveness of ICT implementation in student academic services. In addition, it attempts to formulate a hypothetical model of ICT implementation in student academic services. The research adopted the analytical-descriptive method through qualitative approach. Data were collected through interviews, observations, and documentary analysis. Afterwards, the data were analyzed through data reduction, data display, inference drawing, and verification. The research took place in Bandung Institute of Technology. The findings show that: The ICT policies and programs are based on the implementation of the three pillars of higher education (education, research, and community service); the strategies give emphasis on coordination patterns; ICT implementation in academic services is realized through e-learning (online, blended learning, video conference), academic information system, and digital library; the effectiveness of the ICT implementation is analyzed based on the realization of the program at the level of unit (decision-focused approach), performance achievement (goal-oriented approach), and student satisfaction (user-oriented approach) in terms of tangibles, reliability, responsiveness, assurance, and empathy. It is recommended that ICT implementation in academic services should be able to realize the competitive advantage of the implementation of the three pillars of higher education, which is in accordance with the institution's vision, missions, and strategic goals, supported by the availability of infrastructure, human resources, funds, managerial and organizational commitment, and periodical evaluation and monitoring.

Keywords: effectiveness; ICT; academic services

To cite this paper (in APA style):

Supriadi, D. & Sa'ud, U. S. (2017). The effectiveness of implementing information and communication technology on student academic services (A case study in Bandung Institute of Technology for the 2015-2016 Period). *International Journal of Education*, 9(2), 139-148. doi: dx.doi.org/10.17509/ije.v9i2.5478

INTRODUCTION

ICT has been proven to create value advantages for a higher education institution to compete with other higher education institutions (Talebian, Mohammadi, Rezvanfar, 2014; Vajargah, Jahani, & Azadmanesh, 2010). In addition, the role of ICT in the administration of education is to improve service quality to the whole academic communities, ultimately students. Through ICT, various forms of services can be given easily, such as information, administrative affairs, instructional/academic services, and other types of services. This so is considering the fact that the demands of higher education nowadays is not only limited to creating high quality graduates in terms of the academic achievements. Higher education should also be able to prove its quality in the aspects of institutional accountability, transparency, and effectiveness.

The society and interested parties desire transparency from the management of higher education in terms of any information related to the

interest of the society, both the academic and administrative information. Academic information can take the forms of academic calendar, new student registration, student data, student academic activities, scholarships, study programs, and other relevant information. Meanwhile, institutional information is commonly related to university's identity, such as: vision and missions of the university, graduate profiles, related policies, organizational structure, and other relevant information.

The Law Number 12 of 2012 regarding Higher education, article 56, paragraph 4, states that "Higher education institutions are obliged to provide data and information of the administration of higher education and to ensure their truth and precision." Further analysis of the law makes it clear that the government desires the administrators of higher education to manage their institution by prioritizing correct and actual information for the society as a form of its responsibility for the organization of education. One

of the efforts of realizing this is by using ICT devices to support the educational activities.

Higher education is an institution whose one of the main functions is to provide educational services to the society to prepare quality and useful human resources in the future. In its process, higher education always requires sophisticated and up-to-date information sources. Developing ICT in higher education is naturally necessary. The primary activity in higher education, in accordance to its function as the administrator of education, is in the form of academic service. In the implementation of academic services, ICT is needed in order to meet the goals of the services. ICT use in relation to student academic affairs can take the forms of: 1) Academic information; student admission, faculty/school and study program information, scholarships, student registration, student selection process, and student outcomes; 2) academic services: counseling services, contract system, learning outcomes reports, advisory, and student feedback; and 3) academic infrastructure: e-library, e-book, e-journal, e-mail, and e-learning services.

The same also applies in the academic services in Bandung Institute of Technology (Indonesian, and henceforth, ITB). ITB is one of the higher education institutions that implement ICT to support the academic services provided to students, lecturers, and staffs and to ensure that academic services can be implemented in all working units.

ITB, as one of the excellent state universities in Indonesia, has used ICT in all fields, including academic field. This implementation can be seen in the development of ICT-based academic information system. One of the realizations can be observed in the available infrastructure there. The use of ICT in ITB in helping realize academic services is done by building backbone networks that can reach all locations of ITB, starting from the central library, to Sasana Budaya Ganesha (Cultural Convention), Research and Industrial Affiliation Institution (Indonesian, LAPI), Taman Sari Rectorate Building, Surapati Scientific Research Building, and Boscha Observatory in Lembang.

