Designing of integrated information system (IIS) scheme for private higher education in Indonesia: a strategic plan

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Abstract. The private higher education (PHE) is now starting to intensify the use of IT (Information Technology). Often the activities conducted under conditions that are not ideal due to budget constraints. To develop the ICT (Information Communication Technology) systems in legalization efforts of private higher education is to encourage the use of software based on open-source software, the integration of all cross-data unit services within a more efficient organization to support the Decision Support System database and data warehouse, a service that is prioritized for all and access to all levels and access universally. Integration of both horizontally (between systems managing different areas) and vertically (following a structural hierarchical relationship). Placed within the framework of a holistic, top-down approach. Developed and implemented naturally, from the base (database infrastructure) grew (application and access). The PHE development done gradually evolved in different time frames, focus on procurement and IT facilities, both hardware and software. Focus on how to manage IT-based services. Focus on how to bring IT and internal seep into the organizational structure, and ultimately the transformation of the organization and the people in it. Stages of analysis can be defined with the Use Case diagrams, divided into several main modules.

1. Introduction

The rapid evolution of information and communications technology (ICT) is bringing drastic changes to society and industry [1]. The private higher education (PHE) [2] as a whole institution began to feel explain more intensive in IT (Information Technology) support and comprehension. Often the activities carried out under operating conditions that are not ideal such as limited funds, the budget system is less support, and limited human resource capacity. At the time of the institution requires the integration of information, the difficulty arises because the systems of information on the units are not able to work in an integrated way [3], negative infrastructure [4].

The condition of the Information and Communication Technology (ICT) [5] such as Superstructure campus, Infrastructure Technology, Stakeholder Profile, Variety Utilization
Applications, National Education Strategy, impression and Benefits Application of Technology, External Communities, Research & development, E-Green [6] (Green ICT), Innovation (Education) [7] indicates in Fig.1 below the application of the ICT in higher education in North Sumatera is poor [8].

![Spider web diagram of ICT PHE North Sumatera](image)

**Figure 1.** Spider web diagram of ICT PHE North Sumatera [9].

Investment calculation using the benefit cost ratio (BCR) = total benefits / total costs = total present value / total investment = 4.66. BCR calculation results showed the ratio is greater than 1 (one) in the amount of 4.66 this indicating the value of benefits cost more dominant than that produced so that this alternative would be more helpful about 400% of the total investment if the IIS develop [10][11]. quality service [12], improving the competitiveness [13], improving their profitability [14], Increased productivity and job performance [15].

In this paper, we want to study designing of an integrated information scheme as a roadmap strategic plan for private higher education

1.1 Method
The inquiry was conducted using research methods to examine the object of research literature is PHE activity in Medan to the ICT [8].

2. System And Modelling

2.1. Development System and Access Services
To develop the ICT [16] systems in Private Higher Education (PHE) in North Sumatera-Indonesia, there are a number of steps to be taken such as legalization of software, information systems integration, and warehouse database and access services for all. The legalization of software serves to encourage the use of open-source software [17] based on the relatively cheaper so as to reduce the cost of software procurement spending. Allocation of software procurement funds could be diverted to an increase in human resources or education and training. With an integrated system [18], the entire administrative process is expected to be more effective, efficient, transparent, and able to suppress the negative things that hinder the ongoing process. Likewise, the speed of information flow in support of Decision Supports System (DSS) [19] will be very effective in the era of ICT-based leadership [20]. The integrated information system [21] includes the integration of all the services applied cross-study programs and units within one organization to more efficiently [22]. The objectives of accelerating the
development of ICT-Based PU were to improve the quality of education provision and contribute to the development of information systems of university in Indonesia.

Integrated [23] Information System (IIS) is needed in the PU for all communities in their respective campuses. Therefore it is necessary to prioritize services and access for all (universal service obligation, USO) [24] [25] and (universal access obligation, UAO). There should be no community members who do not have access to ICT services (digital divide) because; access is not to make the community as a consumer [26], but also as a producer of the content. In Fig. 2 below is a Architecture Framework integrated information system and in figure 3 below is Information Systems Integrated Roadmap.

![Architecture Framework Integrated Information System](image_url)

**Figure 2.** Architecture framework integrated information system.
2.2. Information Systems, Applications, and Electronic Services

Development of information systems should be done in an integrated manner in order to accommodate the needs of increasingly complex information. The integration is carried out both horizontally (between systems that manage different areas) and vertically (following structural hierarchical relationship). System integrated information is then needed to be placed in an architectural framework that is holistic. Use of the architecture of the system level software is a necessity; given the complexity of the systems to be built require a development framework that can explain the position of each component of the system and its links with other components.

