DIGITAL SCHOOL: EXPEDITING KNOWLEDGE TRANSFER AND LEARNING THROUGH EFFECTIVE USE OF INFORMATION AND COMMUNICATION TECHNOLOGY WITHIN EDUCATION SYSTEM OF REPUBLIC INDONESIA

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Abstract

The involvement of Information and Communication Technology (ICT) within the educational system has been widely discussed and implemented by various scholars and practitioners. A good number of cases have shown that the effective use of such technology can bring positive and significant improvement to the quality of learning deliveries. For a country which believes that a serious development on ICT for education system could gain some sorts of national competitive advantage, a series of strategic steps has been undergone. Such effort is started from finding the strategic role and context of ICT within the country's educational system, followed by defining the architectural blue print of the various ICT implementation spectrum and developing an implementation plan framework guideline. This article proposes one perspective and approach on how the ICT for education should be developed within the context of Indonesia's educational system.

Keyword*: information and Communication Technology (ICT), Education System*

Schools in Indonesia

As the biggest archipelago country in the world, Indonesia consists of more than 18,000 islands nationwide. In 2005, there are more than 230 million people living in this 5 million square meter area where almost two third of it is water. The existence of 583 languages and dialects spoken in the country is the result of hundreds of ethic divisions split up by diverse separated island. According to statistics, 99 million of Indonesia population are labors with 45% of them works in agriculture sector. Other data source also shows that 65% of total population are within productive age, which is 15-64 years old. The unbalanced region development since the national independent's day of August 17th 1945 has made Java as the island with the highest population density (average of 850 people per square meter), comparing to the nation average of 100 people per square meter. It means that almost 60% of total Indonesia population live in this island alone.

In the year 2004, the number of formal education institutions (schools) in the country – ranging from primary school to universities – has succeeded 225,000 institutions.

There are approximately 4 million teachers who are responsible for more than 40 million students nationwide. Note that almost 20% of the schools still have problems with electricity as they are located in very remote area. For the purpose of leveraging limited resources and ensuring equal yet balance learning quality growth of the society, the government adopts a centralized approach of managing education system as all policies and standards are being set up by the Department of National Education lead by a Minister of Education.

ICT in Education Institution

The involvement of ICT (Information and Communication Technology) within education institution in Indonesia started from the higher-learning organization such as university and colleges. As the rapid development of such technology in the market, several state universities and prominent colleges that have electrical engineering related fields introduced what so called as computer science program of study. At that time, most of the computers were used for two major purposes: s organizations in taking care of their academic administrations, and supporting students conducting their research especially for the purpose of finishing their final project as a partial requirement to be awarded a bachelor degree. Currently, in the existence of 7 million fixed telephone numbers and 14 million mobile phone users, there are at least 12.5 million of internet users in Indonesia. Data from May 2005 has shown that there are more than 21,762 local domain name (.id) with the total accumulative of IPv6 address of 131,073. From all these domain, there are approximately 710 domains representing education institutions (e.g. with the ".ac.id" sub-domain). It means that only less than 0.5% of Indonesian schools that are "ICT literate" – a ration that is considered very low in Asia Pacific region.

History has shown that a significant growth of ICT in education started from the commencement of the first ICT related ministry, namely Ministry of Communication and Information in 2001. Through a good number of efforts and socialization programs supported by private sectors, academicians, and other ICT practitioners, a strategic plan and blueprint of ICT for National Education System has been produced and announced in 2004 by the collaboration of three ministries which are: Ministry of Communication and Information, Department of National Education, and Department of Religion.