ITB has also built external networks that enable the university to maintain relationships with the external parties through both telecommunication and satellite networks, internet connection, Indonesian Internet Exchange, and Research and Education Network, such as Asian Internet Interconnection Initiative (AI3) and Trans-Eurasia Information Network (TEIN), which connect ITB to two greatest education networks in the world, namely GEANT in Europe and Abilene in the United States. Furthermore, ITB is connected to the inherent network connecting the university to more than 500 universities in Indonesia.

The implementation of ICT in supporting the administration of education and services for the whole academic community members should be supported by the policies, programs, and activities, whose implementation can be measured through the determination of strategic goals. Policy is the fundamental guideline for an institution, as a form of strategic effort in realizing its vision, missions, and goals.

In the 2016-2020 Strategic Planning of ITB, there a number of institutional strategic goals related to academic services, in which ICT use becomes one

of the primary elements, namely: 1) The development of management system and SOP; 2) performance system management; 3) the development of institutional monitoring and evaluation of international accreditation (International Accreditation Office); 4) the improvement of e-learning management; 5) the improvement of supporting units for international programs; and 6) the strengthening and development of information system.

In order for higher education/university, as one of education institutions, to be accountable and of good quality, it is required to provide quality academic services. Universities as service industries should begin considering the importance of customer services more maturely, because it is increasingly realized that student services and satisfaction is a vital aspect in surviving the competition. Academic satisfaction becomes very important, for it will make students loyal to the institutions, willing to promote the institution to others, and it will increase the interest of the society in continuing their education in the institution, increase the institution's bargaining position, and increase its image. Meanwhile, for a university, student satisfaction with the academic services that they get becomes an important aspect that needs to be prioritized, considering students are the primary customers of higher education. Students are directly related in all stages of education in universities, starting from the input mechanism/stage through selection process in both academic and non-academic activities to the output mechanisms.

Academic services are directly related to students' activities. Hence, universities should try to understand students' needs and perceptions. Students' satisfaction is shown by their loyalty to their university and their story to others about the satisfactory academic services of the university. It certainly is a positive thing that gives added values to the university. Students who are satisfied with the services of a university will continue their education in the same university. In addition, they will promote the good services to future students, thereby increasing the number of students attending the university.

The quality of a service is dynamic and continues to develop in order to meet students' expectation. Students' expectations also develop in line with the demands of the market and the development of employment, thereby necessitating continuous improvement. The changes and development in students' demands should be heeded to and facilitated through various supporting programs and facilities.

ICT implementation in ITB is still limited to student services. This limitation is not in line with the concept of ICT in schools as put forward by Tondeur et al. (2008) that ICT should be implemented in the whole aspects of a school. However, research especially in the classroom context is still limited. The existing research is a follow-up action of the research on practical ICT integration at all levels, which is rarely done by focusing on the services. Similar concern is expressed by Lai and Haleem (2002, p. 101) that "Information Technology is changing the way the society functions. Internet is the biggest revolution in human society. The impact of IT can be felt in all economic and social activities in every conceivable manner."

Results of observations reveal that student service management using ICT has not been integrated into the organizational management system. One of the important aspects related to the integration is leader's policies as the foundation to build efficient structure in the organizational functions. The lack of focus on one service model integrated with ICT in the policy has caused changes in the practice of ICT to be seen as something common, without further evaluation for the efficiency and effectiveness of the ICT-based service model. Saleem and Higuschi (2014) stated that the better policy in ICT use in education will affect the quality of education. The better policy in ICT management is one that integrates the policy of technology, innovation, and educational policies. In practice, ICT-related policies in ITB have not been well integrated with the policies on technology (technology used), innovation (innovative technology and system developed compared to the previous system and connected to service performance), and educational policy. The policies in the use of ICT have not been directed towards encouraging sustainable mobility in student services. This is not in line with Wiegman et al.'s (2003) suggestion that policy affects the continuity of ICT system.