The scope of development in the field of information systems, applications and electronic services are to realize the implementation of systems in terms of architecture. All systems are built as integrated information [27], both among themselves and with the components of the system. Currently, not all information systems have built up, as well as its integration is still not running. The targets were in the development of information systems, applications, and electronic services emphasis on the availability, integration, and the effectiveness of utilization. In contrast to the infrastructure [28], the development of information systems has implications should do the adjustment bureaucratic processes associated with the system. The success of the alignment between information systems and processes in the bureaucracy is also an indicator targeting.

2.3. Modelling of Information System

Manifestation of information technology may be the ease, speed, productivity, accuracy, efficiency, and greater transparency. Everything was not done, now it is becoming possible because of the help of
information technology. Enabling process involving information technology is almost always followed by the need for alignment of business processes. For an example; the provision of Study Plan Card (KRS) on-line must be accompanied by changes in process or KRS stages. Liabilities facing academic [29] supervisor to request a signature authorization load semester credit unit (credits) to be taken can be eliminated, since this task was taken over by computers. Changes in business processes are not the domain of information technology, but without doing this, the implementation of information systems and technology is of little use. Information technology planning must consider its consequences.

The problem arises at the moment of an institution, as an institution (enterprise), begins to fill IT needed support in a more intensive and comprehensive. At a time when institutions look to these units, which look is a mosaic of the IT systems are variegated, who each worked for the benefit of the units. Data processing and information needs at the level of institutions in general are integrated (information is aggregated, filled by more than one source of information systems). At a time when institutions are demanding the integration of information, there are problems because information systems existing in units unable to work are integrated. Partial and sectorial view of systems that build the barrier walls between systems with another system to form integrated. In the field, difficulties arose in the form of a data format incompatibility, system not in accordance with standard operating procedure (SOP), validity and data integrity etc.

Next issue of the integration of information is generally more going into college that his growing IT development from the bottom (bottom up) because each faculty or study program devising their own application itself as well as other technical units. Nevertheless, it does not mean the using model of development apart from the top-down does not solve this problem. Integration of true information is not associated with the model of top-down or bottom-up, but is determined by a great design (the grand design) system and information technology. A great design to determine the architecture of the system at the enterprise level, and this is where the integration aspect is defined.

Building the information integration does not mean uniform system constituent the information systems. In the top-down model, this uniformity is more possible because of strategic decisions in the procurement information system is fully determined centrally at the institutional level (enterprise). This condition is usually almost impossible if still using a bottom-up model. Since the initiative system development is done from the bottom level, and then almost certainly would appear heterogeneity. If this occurs, it is usually almost impossible uniformity, because the cost (both technical and social) will be very high. In the context of heterogeneous, information integration built without sacrificing systems that already exist. Technology it is possible, but in the end preferred way of integration must also take into account the principle of effectiveness and sustainability.

Schematic design of information systems will be more easily implemented with a top-down approach. Architectural design of information systems can be built and implemented naturally, from the foundation (infrastructure database) growing up (application and access). Although PHE some applications already have a heterogeneous mosaic architecture, implementation of information integration is done by "sew" the components with one another. "Stitches" which is the connecting thread between components, so that the communication and interaction can still be done in a heterogeneous condition.

Architectural design to accommodate the needs of information integration at the institutional level is needed. This design was not only about the integration between information systems, but also how information systems are accessed homogeneously in the same way (the principle of transparency of access). Using the principle of coating (layering), is modular [30] with a clear interface concept that a high level of extensibility. The addition of new information systems or new access modes can be done relatively easily because each component and layer have a scope, specifications, and a clear interface.

The hierarchical structure of the layers also shows the sequence of the flow of information from user access. User access of data and information through a variety of modes, through one integrated portal, using information systems that exist, and work with the data. The design of the horizontal dimensions (each layer) and vertically (inter-layer interaction) which will build a good overall integration as well (seamless integration).
PHE has a volume of a broad scope of administrative affairs. There are many areas (teaching-learning process, finance, human resources, assets, research, collaboration, and so forth) and structural levels (directors, study program, students). With the scope of such great affairs, PHE requires a driver's license consisting of a variety of information systems, for various types of use, at different levels of authority. It required a scheme to classify the information systems so easy to put in the right position.