The National Education System

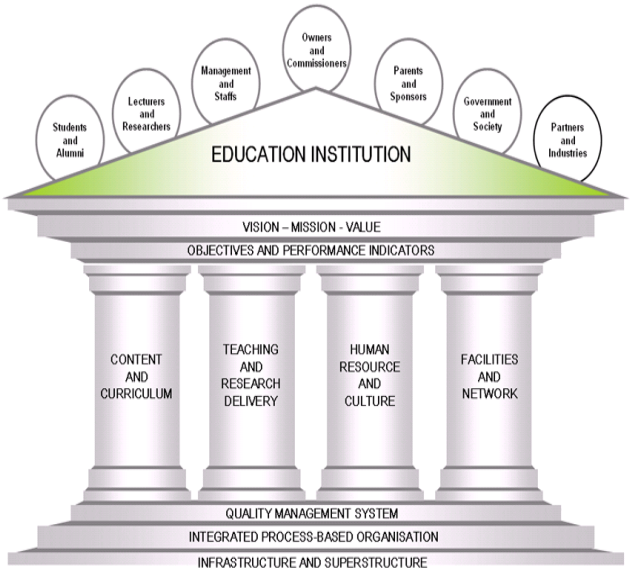
Indonesia's national education system is defined and regulated by the UU-Sisdiknas RI No.20/2003 (Undang-Undang Sistem Pendidikan Nasional Republik Indonesia). This last standard has been developed under the new paradigm of modern education system that is triggered by new requirements of globalization. All formal education institutions – from primary schools to universities – have to develop their educational system based on the philosophy,

principles, and paradigms stated in this regulation.

Based on the national education system that has been powered by many discourses from Indonesia's education experts, the conceptual architecture of an education institution can be illustrated through the following anatomy.

Vision, Mission, and Value

Every school has its own vision and mission(s) in the society. Most of them are related to the process of knowledge acquisition (learning) for the purpose of increasing the quality of people's life. As being illustrated above, the vision and mission(s) of an education institution is very depending upon the needs of stakeholders that can be divided into 7 (seven) groups, which are:



Picture 1. Seven Groups of Stakeholders Needs

1. Owners and commissioners – who are coming from various society, such as: religious communities, political organizations, education foundation, government, private sectors, etc.;
2. Parents and Sponsors – who are taking an active portion as the parties that decide to which schools their children or employees should be sent to;
3. Students and Alumni – who are at one aspect being considered as the main customers or subject of education but in other perspective represent output/ outcome's quality of the institution;
4. Management and Staffs – who are the parties that run education organization and manage resources to achieve targeted goals;
5. Lecturers and Researchers – who are the main source of institution's most valuable assets which are intellectual property assets;
6. Partners and Industry – who are aliening with the institutions to increase practical knowledge capabilities of the institution graduates; and
7. Government and Society – who are setting regulation and shaping expectation for ensuring quality education being delivered.

Objectives and Performance Indicators

In order to measure the effectiveness of series of actions taken by institution in order to achieve their vision and missions, various objectives and performance indicators are being defined.

Previously, for all government-owned schools, the measurements have been set up by the states. But nowadays, every education institution is given a full right to determine their control measurements as long as it does not violate any government regulation and education principles (and ethics). Good selection of indicators portfolio can represent not just only the quality level of education delivery status, but also the picture of sustainability profile of the institution.

Four Pillars of the Education System

Through depth analysis of various performance indicators chosen by diverse education management practitioners – backing up also by a good number of research by academicians on the related fields – there are at least 4 (four) aspects or components that play important roles in delivering quality educations. Those four pillars are:

1. Content and Curriculum – the heart of the education lies on the knowledge contained (=content) within the institution communities and network that are structured (=curriculum) so that it can be easily and effectively transferred and acquired by students;
2. Teaching and Research Delivery – the arts on acquiring knowledge through various learning activities that promote cognitive, affective, and psychomotor competencies transfers;
3. Human Resource and Culture – by the end of the day, human resource are the people who are having and willing to share all knowledge they have to other people within a conducive academic environment and culture through appropriate arrangements; and
4. Facilities and Network – effective and quality education deliverables nowadays can only be done through adequate existence of facilities and institutional network (i.e. with all stakeholders).

Some of institutions consider these four pillars as critical success factors while some of them realize that such components are the minimum resources (or even a business model) that they have to carefully manage as educators or management of education institutions. Note that there are some local regulations that rule the education institution to have minimum physical assets or other entities within specific ratio to be able to operate in Indonesia. Such requirements will be checked by the government during the process of building new school and in the ongoing process of the school operations as quality control.

Institution Infrastructure and Superstructure

Finally, all of those vision, missions, objectives, KPIs, and pillars, are being built upon a strong holistic institution infrastructure and superstructure foundation. It consists of three components that build the system, which are:

1. Physical Infrastructure – consist of all assets such as building, land, laboratory, classes,

technology, sports center, parking space, etc. that should be required to establish a school;
2. Integrated Services – consist of a series of processes integrating various functions (e.g. strategic to operational aspects) exist in school to guarantee effectiveness of education related services; and
3. Quality Management System – consist of all policies, standards, procedures, and governance system that are being used to manage and to run the institution to guarantee the quality.