Regarding ICT policy in education system, Jordan (2011) explained that policy broadens the possibility of ICT to be used in order to prepare students with a certain amount of knowledge and skills and to bring about changes in teaching and learning. In a macro view, ICT policy encourages the growth of economy and social development, as argued by Vandeyar (2013, p. 249) that "the policy places an obligation on education to use educational technology to deliver on expectations of quality education for economic growth and social development." In the context of educational institution management, policy is used as an instrument to solve problems of inefficiency and ineffectiveness of institutional management, including the teaching and learning.

ICT policy in ITB has not been made the basis for the operating system of ICT. This is not in accordance with Austin and Hunter's suggestion (2013) that ICT will function optimally with the preparedness of policy as the framework and solid electronic system. Their suggestion shows the strategic position of policy to support efficiency and effectiveness in ICT use in education.

According to O'Brien (2006) in a book titled *Information Technology Association of America*, ICT is a study, design, development, implementation, support of information system management based on computer, especially software and hardware, applications.

Most current research on e-management focused on the issues of efficiency and effectiveness of system and accountability, such as one conducted by Markauskaite (2003) and Nair (2014). Diaz and Tozina (2015) more specifically focused on e-learning assessment system by formulating a grounded theory. The previous research prompted the researchers to conduct research on the implementation of e-management at ITB. In addition to focusing on efficiency and effectiveness, the present research will produce a model that can be used for ICT e-management at the scope of

engineering education along with its unique characteristics. The present research puts forward issues in the practices of ICT related to the ethics formulated by Okaibedieke et al. (2014).

This research is a follow-up of the research done by Wirtz and Daizer (2016), which revealed that e-governance has become the main topic in both academic and practical research, which is expected to produce a body of knowledge in *e-governance*. They recommended quantitative research. Meanwhile, the present research adopted the qualitative method, considering the novelty that is intended to be revealed, both in terms of its epistemology and ontology, as a consequence of the limited studies on the conceptual and practical research on e-governance.

Considering the use of ICT in higher education explained above, the researchers would like to study in more depth the effectiveness of ICT implementation in academic services at Bandung Institute of Technology (ITB).

LITERATURE REVIEW

ICT in Education

In today's globalization era, ICT devices such as computers, netbooks, i-Pads, and the like are ubiquitous in the society of various levels. The devices are no longer secondary goods, but they have become primary goods to support daily life activities. The condition is created by the increasing needs of the society for information day and day. The era of ICT, which has become the ultimate pillar of social and institutional life, becomes even more undeniable. Furthermore, ICT has penetrated into various aspects of life, from culture, politic, social, economy, to education.

Technology is a catalyst of change; in other words, it makes changes become revolutionary, rapid, and intensive (Suryadi, 2006). In education and science, revolution is currently happening and it has double dimensions, namely connecting the incredibly modern research to the power of information and science that can be quickly and easily accessed through information and communication technology. Suryadi (2006) asserted that the revolution in the combination of internet-computer-world wide web has shaped new generations, with new values, new socialization styles, new cultures, and even new economy. For higher education institutions or universities, ICT has become necessary to support educational processes. ICT plays an important role in increasing the competitive advantage of a university. The use of information technology is highly needed to increase the efficiency and productivity and the management of a higher education institution.

The integration of internet into teaching is still limited. The increasing needs for learning sources have not been balanced by improvement in teaching infrastructure, both in terms of its quantity and quality. The internet in teaching has not been used optimally to help improve the quality of students. An increase in the quantity of students that can potentially degrade the quality of teaching has not been of much concern. This lack of attention can be seen in the provision of internet technology to anticipate the increasing number of students that is still limited.

The use of ICT has not been systematically and holistically integrated in each function of organizational management of education in higher education. Only a small number of higher education institutions have optimized the function of ICT holistically, namely as Learning Management System (LMS). As the main vehicle in the teaching and learning process, this system consists of a group of software designed for regulations at the individual, classroom, and institutional levels. The main character of LMS is its users are teachers and students, and both should be connected to the internet using this application.

The use of ICT and its various devices (internet-*penj*) has no longer embodied into complementary goods only, but it has become a kind of primary need

that penetrates into every job sector. Amarulloh (2016) said that one of the most developing technologies is the web-based technology that is often called internet. This technology has been used in various fields, such as business, government institutions, health, education, and many more. This prevalence of internet is proven by the results of a survey undertaken by the Indonesian Internet Service Providers Association (Indonesian, APJII) in 2014, which reported that there were around 13 employment sectors in Indonesia which used internet, starting from trades and services, education, government, to entertainment. Trades and services ranked the first and second in the survey, respectively, while education was ranked the third with a percentage of 8.3%.

