

MEASUREMENT OF IT/IS INVESTMENT ON THE IMPLEMENTATION OF ERP AND THE EFFECT ON COMPANY PRODUCTIVITY

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Information technology can not be denied in daily activities and is the source of life of some business processes that cause companies to compete in making IT investments. Noted that IT investment increased significantly. However, the data also indicated this investment is not always followed by the achievement of organizational performance. This is known as IT Productivity Paradox, where the benefits obtained do not match what is invested. This phenomenon has long been discussed to this day. IT Productivity Paradox has become an interesting topic in some circles because some findings find different results. Some research proves that investment in IT / IS has driven the performance of the company, while not at other companies. This study aims to determine the phenomenon of IT productivity. The object of research is an organization that has invested and developed ERP system for the last 2 years. The analysis using Information Economics method. The result of investment measurement from this research shows that the application of ERP using Economic Information method in the period of about 2 years shows total project score (64,6) with predicate of influential project. The total score of the project is derived from three aspects of benefits, namely the real aspect, the quasi-real aspect, and the intangible aspect.

Keywords: Investment of IS / IT, IT Productivity Paradox, Information Economic

I. INTRODUCTION

Information technology is undeniably a mandatory requirement that is applied in daily activities and is the life of some business processes in the company. Changes from the manually carried out process have now been computerized in such a way as to cause changes in business processes in each company. This kind of event resulted in companies competing to make IT purchases on a large scale. Recorded in 2015 IT spending in Indonesia was 199 trillion and increased by 8.3 percent increasing in 2016 to 214.4 trillion [1]. This kind of phenomenon is not only for large-scale companies but in the SMEs sector also experiences similar phenomena and Indonesia is listed as the country with the

most investment. Information technology (IT) in a company is said to have a role of competitive advantage, but when companies invest more in the IT field in line with the income that has been obtained by the company.

IT Productivity Paradox is a phenomenon where IT investment carried out by a company does not provide an increase in company productivity [2]. Productivity in a company is not just one of the company's goals but a chain of activities in an organization or commonly called a company's goal in the long run. Maximizing productivity can improve the company's standard of living [3]. The Paradox IT productivity phenomenon is a study that occurs in several companies that have implemented IT in running the company's business processes. Some research shows that from the past 20 years to the present phenomenon the paradox of IT Productivity remains something that is being studied. This study considers that investment in information technology does not have a significant impact in improving corporate finance [4].

Some empirical studies have had difficulty determining the relationship between IT investment and financial performance. The Empirical Study above is proven through some research evidence, this study compares successful users of implementing IT with users less successful in implementing IT. But it is more focused on the successful use of IT, especially to measure the phenomenon of the IT Productivity Paradox. As many as 71 companies examined their financial statements in the last 10 years, the results show that companies that successfully implement IT can be seen in the first 3-4 years, compared to companies that are not successful in implementing IT. The more important thing to note is how to manage IT assets for further investment [5]. Other research shows that there is no positive impact on IS / IT on company performance. This proves the paradox of IT productivity phenomenon in IT investment.

Previous research said the development of research from the IT Productivity Paradox should describe a more detailed explanation of the causes of missmeasurement and mismanagement issues and independent testing of the causes

of the IT Productivity Paradox phenomenon [5]. Missing Measurement of Input and Output is an issue that still occurs to this day as a cause of Paradox's IT Productivity, measurement errors are mainly related to the difficulty of assessing the productivity of the service sector, and the inability of national statistics to take into account the IT contribution qualitatively [2]. In Sims' study [6] stated that there were no significant answers between measurements taken in answering the phenomenon of the Paradox IT Productivity to date. Inappropriate measurement methods will add to the issue of missmeasurement increasingly developing. For example, at present there are too many studies that only use financial methods as a measure, the absence of precision from the measurement method and includes the intangible side, does not include long-term investment and does not analyze the risks of a project [7]. Measuring implementation performance is still being carried out so far but not much is focused on financial and corporate strategy, measurements usually focus on the capability level of an organization [8]. According to the above phenomenon, IT investment requires development to make measurements and evaluate investments in various factors not only in terms of finance, but several related factors must also be involved, such as factors related to IT investment, tangible factors, intangible factors and the risk of IT implementation that has been invested [7]. And these measurements must have several criteria that are measured so that the results of the measurement are more valid and viewed from various aspects [9].