ICT Context on Education

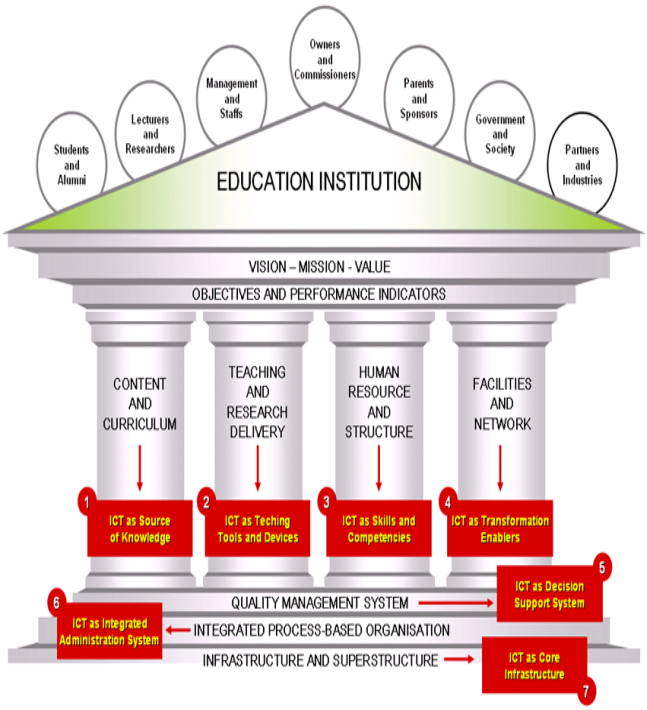
While trying to implement these education principles, all stakeholders believe that information is everything, in the context of:

- Information is being considered as the raw material of knowledge ➔ since the operational of a school is highly depending on their knowledge collections, the capabilities to access, to process, to distribute, and to use information are mandatory;
- Information is something that is very crucial for managing and governing purposes ➔ since the sustainability of a school can be seen from all data and/or information derived from daily activities – that are being consumed by diverse stakeholders – the availability of relevant and reliable information are very important; and
- Information is a production factor in education services ➔ since in every day's transactions, interaction, and communications require information, the flow of data should be well managed.

ICT Context and Roles in National Education System

Based on the defined National Education System, there are 7 (seven) context and roles of ICT within the domain, which are:

1. ICT as Source of Knowledge;
2. ICT as Teaching Tools and Devices;
3. ICT as Skills and Competencies;
4. ICT as Transformation Enablers;
5. ICT as Decision Support System;
6. ICT as Integrated Administration System; and
7. ICT as Infrastructure.



Picture 2. Seven Context and Roles of ICT

It can be easily seen that these seven context and roles are derived from the four pillars and three institution infrastructure/ superstructure components within the national education system architectural framework. Each context and/or role supports one domain on the system. The followings are the justification on what and why such context and roles exist.

ICT as Source of Knowledge

The invention of internet – the giant network of networks – has shift on how education and learning should be done nowadays. As more and more scholars, researchers, and practitioners are being connected to internet, a cyberspace has been inaugurated as source of knowledge. In other words, ICT has enabled the creation of new world where knowledge are being collected and stored. Several principles that are aligned with the new education system paradigm are as follows:

- New knowledge are being found at a speed of thought today, which make any scholar has to be able to recognize its existence ➔ through ICT (e.g. internet), such knowledge can be easily found and accessed in no time;
- Most of academicians, researchers, scholars, students, and practitioners disclose what they have (e.g. data, information, and knowledge) through the internet so that many people in other parts of the world can take benefit out of it ➔ through ICT (e.g. website, database), all those multimedia formats (e.g. text, picture, sound, and video) can be easily distributed to other parties; and
- New paradigm of learning states that the source of knowledge is not just coming from the assigned lecturer or textbooks of a course in a class, but rather all experts in the fields and every reference found in the world are the source of knowledge ➔ through ICT (email, mailing list, chatting, forum) every student can interact with any lecturer and can have accessed to thousands of libraries for references.