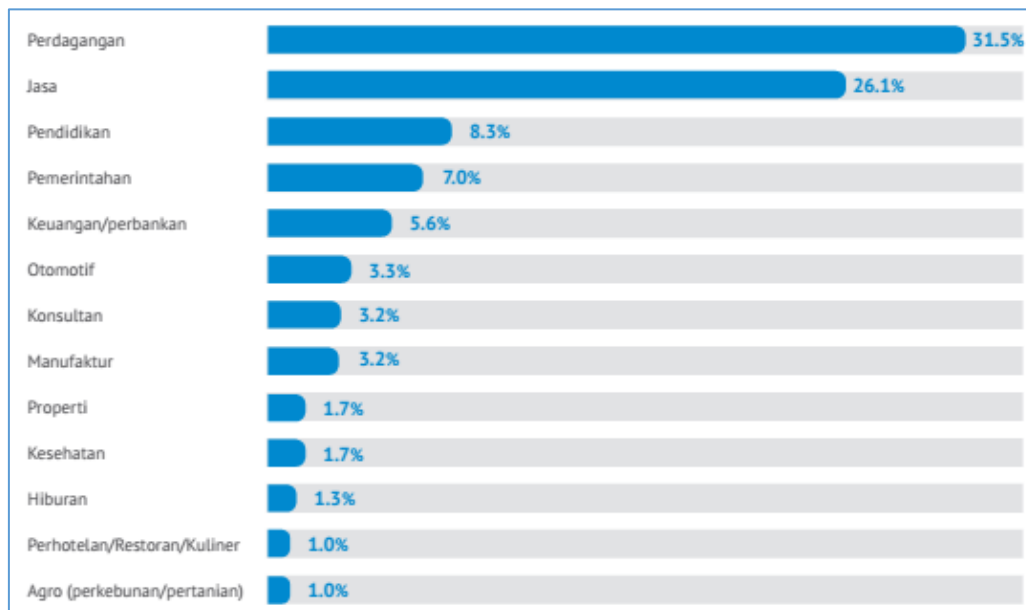


Figure 1. The Use of Internet in Various Employment Sectors

Figure 1 shows that the use of ICT nowadays in the form of internet has become inseparable from various educational activities in higher education institutions, especially in terms of provision, delivery, and dissemination of information to the stakeholders of education.

Higher education, in the framework of organizational theory, is an element of the society that is ever changing in line with the development of the environment in which the higher education exists, such as society's needs, government policy, and globalization. Hence, a good adaptive ability is needed by the education institutions by making the necessary organizational adjustment and dynamization in order to survive and adapt to the changes well.

Quality Academic Services and Their Effectiveness

Conceptually, quality is a dynamic condition that pertains to products, services, humans, processes, and the environment that meets or exceeds expectations. Quality is something dynamic, something that keeps moving; when it moves forward, it can be said that there is improvement in the quality; when it moves backward, it can be said that the quality decreases. Avianti (2005) said that quality can

mean superiority or excellence, namely exceeding the prevalent general standards. Something can be said to have quality if there is a match between the desired requirements of an object or service and the intention of the person who desires them. Meanwhile, academic services can mean a series of activities in the process of meeting students' academic needs routinely and continuously (Moenir, 1995).

Meanwhile, service quality is to what extent the service provided by an institution is in line with the needs and expectations of the customers (Sviokla, 2002). The argument makes it clear that quality services mean the extent to which reality is far from or close to customer expectation, which in this case, students' expectation of the services they get from their institution.

Thus, quality is a holistic description and characteristic of an object or service that shows the ability to satisfy the expected or implied needs. Service is a part of the functions of organizational management involving customers. The customers of higher education are students, graduate users, students' parents, and other interested community members. The services are given in the form of service products to meet customers' needs. In assessing service quality, according to Parasuraman (2009), there are at least five primary dimensions

related to student academic service quality, namely: tangibles, reliability, responsiveness, assurance, and empathy.

