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ANALYSIS OF THE IMPACT OF INFORMATION TECHNOLOGY INVESTMENTS-A SURVEY OF INDONESIAN UNIVERSITIES

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ABSTRACT

In recent years, the utilization of information technology has been magnificently increased in service industries, particularly, education institution, which by using Information Technology related products such as academic information system and learning management system. In Indonesia, universities invest enormous resources in information technology (IT), with little evidence of the latter's effectiveness. Stakeholders struggle with gauging how effective or ineffective making these investments truly is, given the lack of instruments of measurement by which to establish, for instance, an internal rate of return or a period of recovery on investments. This paper investigates the impact of investment in information technology on the return on assets (ROA) of selected private universities in Indonesia for the period 2008 - 2014 using Adapted Information Economics. By using this method, it is possible to implement into other university. Primary and secondary data were collected during this research. The study recommends that universities should increase investments in software, hardware and infrastructure which will enhance their Management Information System and profitability.

Keywords: IT investments, management information system, university, impact, return on assets.

INTRODUCTION

Information is an important resource in the operation and management of organizations. The availability of appropriate information is vital for effective performance of managerial functions such as planning, organizing, staffing, directing and controlling. Indeed, today's organizations run on information using information system. An information system encompasses transaction processing systems, management information systems, decision support systems, and strategic information systems.

In recent years, the utilization of information technology has been magnificently increased in service industries, particularly, education institution, which by using Information Technology related products such as academic information system and learning management system. Therefore, many organizations are competing to invest in order to optimize the resources at their disposal
The huge of money of which must be paid to invest in information technology (IT) makes many people began to wonder, "are we spending enough or too much on information technology?". The fact states that the benefits of IT investments can be counted (tangible) or uncounted (intangible). These benefits are also there which can be felt directly and there are also only be felt after a certain period of time.

Much of the research on investment analysis of information technology (IT) has been carried out for the various fields in recent years, particularly by developing countries, for example in Fiji [1], in Mexico [2] and in China [3]. Analysis of IT investments in the banking industry has done in Nigeria [4], Ghana [5] and Kenya [6]. Analysis of IT investments in telecommunications companies in France have also been carried out [7]. In Turkey, has done an analysis of IT investments on national and multinational companies [8], while in China a similar study on the industry supply chain [9].

In Indonesia, universities invest enormous resources in information technology (IT), with little evidence of the latter's effectiveness. Stakeholders struggle with gauging how effective or ineffective making these investments truly is, given the lack of instruments of measurement by which to establish, for instance, an internal rate of return or a period of recovery on investments. There is also no evidence by which to link IT investment to improvements in a university's performance.

This paper investigates the impact of investment in information technology on the return on assets (ROA) - The return on assets measures the rate of return on the assets by the university - of selected universities in Indonesia for the period 2008 - 2014 using Information Economics. In this study, IT investment level, IT usage, IT at making decision process concepts and their effects on technology orientation, future orientation and university performance were investigated and a research model was developed. The study specifically assesses how the adoption of MIS by universities' management in Indonesia impacted on the service performance of their universities in term of returns on assets.

Furthermore, the paper basically is divided into five sections. Section one is the introduction as above; Section two is the literature review and theoretical framework. Section three is the research methodology adopted for the study, followed by section four which is discussion of results and findings, and section five is about conclusion and recommendations.

INFORMATION ECONOMICS

Information Economics (IE) is a set of equipment (tools) to quantify the computational costs and benefits of an IT project [10]. This method was introduced by

Marilyn M. Parker and his team of IBM in 1985, which is used to quantify the cost and benefits of IT projects. IE method is a development of the Cost Benefit Analysis (CBA) traditional. IE was developed because of the needs of the company to find out how the economic impact of IT investments on the company.

IE is used to analyze the costs and benefits, which quantify the cost of IT project results, are expected to provide benefits to the company. The basis of IE is value which can be regarded as a size and cost incurred by the company, which is associated with the progress of the company's business. Meanwhile, according to Robson (1997, p237) IE explicitly evaluating investment alternatives and information systems by identifying and evaluating, scoring, and ranking, the positive factor (value) and negative factors (risk or uncertainty) from a set of potential investment candidates.