With respect to this context, at least there are 7 (seven) aspects of application any education institution stakeholder should be aware of, which are:

1. Cyber Net Exploration – how knowledge can be found, accessed, organized, dissemi nated, and distributed through the internet;
2. Knowledge Management – how knowledge in many forms (e.g. tacit and explicit) can be shared through various approaches;
3. Community of Interests Groupware – how community of lecturers, professors, students, researchers, management, and practitioners can do collaboration, cooperation, and communication through meeting in cyber world;
4. Institution Network – how school can be a part of and access a network where its members are education institutions for various learning-based activities;
5. Dynamic Content Management – how data or content are dynamically managed, maintained, and preserved;

6. Standard Benchmarking and Best Practices – how school can analyze themselves by comparing their knowledge-based acquisition with other education institutions worldwide and learning from their success; and
7. Intelligence System – how various scholars can have the information regarding the latest knowledge they need without having to search it in advance.

ICT as Teaching Tools and Devices

Learning should become activities that are considered enjoyable by people who involve. It means that the delivery processes of education should be interesting so that either teachers and students are triggered to acquire and to develop knowledge as they convenience. As suggested by UNESCO, Indonesia has adopted the "Competence-Based Education System" that force the education institution to create curriculum and to conduct delivery approaches that promote not just cognitive aspect of competence, but also affective and psychomotor ones. There are several paradigm shifts that should be adapted related to teacher's learning style to promote the principle. The followings are some transformation that should be undergone by all teachers in education institution.

Table 1. Paradigm of Transformation

• From teacher-centered instruction	to student-centered instrc.
• From single-sense stimulation	to multisensory stimulation
• From single-path progression	to multipath progression
• From single media	to multimedia
• From isolated work	to collaborative work
• From information delivery	to information exchange
• From passive learning	to active/inquiry-based learn.
• From factual	to critical thinking
• From knowledge-based	to informed decision making
• From reactive response	to proactive and planned act.
• From isolated	to authentic
• From artificial context	to real-world context

From above paradigm, it is clearly defined on how ICT can help teachers in empowering their delivery styles to the students and how students can increase their learning performance. There are at least 17 (seventeen) applications related to this matter as follows:

1. Event imitation – using technology to create animation of events or other learning subjects representing real life situation;
2. Case Simulation - enabling teachers and students to study and to perform "what if" condition in many cases simulation;
3. Multimedia Presentation – mixing various format of texts, graphics, audio, and video to represent many learning objects;
4. Computer-Based Training (CBT) – technology module that can help students to conduct independent study;
5. Student Learning Tools – a set of programs to help students preparing and storing their notes, presentation, research works, and other learning related stuffs;
6. Course Management – an application that integrates all course related activities such as attendees management, materials

deliverable, discussion forum, mailing list, assignments, etc.

7. Workgroup Learning System – a program that can facilitate teachers and students group-based collaboration, communication, and cooperation;
8. Three-Party Intranet – a network that links teachers, students, and parents as main stakeholders of education;
9. Examination Module – a special unit that can be used to form various type of test models for learning evaluation purposes;
10. Performance Management System – software that can help teacher in managing student individual learning records and tracks for analyzing his/her specific study performance;
11. Interactive Smart Book – tablet PC or PDA-based device that is used as intelligent book;
12. Electronic Board – a state-of-the-art board that acts as user interface to exchange the traditional blackboard and whiteboard; and
13. Blogger – a software module that can help the teacher keep track of student progress through their daily experience and notes written in the digital format.

ICT as Skills and Competencies

Since teachers and students will be highly involved in using many ICT-based application, the next context and role of ICT that should be promoted is its nature as a thing that every teacher and student should have (e.g. skills and competencies). This digital literacy (or e-literacy) should become pre-requisites for all teachers and students who want to get maximum benefit of ICT implementation in education system. In other words, a series of training program should be arranged for teachers and range of preliminary courses should be taken by students so that at least they are familiar in operating computer-based devices and applications. To be able to deliver education and to learn in an effective and efficient way – by using ICT to add value – several tools and applications that should be well understood by both teachers and students are listed below:

1. Word Processing - witting software that allows the computer to resemble a typewriter for the purpose of creating reports, making assignments, etc.;
2. Spreadsheet - type of program used to perform various calculations, especially popular for mathematic, physics, statistics, and other related fields;
3. Presentation Tool – a software to be used for creating graphical and multimedia based illustration for presenting knowledge to the audience;
4. Database - a collection of information that has been systematically organized for easy access and analysis in digital format;
5. Electronic Mail - text messages sent through a computer network to a specified individual or group that can also carry attached files;
6. Mailing List - a group of e-mail addresses that are used for easy and fast distribution of information to multiple e-mail addresses simultaneously;