Academic service quality becomes the most important thing to be paid attention to and improved in higher education. Service quality is always dynamic and develops in order to meet student satisfaction. Sufiyah's research (2011) has found that the quality of academic services had an effect on student satisfaction. The academic services received by students in the forms of curriculum, lectures, materials presented, and evaluation as well as supervision will cause students to give their trust to the institution, so that continuous efforts are required from the institution. Student satisfaction also develops in order to meet the demands of the market and the development of employment, so that continuous improvement is required. These changes and developments should be taken into account and facilitated through the supporting programs and infrastructure.

The use of ICT in higher education with its various forms and purposes has changed the working paradigm of the institution into one that is more effective, faster, and accurate. In academic services, for instance, web-based technological devices have changed the conventional patterns of course credit contract, advisory, grade information, and the like. The impacts of these changes for the institution can certainly be seen in the quality performance of the institution, while the impacts on students are apparent in the satisfaction with the academic services the students get. According to Armin (2011), the use of ICT requires the ability to manage IT resources effectively, so that efficient and excellent business processes can be created in meeting the vision of an organization. The use of ICT in higher education should be effective and successful in order to give benefits to students. To measure the effectiveness of an activity, it is important to first define what effectiveness is, as it means differently for each person, depending on the theoretical framework used. According to Ravianto in Masruri (2014), effectiveness is how well a job is done, to what extent the output resulted from one's work meets the expectation. This means that when a job can be completed according to the plan, in terms of timing, budget, and quality, then it can be said to be effective. In addition, Emerson in Handyaningrat (1990) defined effectiveness is the result of measuring the achievement of the predetermined goals. Effectiveness should become a great concern, as it has great effects on many people's interest. Another definition is given by Pasalong (2007), in which effectiveness is defined as follow: Effectiveness basically originates from the word effect, used as a term in a causal relationship. It can be regarded as one of the causes of other variables; effectiveness means the previously determined goals have been met; in other words, targets are met because of the activities. Hence, it can be concluded that effectiveness is an action that entails the occurrence of a desired effect or cause and stresses results or effects in the meeting of certain goals.

The research results of Aulianto (2010) demonstrate that the implementation of web-based academic information system, containing study-plan forms, student learning outcomes, course schedules,

academic transcripts, instructional evaluation, can be accessed online, thereby making it easy for students to access the information. The system is simultaneously a fast feedback tool. In this research, it is also explained that the implementation of web-based academic information system has a significant influence on academic service quality.

METHOD

This research adopted the qualitative approach with analytical-descriptive method at Bandung Institute of Technology (ITB). It was designed to find about ICT implementation at ITB in an attempt of improving the quality of student academic services. ITB has been selected as the focus of the study, considering this university is one of the best universities in Indonesia. The researchers in this regard would like to further explore the mechanisms of ICT implementation, starting from planning, implementation, to evaluation. In addition, other aspects to be explored are related to information sources, the tools used, information/data sources as input, and indicators of the effectiveness of ICT use in academic services.

The research began with identifying the case, limiting the system and analysis unit for investigation. In each case, the researchers selected events or activities to observe, the people to be interviewed, and the documents to read. Non-probability and snowball sampling is more suitable for this research. When research questions do not focus on frequency or amount/number; instead, they are intended to find answers in qualitative problems, then non-probability sampling is more appropriate.

In obtaining detailed information, the researchers employed the continuous adjustment or focusing of the sample, namely selecting sample in line with the direction of the research's focus.

ANALYSIS

The Effectiveness of ICT Implementation in Student Academic Services

The success of a university in meeting the needs and desires of its users, especially students, can be measured through the effectiveness of the implementation of its policies and programs. Students are the raw input of education who have the right to be served and catered to for their needs in an attempt of developing their potentials to be capable, skilled, independent, and competitive individuals in the society. Academic services become one of the important elements for a higher education institution/university to be able to increase its credibility and trust from the society.

The review of the effectiveness of the implementation of academic services in Bandung Institute of Technology (Indonesian, and henceforth, ITB) emphasizes three approaches, namely decision-focused approach, goal-oriented approach, and user-oriented approach (Stecher & Davis, 1987). The three approaches are selected on the basis of the consideration that effectiveness is a series of interrelated processes.

The findings regarding the effectiveness of academic services in the perspective of decision-focused approach show a harmony in the working programs formulated at the level of working units. The working programs formulated at the working units

have been in line with the policy at the executive level. Basically, the essence of this approach is to see the extent to which the policies of Bandung Institute of Technology (ITB) can be elaborated through the working programs whose success can be measured quantitatively and qualitatively.