Value is based on the profit from the competition, reflected in the performance of present and future dating [10], which will increase profits in excess of its competitors and the value will make the management is willing to do investment. Cost is a measurement of the amount of resources needed to obtain a product [10]. Cost specified in the measurement currency (e.g. rupiah or dollars). In IE, there are two types of costs, namely investment cost and ongoing cost. Maintenance costs are included in the ongoing costs.

IT Benefits are divided into two categories: tangible benefits and intangible benefits. Tangible benefits are benefits that directly affect the level of corporate profits, while the benefits are intangible benefits that seem to have a positive influence on the company but do not directly affect the company's profit [11, 12].

Activities within a company can be divided into two major parts, namely the business activities and technologies that support business activities [10]. The term "domain" itself is used to characterize the two different activities. IE uses the two domains as a model. From the standpoint of the business domain, the value created by the use of IT, such as an increase in revenue, cost reduction, and increased effectiveness. From the standpoint of technology domains, can be seen the value of the benefits derived by the business domain.

Cost Benefit Analysis is the most common technique used to quantify the costs and benefits of an IT project [13, 14]. To perform a cost benefit analysis, it must first determine the costs and benefits are worth to be taken into account, how costs and benefits weighted, and to achieve all this, what obstacles would be likely to arise. Cost is the amount of resources allocated/spent to finance the project. Meanwhile, the benefit is savings, cost reduction, profitability, increase effectiveness or productivity of the employees. The costs will be calculated by using the development costs and running costs worksheet. While the benefits will be calculated using Linking Value, Value Acceleration, and Value Restructuring, Valuation and Innovation techniques. After determining the expected benefits and costs of project implementation, the relationship of these benefits against the costs needs to be defined [15]. There are several approaches used to develop the relationship between costs and benefits, including:

- **Simple Return on Investment (ROI)**

This technique is also called the accounting rate of return. Simple ROI is the ratio of the average net income of the project on the project's internal investment. This method is excellent for project data processing or information systems. Expected implementation costs, operational costs and benefits are determined for many years to come.

- **Present Value (PV)**

The present value is a future amount of money that has been discounted to reflect its current value, as if it existed today. The present value is always less than or equal to the future value because money has interest-earning potential, a characteristic referred to as the time value of money.

$$PV = \frac{(C)t}{(1+i)^t} \quad (1)$$

Where (C) t is the future amount of money that must be discounted, t is the number of compounding periods between the present date and the date where the sum is worth (C) t, and i is the interest rate for one compounding period.

- **Internal Rate of Return (IRR)**

The internal rate of return (IRR) is a rate of return used in capital budgeting to measure and compare the profitability of investments. IRR calculations are commonly used to evaluate the desirability of investments or projects. The higher a project's IRR, the more desirable it is to undertake the project. Assuming all projects require the same amount of up-front investment, the project with the highest IRR would be considered the best and undertaken first. Because the internal rate of return is a rate quantity, it is an indicator of the efficiency, quality, or yield of an investment. This is in contrast with the net present value, which is an indicator of the value or magnitude of an investment. An investment is considered acceptable if its internal rate of return is greater than an established minimum acceptable rate of return or cost of capital.

Analyze proposed project by looking at the IRR calculation is as follows: IRR greater than required rate of return, the project is acceptable. Moreover, if IRR < required rate of return, the project is rejected.

- **Net Present Value (NPV)**

NPV is the difference amount between the sums of discounted: cash inflows and cash outflows. It compares the present value of money today to the present value of money in the future, taking inflation and returns into account (Hayes *et al*, 2005). This method uses a discount

rate that is determined by the cost of capital to establish the present value of a project. NPV formula is as follows:

$$\text{NPV} = \sum_{t=0}^{n} \frac{(C)_t}{(1+i)^t} - \sum_{t=0}^{n} \frac{(C_0)_t}{(1+i)^t} = \sum_{t=0}^{n} \frac{R_t}{(1+i)^t} \qquad (2)$$

where: t is the time of the cash flow, i is the discount rate and Rt is the net cash flow i.e. cash inflow - cash outflow, at time t.