7. Browser - software used to view and interact with resources available on the internet;
8. Publisher – an application to help people in creating brochures, banners, invitation cards, etc.;
9. Private Organiser - a software module that can serve as a diary or a personal database or a telephone or an alarm clock etc.;
10. Navigation System – an interface that acts as basic operation system that is used to control all computer files and resources;
11. Multimedia Animation Software - system that supports the interactive use of text, audio, still images, video, and graphics;
12. Website Development– a tool that can be used to develop web-based content management system;
13. Programming Language – a simple yet effective programming language to help people in developing small application module;
14. Document Management – a software that can be used in creating, categorizing, managing, and storing electronic documents;
15. Chatting Tool – an application that can be utilized by two or more individuals connected to Internet in having real-time text-based conversations by typing messages into their computer; and
16. Project Management - an application software to help people in planning, executing, and controlling event based activities.

ICT as Transformation Enablers

As the other industrial sectors, ICT in the education field has also shown its capability to transform the way learning is delivered nowadays. It starts from the facts that some physical resources can be represented into digital or electronic forms type of resources. Because most of education assets and activities can be represented by digital forms, then a new world of learning arena can be established and empower (or alternate) the conventional ones. There are some entities or applications of these transformation impacts, which are:

1. Virtual Library - A library which has no physical existence, being constructed solely in electronic form or on paper;
2. E-learning Class - any learning that utilizes a network (LAN, WAN or Internet) for delivery, interaction, or facilitation without the existence of physical class;
3. Expert System - computer with 'built-in' expertise, which, used by a non-expert in an education area as an exchange of a teacher or other professional in particular field (expert);
4. Mobile School – a device that can be used to process all transactions or activities related to student-school relationships (e.g. course schedule, assignment submission, grade announcement, etc.);
5. War Room Lab – a laboratory consists of computers and other digital devices directly linked to many network (e.g. intranet, internet, and extranet) that can be

freely used by teachers or students for their various important activities; and
6. Digital-Based Laboratory - a room or building that occupied by a good number of computers to be used for scientific testing, experiments or research through diverse digital simulation system.

ICT as Decision Support System

Management of school consists of people who are responsible for running and managing the organization. Accompany by other stakeholders such as teachers, researchers, practitioners, and owner, management has to solve many issues daily related to education deliveries – especially with related to the matters such as: student complains, resource conflicts, budget requirements, government inquiries, and owner investigation. They have also needed to dig down tons of data and information to back them up in making quality decisions. With regard to this matter, several ICT applications should be ready and well implemented for them, such as:

1. Executive Information System - a computer-based system intended to facilitate and support the information and decision making needs of senior executives by providing easy access to both internal and external information relevant to meeting the strategic goals of the school;
2. Decision Support System - an application primarily used to consolidate, summarize, or transform transaction data to support analytical reporting and trend analysis;
3. Management Information System - an information collection and analysis system, usually computerized, that facilitates access to program and participant information to answer daily needs of management, teachers, lecturers, or even parents; and
4. Transactional Information System – a reporting and querying system to support managers and supervisors in providing valuable information regarding daily operational activities such as office needs inventory, student attendance, payment received, etc.

ICT as Integrated Administration System

The Decision Support System that has been mentioned can only be developed effectively if there are full integrated transaction system in the administration and operational levels. It means that the school should have an integrated computer-based system intact. Instead of a "vertical" integration (for decision making process), this system also unites the four pillars of ICT context in some ways so that a holistic arrangement can be made. The system should be built upon a modular-based concept so that it can help the school to develop it easily (e.g. fit with their financial capability) and any change in the future can be easily adopted without having to bother the whole system. Those modules that at least should be developed are:

1. Student Management System – a program that records and integrates all student learning activities ranging from their

detail grades to the specific daily progresses;
2. Lecturer Management System – a module that helps the school in managing all lecturer records and affairs;
3. Facilities Management System – a unit that manages various facilities and physical assets used for education purposes (e.g. classes, laboratories, libraries, and rooms), such as their schedules, allocations, status, etc.);
4. Courses Management System – a system that handles curriculum management and courses portfolio where all of the teachers, students, and facilities interact;
5. Back-Office System – a system that takes care all of documents and procedures related to school's records;
6. Human Resource System – a system that deals with individual-related functions and processes such as: recruitment, placement, performance appraisal, training and development, mutation, and separation;
7. Finance and Accounting System – a system that takes charge of financial management records; and
8. Procurement System – a system that tackles the daily purchasing processes of the school.