The use of ICT in academic services at ITB as summarized in the policy of the management and organization stresses two priority programs, namely improvement of e-learning institutional management and strengthening and development of dashboard information management system, which in its implementation is elaborated and executed by the working unit that has the authority to implement the program based on its duties and functions, namely: Directorate for Information System Technology that is responsible for the success of the integration of information system and dashboard; and Directorate for Education that is responsible for the development of e-learning, online lectures, video conference, blended learning, Introduction to Information Technology, and Indonesian Open and Integrated Online Learning, and other academic support systems, such as digital library. The development of academic information system for the interest of academic administration is jointly organized by Directorate for Information Technology System and Directorate for Education. Directorate for Information

Technology System as the supporting unit provides information system infrastructure and Directorate for Education manages the facilities independently.

The appropriateness of the working program shows synergy of planning system in ITB. What is desired by the top leaders is understood and realized well by leaders at the unit levels, so that the vision of ITB can be achieved, namely to be an excellent, dignified, independent, world-class university, leading in changes and able to improve the welfare of Indonesia and the world. ICT use programs in ITB are also in line with the strategic objectives of higher education at the national level, where in the Regulation of the Minister of Research, Technology, and Higher Education Number 13 of 2015, it is stated that one of the objectives is to improve the quality of instruction and student affairs and to improve the quality of science and technology institutions and higher education.

The synergy of certain working programs has some merits for the institution in building a shared commitment, mustering the maximum ability of each unit, increasing coordination and communication, increasing cooperation, and building shared responsibility so that the output and outcome will be better and eventually will increase organizational capacity.



Figure 2. Effectiveness from Decision-Focused Approach

The formulation of working programs established by the working units at ITB describes the outcomes that can be perceived by the academic community members of ITB, namely excellence in educational services and in learning through classes/lectures that can reach not only the areas of ITB (Ganesha-Jatinangor Campuses), but also the partner universities, both domestic and international ones. The outcomes of working programs are also observable in the excellent strategic research of ITB (excellence in research) that can be proven by a large number of citations and intellectual rights owned by ITB compared to those of other universities in Indonesia. In addition, the use of ICT in realizing excellence in research is realized by ITB through its

participation in the international research community through Web of Science (WoS), which makes it easy for the university to analyze writers' citation indices, research trends in various topics, citation and writers' information, institutional profiles, comparison to other universities, and improvement in research productivity.

Meanwhile, the effectiveness of ICT implementation at ITB from the goal-oriented approach can be said to have not been fully effective. The goal-oriented approach is an approach in assessing the effectiveness of the achievement or success of the implementation of a program. A program is said to be effective if the results meet the expected targets, and this is usually stated in the form

of quality or quantity indicators. ICT use programs at ITB are intended for classes in the forms of e-learning, covering online class, blended learning, video conferencing, Introduction to Technology Information, and Indonesian Open and Integrated Online Learning. Out of these programs, only blended learning and online classes have met the pre-determined targets.

The failure of a number of ICT-use programs to meet the targets is caused by several factors, such as management commitment, capability of human resources as managers and users, policies, and infrastructure. As in the case of the use of video conference, the problem is caused by the policy. The policy on the use of video conference has not been made the priority program at ITB in realizing competitive advantage, although the infrastructure of each faculty permits the implementation of the instructional model. The use of video conference up to this day is mostly for management meeting and thesis defense or final examination. This can be understood considering the fact that using video conference requires support from adequate infrastructure, not only provided by ITB, but also provided massively for users, namely students who also require adequate infrastructure, besides support from the platform of application used. In order to use the facility of video conference technology massively, application platform supported by stable internet connection is required, such as Google Hangout, Skype, Tango, and similar applications.

According to Toro and Joshi (2012), formulating a policy is a complicated matter. There are many aspects to be considered, among others: "content/digital resources, capacity building, monitoring and evaluation framework, ICT for education management, implementation plans, financial allocations, political and administrative support, community demand for ICT, and staff development and training program" (p. 22).