Technically, information systems can be made using existing technology. Many options are available, both Open Source and free, as well as proprietary and paid. In technical terms, the information systems are systems based on client-server that can run on a computer network and the Internet. Component consists of a server component that implements the back office application, database management systems, and client applications. PHE used the programming language PHP, MySQL for database management, and Apache as the web server. This option is reasonable, considering all of these tools can be obtained free of charge, and technical support can also be obtained easily.

3. Integrated Information System Scheme

The need for the ability to organize information based on the information demanded information system can communicate with each other. The ability of communicate means being able to send or receive data from other system, despite the different platforms used. Overall, the relationship between information systems will build a large integrated system.

Associated with system integration requirements, the analysis needs to be able to identify the "meeting points" (interface points) between two different aspects in a series of business processes. The points of this meeting show how both these aspects interact. PHE information systems development is done in stages. E-registration, e-marketing, e-management, e-lecturer, e-student and e-learning developed in different time frames. Challenges faced in the analysis and design of an information system is, in addition to the ability to take pictures of all the relationships between entities that are considered important in the domain of information systems, must also be able to provide enough flexibility for entities from other information systems to build relationships with entities of information systems Here you are. Issues arise when implementing the integration of data frameworks is the heterogeneity that happens. The thought of execution of framework integration is tired the early stages of framework advancement and was top-down.

The framework integration of PHE in Medan was done after waking data frameworks and operations on the space and units respectively. Because development is not centrally coordinated, there is usually a pretty big difference between the platforms of these systems. Contrasts in equipment, working frameworks, programming dialects, and database framework makes communication between the framework cannot be done straightforwardly. Luckily today's innovation has been able to suit these contrasts. Interoperability advances such as web benefit enable the two frameworks with diverse stages to communicate through standard conventions. Nowadays the utilize of web administrations for the purposes of integration of data frameworks has been very prevalent, and arrangements to an assortment of improvement stages (PHP) is additionally accessible.
A matter of concern is that the integration is done by keeping up more seasoned frameworks and construct "bridges" between the framework will not provide ideal comes about. The objective of integration cannot be accomplished since the more seasoned frameworks are by plan not planned to realize the objective of integration. Fractional plan (as it were for certain sectoral interface), as on the off chance that the "boundary" to the accomplishment of the objectives of inside integration. To realize full integration of thought and required and overhaul of the existing framework. Tragically, this technique requires colossal assets, a tall level of consistency, and a long time.

Another issue concerning the implementation of the integration is the migration strategy for older systems to the new integrated architecture. Leaders PHE set the effective date of the new system and also the abandonment of the old system. This method is fast, but high-risk business and social. The unpreparedness of some units or emerging resistance can disrupt the organization as a whole, because there is no backup system again after the old system was abandoned. More conservative strategy is to integrate gradually. The first step is determined to be taken, then the integration process carried out based on the stages.

Although it takes more time, is a more secure way for businesses and social risks can manageable. The old system is still there in case unanticipated circumstances arise before. PHE also can minimize the resistance that arises, for example, with the approach of the successful examples. The units / modules has been successfully integrated as an example and exposed the advantages and benefits to attract people who oppose. Information Systems integration strategy with Phased Approach, this is because:

Figure 4. Scheme for information systems integrated
• Start from the bottom and utilize existing information systems
• The system of information-system arranged to follow the pattern of integration of information and information needs will come
• It took a long time and consistent in order not to fail
• Relatively cheap compared to SAP or Oracle
• Need a specific strategy (Non Technical Including Political Will of Leadership)
• Integration should be based on clear goals. At the end of the integration should lead to the improvement of processes / services
  • Focus on business processes / bureaucracy, not on information systems
  • Specifically note the grooves are formed of a series of activities
• Identification of the parties involved: the role, duties, powers, and activities that do all of this into a predetermined groove
• The similarity of views on integration need to be built
• Support needs to be prepared
• If there is no information system at all, the various parameters of integration (data format, data communication protocols, database, user interface, and so on) can be defined more easily
• If there are some previous systems (and different from each other):
  • Selecting one of the system and promote it as a standard system; other systems should follow
  • Building a new standard and forcing all the system should follow this standard
  • Building a new standard and let all the old system as it is; integration is performed by a system Integrator

Figure 5 showed the first stage of integrated information system scheme of PHE.

4. Conclusion
Strategic plan, roadmap, scheme and working plans taking into account the urgency and the proper fees implemented integrated information system. The PHE development done gradually evolved in
different time frames, focus on procurement and IT facilities, both hardware and software. Focus on how to manage IT-based services.

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