ICT as Core Infrastructure

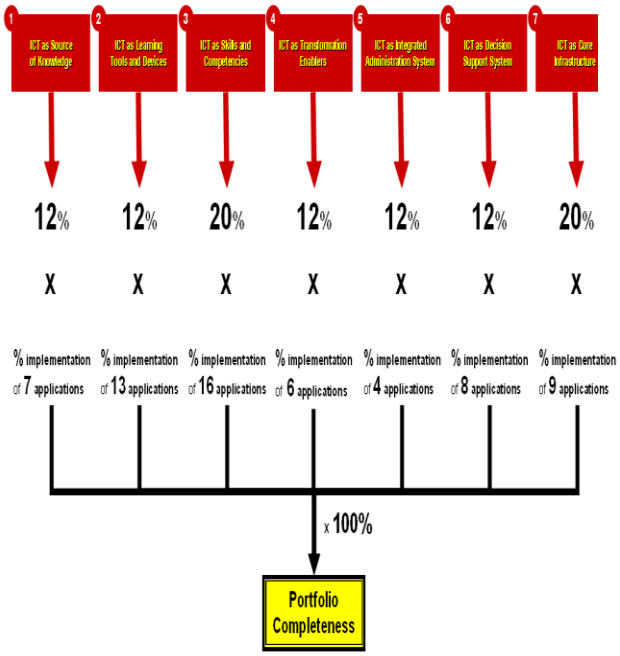
All of the six ICT contexts explained can not be or will not be effectively implemented without the existence of the most important assets which are technologies themselves. There are several requirements for the school to have physical ICT infrastructure so that all initiatives can be executed. In glimpse, these layers of infrastructure look like the seven OSI layer that stack up from the most physical one to the intangible asset type of infrastructure. There are 9 (nine) components that are considered important as a part of such infrastructure, which are:

1. Transmission Media – the physical infrastructure that enables digital data to be transferred from one place to another such as through: fiber optic, VSAT, cable sea, etc.;
2. Network and Data Communication – the collection of devices that manage data traffic in one or more network topology system(s);
3. Operating System – the core software to run computers or other microprocessor-based devices;
4. Computers – the digital-based processing devices that can execute many tasks as programmed;
5. Digital Devices – computer-like gadgets that can have a portion of capability as computers;
6. Programming Language – a type of instructions set that can be structured to perform special task run by computers;
7. Database Management – a collection of digital files that store various data and information;
8. Applications Portfolio – a set of diverse software that have various functions and roles; and
9. Distributed Access Channels – special devices that can be used

by users to access any of the eight components mentioned.

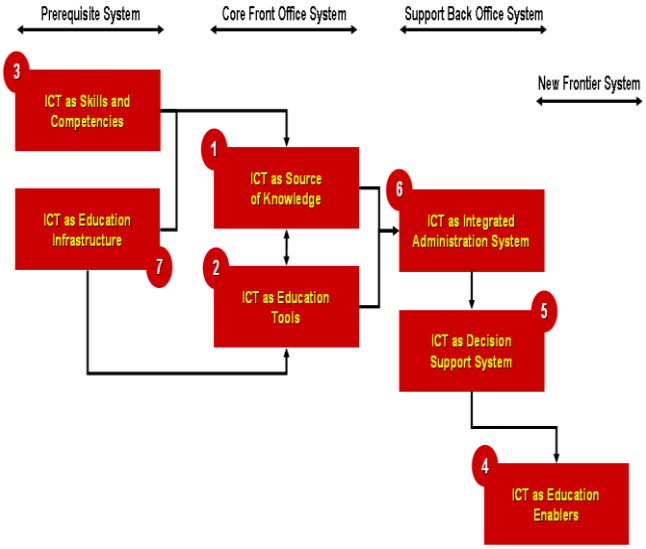
Measurements of Completeness

Every school in the country has been trying to implement the all spectrum portfolio of the applications. To ensure that from time to time an incremental improvement has been made, a performance indicator should be defined. The basic indicator that can be used as measurement is portfolio completeness. The idea behind such measurement is to calculate how many percent of the applications on each domain the school has been implemented. The total sum of it reflects the completeness measurement. A "0% completeness" means that a school has not yet implemented any system while a "100% completeness" has a meaning that a school has been implementing all applications portfolio.