Supporting infrastructure also plays an important role in ensuring the success of the implementation of e-learning, especially in the program of Introduction to Information Technology. Introduction to Information Technology is a program to equip new students with the basic knowledge of science and technology and to build their scientific attitudes. The implementation of Introduction to Information Technology uses the facilities of ITB computer laboratories (Comlabs) for the needs of computation, internet access, and class assignment. The intensity of Comlabs use affects a decline in the quality of the infrastructure (PC Client, internet, multimedia devices, etc.) and requires adequate funds for maintenance cost, component replacement, and program/software licensing. The more components replaced and the more licensed programs used, the higher the required funds.

The less than optimal achievements of programs are subsequently found in the Indonesian Open and Integrated Online Learning. This is an LMS-program intended for academic community members outside ITB by providing a number of integrated courses to a number of universities in Indonesia. The program has not been fully realized because of the obstacles with the course content and materials. ITB along with Quality Assurance of Indonesian Higher Education attempts to prioritize service quality in order for the course content and

materials presented in the Indonesian Integrated and Open Online Learning to meet the standard quality.

The effectiveness of a university cannot be sufficiently measured from its performance achievements and the indicators attached to the bureaucracy, but it should also be seen from the indicators of its service users, such as students' satisfaction and trust.

The core values of education are on the quality learning. This is well understood by ITB, and the university always attempts to improve the learning quality through various innovations, such as using ICT as learning tools in optimally accelerating students' learning achievements. The use of e-learning in the courses at ITB is an implementation of ITB 2013 Curriculum that emphasizes learner-centered education. Through this curriculum, students are required to be more proactive in seeking for and exploring various ideas and sharing their knowledge with the whole academic members of ITB.

The effectiveness of ICT implementation in academic services can also be measured from the outcomes perceived by students in the form of service satisfaction. Student satisfaction with the existing university's services can be made an effective barometer of whether a certain service is effective or not. The concept of service satisfaction in education institutions is not really different from that of product satisfaction in profit organizations in the perspective of customers or what is frequently called customer satisfaction. Students are the primary customers of education who have the rights to be satisfied for their needs in an attempt of their self-development and to be served professionally.

Students' responses to the academic services integrated with ICT at ITB have met the expectations and shown student satisfaction, in terms of tangibles, reliability, responsiveness, assurance, and empathy. The forms of academic services at ITB have accommodated students' desires and needs. For academic administration affairs, such as course contract, course results, learning outcomes (grades), advisory, and other needs, the students are provided with academic information system that can be accessed online. Meanwhile, for the needs of learning sources, ITB provides Ganesha Digital Library, e-journal, online catalogues, and a number of materials in online courses and blended learning. These services can be easily accessed through the available infrastructure at ITB or through digital devices, such as PC, laptops, smartphones, and other devices connected to the internet. For the handling of complaints or problems related to ICT services, ITB provides IT Helpdesk as a technical unit functioning to handle any complaints and problems with ICT uses, and other needs such as program/software installation.

Student satisfaction with the services they get can be made an indicator of the effectiveness of a service. This means that the services provided have been in accordance with users' expectations and desires that the services can be well-accepted. Satisfaction is an individual's feeling that is triggered after comparing reality with expectations. Satisfaction with a service is identical to excellence and quality.

University as an education institution that operates in the field of services stresses quality and excellence in services and attempts to make the

primary customers, namely students, satisfied. Student satisfaction with a service should be maintained in order to maintain the existence of the university. The feeling of being satisfied with a service can be created through building a harmonious relationship between the institution and users (students), increasing users' trust, increasing their loyalty, increasing the image of the institution (branding), and increasing the institution's competitiveness.

CONCLUSIONS

Effective student academic services are those provided to students in line with the academic needs of students/users of a university. To give effective services, the implementation of information and communication technology (ICT) is needed. For ICT implementation to be effective, ICT use should be in accordance with students' academic needs. Several ICT uses for universities are the use of ICT as learning tools, the use of ICT as management tools, and the use of ICT as business intelligence, which are universities' efforts in realizing transparency, quality, effectiveness, and efficiency.

ICT implementation in student academic services will be effective if there is support from ICT policies and programs. The policies stipulated by an organization in general are written in the master plan development and Strategic Plans. Strategic Plans are the guidelines for the organization to make its policies in the five-year medium term. The components included in Strategic Plans generally are: policies, programs, activities, goals, objectives, and achievement indicators. In formulating a policy, the main consideration taken into account by an organization is concerned with the vision and missions.