Reviewing the proposed project NPV gives instructions (indicated as follows): NPV is positive means the project proposal is acceptable. NPV is 0 means neutral. NPV is negative means the project proposal is rejected

RESEARCH METHODOLOGY

This research uses both descriptive and field survey research methods with a population of 5 private universities in Indonesia. The research uses primary and secondary data of selected universities. For the secondary data, it is a time series data therefore the data to be used for this study is pooled data that examines the impact of information technology project on the Return on assets.
Research methodology that has been conducted by the researchers can be seen in the Figure-1.

Firstly, the benefits of information system must be identified. Identification of the obtained benefits with the implementation of information system divided into two parts, namely the tangible benefits and intangible benefits. Tangible benefits were collected from reduced operating costs directly on the economic worksheet impact. While intangible benefits will be calculated by the concept of value linking, value acceleration, value restructuring, and innovation valuation. A preliminary study based on the extent of the use of IT in universities. Semi-structured interviews were held with the executive management, middle management and operation management, focusing on the benefits achieved from the IT investments at operational level.

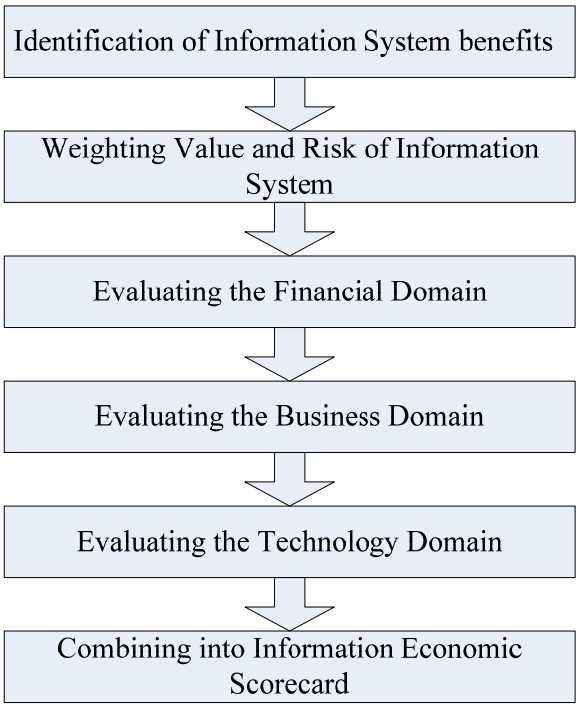

Figure-1. Research Method.

In the IE framework, the values and risks are needed to be weighted. To find the weighting for the value and risk, necessary tools like questionnaire are needed. Questionnaires carried out on people who are concerned and aware and involved in the SI Academic. This questionnaire is on a 5-point likert scale, with 1 indicating excellent benefits, and 5 indicating no benefits at all.

Next, the evaluation of the financial domain includes CBA analysis, linking value, value acceleration, and value restructuring. The evaluation of business domains includes strategic match analysis, competitive advantage, competitive response, management information systems, and organizational project risk. Evaluation of technology domain includes analysis of strategic architecture, definitional uncertainty, technical uncertainty, and IS Infrastructure Risk. Finally, the weight of the simple ROI calculation, combined with the assessments of the business domain and the technology domain, are then combined using the IE scorecard.

DISCUSSION AND RESULTS

There is value and risk of information systems in the context of business domains and technology domains that enable to quantify financially because of the values and risks are generally intangible.

In the IE framework, the weighted value and risks are needed. Questionnaire is a required tool to determine the weighted value and risk. Questionnaires carried out on people who are concerned and aware and involved directly in the information system.

The factors in the business domain are divided into five categories, namely financial values, strategic

values, stakeholder values, risk strategy competition, and organizational risk and uncertainty. Whereas in the technology domain is divided into three categories, namely: strategic values, competitive strategy risk, and organizational risk and uncertainty. The weighted value is presented in Table-1.

In the system development and implementation, investment costs are a must. Investment costs include the cost of hardware and software. The cost of the hardware is all expenses associated with the purchase of physical computer equipment. The example of initial investments in the hardware is computer server, memory, and storage. The cost of the software is all expenses associated with the purchase of software for the server. The example of initial investments in the software is operating system and database management system.

Table-1. Weighted value.