Picture 3. Application Portfolio

In the calculation above a weighting system is used based on the principles that the existence of human resources and physical technologies are the most important things (people and tools) before any process can be done. People means that they have appropriate competencies and willingness to involve ICT in the education processes while technology represents minimum existence of devices and infrastructure (e.g. computers and internet).

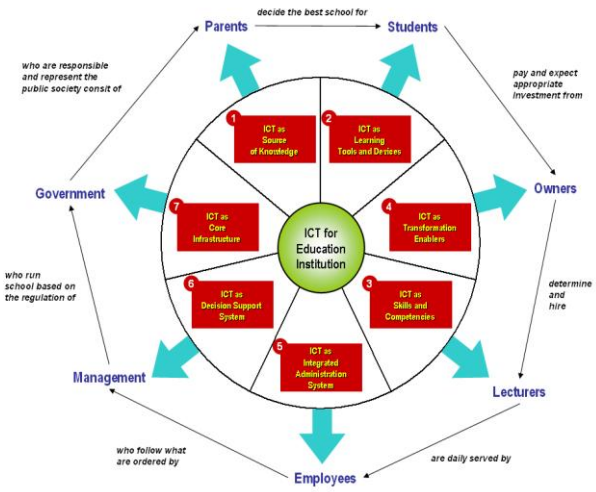


Picture 4. ICT in Education Processes

Stakeholder-System Relationship Framework

The next important thing that should be addressed is the Stakeholer-System Relationships Framework. It consists of one-to-one relation between a system pillar and a stakeholder type – where shows that at least there is a major stakeholder that concerns with the existence of a application type. The seven one-to-one relationships are:

1. Parent or sponsor of student will only select or favor the school that has embraced ICT as one of education tools;
2. Student will expect the school to use ICT intensively in learning processes;
3. Owner of the school should think how to transform the old conventional school into the new modern institution;
4. Teacher or lecturer must be equipped with appropriate skills and competencies to operate and use various ICT applications;
5. Employee of the school has no choice not to use integrated ICT system for helping them doing every day's administration activities;
6. Management of the institution should use ICT to empower their performance especially in the process of decision making; and
7. Government of Indonesia has main responsibility to provide the education communities with affordable ICT infrastructure to be used for learning purposes.



Picture 5. Seven One to One Relationship

Stakeholder Maturity Level

It is extremely important – for a developing country like Indonesia with relatively low e-literacy – to measure the maturity level of each stakeholder in education, especially after realizing the existence between stakeholder and the system and among the stakeholders themselves. By adapting the 0-5 level of maturity as used firstly by Software Engineering Institute, each stakeholder of the school can be evaluated in their maturity.

In principle, there are 6 (six) level of maturity as follows:

0. Ignore – a condition where a stakeholder does not really care about any issue related to ICT;
1. Aware – a condition where a stakeholder has some kind of attention to the emerging role of ICT in education but only rest in the mind;
2. Plan – a condition where a stakeholder has decided to conduct some actions in the future with favor to the ICT existence;
3. Execute – a condition where a stakeholder is actively using ICT for daily activity;
4. Measure – a condition where a stakeholder applies quantitative indicator as quality assurance of ICT use; and
5. Excel – a condition where a stakeholder has successfully optimized the use of ICT as its purposes.