Subsequently, once policies and programs are stipulated, ICT implementation strategies are formulated. The strategic planning becomes the task of the top management and is the key factor for an organization in directing its mission and goals. The importance of strategies lies in the fact that they are the most basic framework that will bring the organization to the ability to adapt with the ever-changing environment. With strategies, the whole elements and resources of an organization can be driven towards the meeting of the goals. In addition, the activities done can be more effective and efficient. ICT implementation strategies that are able to support quality student academic services are translated as the organization's efforts in implementing its policies and programs and realizing the pre-determined targets. There are three general strategies involving ICT elements, namely: 1) Developing a good order in the management and performance systems; 2) Developing institutional system and management that supports international programs in line with the recent needs; and 3) Realizing a complete information system that can support the programs of education, research, and community service.

Based on the selected strategies, ICT implementation should consider the following aspects: 1) ICT infrastructure in student academic services; 2) The forms of ICT use in student academic services; and 3) The obstacles in ICT implementation in student academic services. ICT

implementation will always encounter certain obstacles, depending on the level on which they appear. At the technical level, the common obstacles are related to troubleshooting, software use, program, platform, and network connection. The obstacles found at the management level are different. At this level, the obstacles are more complex in nature, as they pertain to order of works, communication, human resources, leadership, commitment, authority and power, and coordination among the existing units. Handling these obstacles requires structured and systematic solutions from the organization leaders.

The effectiveness of ICT implementation in student academic services can be assessed from the implementation of policies at the level of unit (decision-focused approach), the effectiveness of performance achievements (goal-oriented approach), and the effectiveness in the perspective of students as users (user-oriented approach), using five aspects to measure, namely tangibles, reliability, responsiveness, assurance, and empathy. These show the level of satisfaction with the existing academic services. The execution of jobs at the working unit is essentially the elaboration of policies and programs at the level of institution as stipulated by the top management to accommodate changes at the external order that require adjustment in the organization internally. The policies at the level of institution should be able to be elaborated technically and operationally into a number of activities whose success is measurable, according to the functions of the related working unit. Therefore, the synergy between a program elaborated at the level of working unit and the policy at the level of institution becomes the determining factor of the effectiveness of an institution's performance; in other words, the program at the working unit level should be in line with the program formulated at the level of institution.

The model of development of the effectiveness of ICT implementation in academic services is a systemic model that synergizes the whole components of an institution in order to realize competitive advantage, both at the national and international levels, especially in quality and excellent academic management and academic services.

IMPLICATIONS

Higher education institutions play a key role in society development and the improvement of the competitiveness of a nation through the activities of education, research, and community service, popularly called the *tri dharma* or three pillars of higher education. The implementation of the three pillars of higher education should be supported by policies oriented towards excellence and competitiveness so that the products resulted from both the educational and research processes can be acknowledged by the global academic community. This recognition of the values established by higher education is not inseparable from the management capacity in empowering the whole components, which in the process requires support from ICT in order to be more productive in reaching the goal of creating the competitive advantage. The use of ICT to support various activities of a university is a logical consequence of the increasingly high demands and the increasingly complex employment, especially if

the university has a vision and mission of improving its roles and contribution in the development of global society through the realization of a world class university.

The use of ICT for the sake of business intelligence has implications for the decision quality and strategic policies stipulated by the university. ICT enables integration of various information systems in the administration of a university that makes it easy for the leaders to gain the necessary information and stipulate policies in accordance with the present situations. Meanwhile, in the management process, the existence of ICT can accelerate and make more effective the administration and service processes for the stakeholders and shareholders.

ICT in academic services is intended to realize the excellence in learning by combining various learning concepts which are interactive and innovative, reaching people from all levels and classes regardless of the spatial and temporal boundaries, and cultivating the knowledge-sharing culture among academic communities internally and with other universities in the world. The implementation of ICT to support academic services is to realize quality service and meet the aspects of excellence in service that satisfies the desires of its users, especially students.

ICT implementation in higher education for any needs requires support from the policies and programs, infrastructure, human resources, and commitment of the whole academic community members in order to realize e-literacy culture that supports the development of knowledge products which are beneficial for the academic community and society in general.

The findings of research on the effectiveness of ICT implementation in student academic services also have implications for the strengthening of the science of educational administration, especially in understanding the concept and management of ICT in the educational management at the scope of higher education academic services.

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