Business Domain		**Condition**	**Weighted Score**
Financial Value			
	Return on Investment	High	+ 4.6
Strategic Value			
	Strategic Match	High	+ 4.7
	Competitive Advantage	Medium	+ 4
	Competitive Response	Medium	+ 4
	Management Information for CSF	High	+ 4.7
Stakeholder Value			
	Service and Quality	Medium	+ 4.7
	Environmental Quality	High	+ 4.3
	Agility, Learning and Empowering	High	+ 3.7
	Cycle Time	Medium	+ 4
	Mass Customization	Medium	+ 3.7
Competitive Strategy Risk			
	Business Strategy Risk	Fair	- 3
Organizational Strategy Risk and Uncertainty			
	Business Organization Risk	Fair	- 3
Technology Domain		**Condition**	**Weighted Score**
Strategic Value			
	Strategic IT Architecture	Fair	+ 3.7
Competitive Strategy Risk			
	IT Strategy Risk	Low	- 2.3
Organizational Strategy Risk and Uncertainty			
	IT Definitional Uncertainty	Low	- 1.3
	IT Technical and Implementation Risk	Medium	- 4
	IT Service Delivery Risk	Fair	- 3.7
Total of Value			+ 46.1
Total of Risk and Uncertainty			- 17.3

In addition to the initial investment costs, running costs are also calculated for 5-year calculated from the year 2012 to the year 2017 in the development of this system, running costs will be incurred include maintenance costs of software, labour costs, and the cost of electricity.

Value linking is used to evaluate financially the combined effects of improving performance of a function any consequential results from a separate function. Some of the effects that result in improved performance as intangible benefits such as increasing employee productivity and reducing human error.

Table-2. The assessment of business domain and technology domain.

Business Domain		**Condition**	**Score**
Financial Value			
	Return on Investment	High	+ 1
Strategic Value			
	Strategic Match	Fair	+ 4.3
	Competitive Advantage	Fair	+ 3.7
	Competitive Response	High	+ 4.7
	Management Information for CSF	High	+ 5
Stakeholder Value			
	Service and Quality	High	+ 5
	Environmental Quality	Fair	+ 4
	Agility, Learning and Empowering	Fair	+ 4.3
	Cycle Time	High	+ 4
	Mass Customization	Fair	+ 4
Competitive Strategy Risk			
	Business Strategy Risk	High	- 4.7
Organizational Strategy Risk & Uncertainty			
	Business Organization Risk	Low	- 4.7
Technology Domain		**Condition**	**Score**
Strategic Value			
	Strategic IT Architecture	High	+ 4.7
Competitive Strategy Risk			
	IT Strategy Risk	Low	- 2
Organizational Strategy Risk & Uncertainty			
	IT Definitional Uncertainty	Medium	- 3
	IT Technical and Implementation Risk	Medium	- 3.6
	IT Service Delivery Risk	Fair	- 4
Total of Value			+ 44.7
Total of Risk and Uncertainty			- 22

Assessment on the business domain consists of 5 categories, namely: financial values, strategic values, stakeholder values, strategic competitive risk, and organization of risk and uncertainty. While, assessment of the technology domains include: strategic values, competitive strategy risk, and organization of risk and uncertainty. Table-2 summarizes the assessment of business domain and technology domain.

After weighting and scoring, IE Scorecard was created. It can be seen in Figure-2.

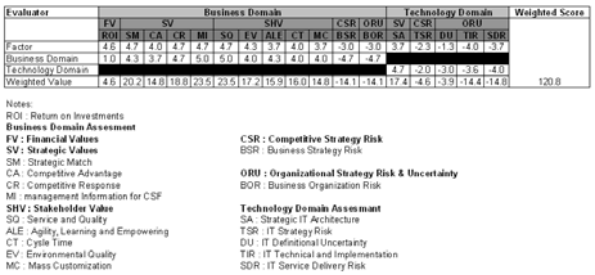

Figure-2. IE Scorecard.

After doing the calculations of weighted score and get the value of 120.8, then this value will be incorporated into the likert scale to determine and assess how much influence investment and information technology systems to universities. This value is inserted into a likert scale with maximum and minimum values obtained from Table-2. Based on these values, the score of predicate Table is designed to categorize feasibility scores of a project. Predicate Table can be seen in Table-3 with a value of 120.8, the project is considered good and worthy to be applied and developed to support the activities of the business processes at the university.

Table-3. Predicate Table of IT Project.