Maturity Level	1 ICT as Source of Knowledge	2 ICT as Learning Tools and Devices	3 ICT as Skills and Competencies	4 ICT as Transformation Enablers	5 ICT as Integrated Administration System	6 ICT as Decision Support System	7 ICT as Core Infrastructure
	Parents	Students	Lecturers	Owners	Employees	Management	Government
0 ignore	Do not care about it	Do not care about it	Do not care about it	Do note care about it	Do not care about it	Do note care about it	Do not care about it
1 aware	Know about it, but do not take into account	Know about it, but do not demand such existence	Know about it, but do not use it	Know about it, but do not decide to allocate resources	Know about it but do not use it	Know about it, but do not use it	Know about it, but do not do anything significant
2 plan	Know about it and advise the candidates	Know and demand for the implementation	Know about it, and prepare for implementing it a.s.a.p.	Know about it and decide to do some investment	Know about it and prepare for changing work environment	Know about it and agree to implement it	Know about it and have develop master plan as roadmap
3 execute	State as the main mandatory requirements	Use it in the class for learning purposes	Use it for teaching devices in the class	Build and Develop the facilities for institution	Acquire and use various applications for daily activities	Acquire and use it for various decision making purposes	Build the technology for widely use by education institution
4 measure	Compare and benchmark one institution to another	Frequent use inside and outside the class	Often use it for teaching inside and outside the class	Invest more money based on cost-benefit analysis	Agree to insert it as one criteria for performance indicators	Decide all matters based on the indicators analysis	Aim for cheaper, better, and faster access by the society
5 excel	Select for the best recognized institution	Go for "one student-one tool" environment	Equip themselves with complete set of teaching devices	Periodically allocate money for maintaining state-of-the-art technology	Fully use all features of the applications effectively	Implement expert and intelligence system	Define and classify technology as public goods

Picture 6. Stakeholders Maturity Level

By crossing the six level of maturity with all seven stakeholders, it can be generated the more contextual conditional statements based on stakeholder's nature.

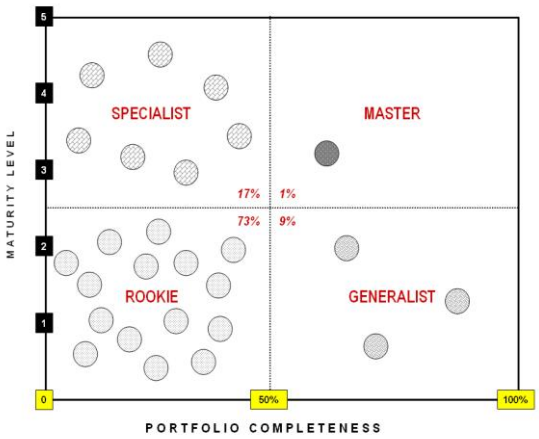
Mapping into ICT-Education Matrix

So far, there two parameters or indicators that can show the status of ICT for education development in Indonesia, which are: portfolio completeness and maturity level. Based on the research involving approximately 7,500 schools in Indonesia – from primary school to the college level – the existing status of ICT development can be described as:

- Rookie – the status where majority of schools (73%) only implement less than 50% of complete applications and have average maturity level of stakeholders less than 2.5;
- Specialist – the status where 17% of schools has high maturity level (more than 2.5) but only for implementing less than 50% of total application types;
- Generalist – the status where more than 50% applications have been implemented (or at least bought by the schools) but with the maturity level of less than 2.5 (approximately 9% of the schools are in this type); and
- Master – the status where more than 50% application types have been implemented with the maturity level above 2.5 (only 1% of schools fit with this ideal condition).

Also coming from the research, several findings show that:

- Most schools that are in a "master" type are located in Java Island and considered as "rich institution"
- Most schools that are in "rookie" type are considered as "self-learning entrepreneur" since their knowledge to explore the possibilities to use ICT in education is coming from reading the books, attending the seminars, listening the experts, and other sources;
- Most schools that are in "specialist" type are profiled schools that have pioneered themselves in using ICT from sometimes ago; and
- Most schools that are in "generalist" type are the ones that receive one or more funding or helps from other parties.



Picture 7. ICT – Education Matrix

The Plan Ahead

So far, there two parameters or indicators After understanding all issues related to the strategic roles of ICT within Indonesia education system setting – and through depth understanding of the existing conditions – a strategic action can be planned as follows:

- 2005-2007 – there should be 200 selected pilot schools that have been successfully implemented all applications portfolio with the high maturity level of stakeholders (master class) spreading out in the 33 provinces of Indonesia;
- 2007-2009 – these 200 schools have responsibilities to develop 10 other schools per each so that 2,000 schools in 2009 that are in master level class;
- 2009-2010 – the same task apply to the new 2000 schools so by 2010, approximately 20,000 schools can set the national standard of ICT in education (since it already covers almost 10% of total population).

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