Information Economic is the development of Cost Benefit Analysis that uses multi-criteria aspects in evaluating information technology (IT) investments in terms of tangible and intangible benefits [10]. Information Economic can provide a measurement contribution to the management of the company in managing the investments that have been made and will be done [11]. Information Economic that measures tangible and intangible benefits related to IT investment [12]. Information Economic measures the impact of IT investment by referring to business performance, the advantages of this measurement can evaluate the next investment strategy [13].

Research The development of Enterprise Resource Planning software is growing rapidly in line with the development of the company which was recorded in 2013 with an investment value of Rp.969,12M ERP [14]. This incident describes many companies that implement it to improve their business processes. The development of ERP is still being carried out, but is the investment made in software development in line with the productivity gained by the company. Until now, the measurement of software implementation on each ERP has not been done much and measurements have been carried out to date, it is still only measuring Net Present Value on an information system [15].

Based on the measurement problems above, it was found that there were no measurement tools or frameworks that included measurement of SI / IT investment, until the ERP implementation was always increasing every year, it was

necessary to measure ERP implementation. So this study discusses investment in ERP implementation. Investments are made to contribute more to the company's performance by proving one of the causes of the Paradox IT Productivity, namely output and input mismeasurement using the Information Economic approach. Economic Information has the advantages of investing in all the factors that contribute from the tangible and intangible benefits.

II. RESEARCH METHOD

This research collects two types of data, namely financial and non-financial data. The financial data used in this research is financial report data from 2015-2017. Non-financial data is the result of the questionnaire. The financial report is the main data used to calculate whether the investment is done by the research object because it is used to measure the investment feasibility of ERP. This study takes the object of research company that has implemented ERP for 2 years in Indonesia using information economic. The data has been processed using the method of information economic. By using the method of information economic this research can find tangible benefits, intangible benefits and quasi-tangible benefits.

Information Economic may provide a measurement contribution to the management of the company in managing the investments that have been made and will be made [10]. ISACA said, Information Economic that measures the tangible and intangible benefits associated with IT investment. Information Economic measures the impact of IT investments with reference to business performance, the advantages of these measurements can evaluate the next investment strategy [13].

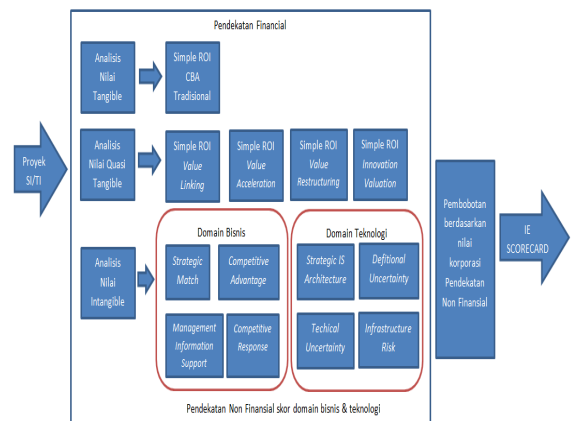


Figure 2.1 Information Economic

- **Collect Data**

Data retrieval is done based on the purpose of the research object environment. Classification of data is taken to collect data related to the implementation of information technology conducted in accordance with the object of research. Data classification is divided into 2 types of data ie financial(tangible benefits and quasi tangible benefits) and non-financial data (intangible

benefits). The following is a classification of benefits :

Tangible Benefits: Real benefit or directly affect the organization's profits. Analysis of the tangible benefits or quantitative using simple calculation method Return on Investment (ROI Simple) - Traditional Cost-Benefit Analysis (TCBA).