Score	Predicate
164 - 210	Very Good
109 - 163	Good
54 - 108	Fair
(-1) - 53	Low
(-65) - (-2)	Very Low

After performing the analysis, an application was developed in order to facilitate the calculation of ROI, NPV, and IE Score. The program was created by using Microsoft SQL Server 2005 for the database and the Microsoft Visual Basic Net 2010 as programming language. The main form of the application can be seen in the Figure-3.

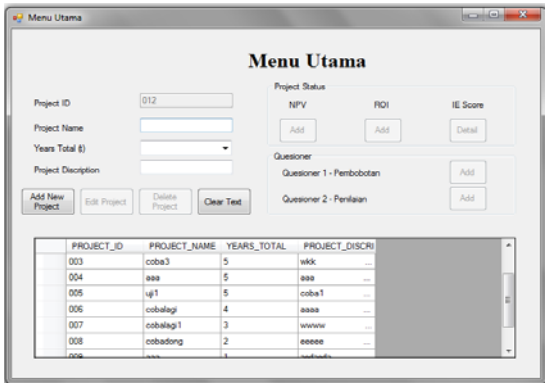

Figure 3. The Main Form.

The weighting form is used to calculate the weighted values and risks. The interface of this form can be seen in the Figure-4.

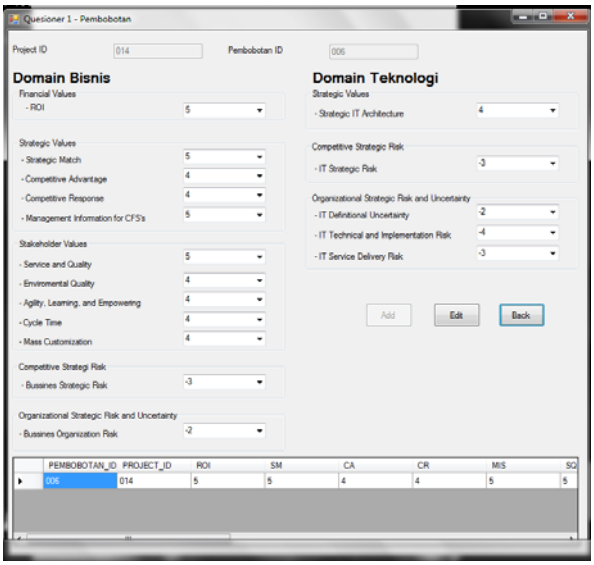

Figure-4. The Weighting Form

The IE scorecard form is used to calculate the IE Score and saved into the database. This form can be seen in the Figure-5.

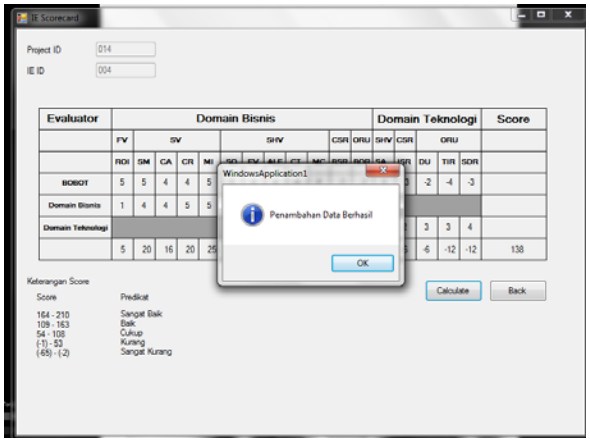

Figure-5. The IE Scorecard Form.

CONCLUSIONS

Overall, the obtained results from the questionnaires in IE Scorecard resulting in a total project value of 120.8. Using the predicate Table, the value of 120.8 means the project gets a good rating. This shows that the project of university information Systems is feasible to develop.

The study recommends that universities should increase investments in software, hardware and infrastructure which will enhance their Management Information System and profitability. These results should

be important to university managers and practitioners beside IT researchers; because IT investments have a vital role today's organizations. The investments' costs are important for organizations. Hence, IT's role in the organizations and maximize the benefits of IT are very important for performance and success of the organizations in the future. This study can be done in universities at developed country such as Australian and the results can be compared.

Information Economics has shown that an investment in information technology is not adequately evaluated mathematically only. There are values which can not be quantified, which is a unique value in the business domain and technology domain that needs to be considered. The results of this research will be more accurate if there is more in-depth analysis including intangible benefits.

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