Quasi Benefits: Benefits that directly affect profits but hard to count or otherwise, does not directly affect profits but can be calculated. For example, improving the process of planning, improvement of decision making, and so on. Benefit analysis of the quasi using the calculation of Value Acceleration (VA), Value Linking (VL), Value Restructuring(VR), and Innovation Value (IV):

Tangible benefits and quasi tangible benefits using enhanced ROI financial approach, where the results of the assessment results in a monetary value measured by the following formula [9]:

$$\text{Enhanced ROI} = \text{Traditional ROI} + \text{VL} + \text{VA} + \text{VR} + \text{IV}. \quad (1)$$

Intangible Benefits: Benefits not real or that can be seen to have a positive impact for the organization but does not directly affect the profits. For example, enhance the corporate image, increase employee morale, and so on. Intangible values obtained from the questionnaire. Questionnaire using a table of Parker survey. Analysis of the intangible benefits of using two assessments are Bussiness Domain and Technology Domain.

• **Total Score Project**

The project value of IS / IT is measured by the following formula [9]:

$$\text{Score Project} = \text{Enhanced ROI} + \text{weight of Business Domain} + \text{weight Technology Domain}. \quad (2)$$

III. RESULT AND DISCUSSION

The analysis in this study begins by classifying the collected data. Then process with information economic method. Information Economic processing there are 3 stages of financial benefit processing (Tangible Benefit and Quasi Tangible Benefit), Intangible Benefit and Total Score Project.

Table 3.1 Classification Benefit COST

NO	Information	Classification	
		Value	Aspect
1.	Development Project Cost	Financial	Tangible
2.	On-Going Cost	Financial	Tangible
BENEFIT			
1.	Reduce the cost of shipping documents	Financial	Quasi-tangible
2.	Project Cost	Financial	Quasi-

3.	Efficiency up to 30% reduce the cost of operational error	Financial	tangible Quasi-tangible
4.	Questionnaire (Business Domain and Technology Domain)	Non-Financial	intangible

A. *Collected Data*

The following is a classification of data using the methods of information Economic:

• **Tangible and Quasi Tangible Benefit**

Tangible benefits or direct benefits directly affect the company's profits, these benefits are identified from the impact of the implementation of a technology. The tangible benefits of ERP implementation are evident in the reduction of shipping costs made by the organization.(see table 3.2).

Quasi Tangible benefit are a difficult profit to calculate but have an impact on the implementation of ERP. This section explains about category of benefits ERP implementation as *Value Linking (VL)*, *Value Acceleration (VA)* and *Innovation Valuation (IV)*. The benefits of value linking are illustrated in the table below (see table 3.2)

Table 3.2 Benefit Tangible

BENEFIT	TOTAL COST
TANGIBLE BENEFIT	Rp. 9.560.000
QUASI TANGIBLE	
VALUE LINKING	Rp. 22.710.870.000
VALUE ACCELARATION	Rp. 9.576.000.000

The table above is a table that contains the benefits of implementing ERP. The benefits are classified into 2 parts tangible benefits derived from benefits directly after the implementation of ERP during 2015-2017 with a total of Rp. 9,560,000 and the benefits of Quasi tangible for 2015-2017 years amounted to Rp. 32,286,870,000.

• **Intangible Benefits**

Intangible benefits can be obtained by filling in a questionnaire consisting of two domains: business domain and technology domain.

B. *Tangible Benefit and Quasi Tangible Benefit*

The processing of tangible and intangible benefits is part of the processing of information economic methods. This data processing uses Enhanced ROI as illustrated in the table 3.3.

Table 3.3 Score ROI

INVESTMENT COST	RP. 13.882.500.000		
COST	2015	2016	2017
VALUE LINKING VALUE ACCELERATION	2.034.000.000	7.272.000.000	13.404.870.000
TANGIBLE BENEFIT	1.560.000.000	2.400.000.000	5.616.000.000
ON-GOING COST	3.700.000	4.960.000	2.480.000
CASH FLOW	0	19.595.000.000	12.090.000.000
TOTAL CASH FLOW	3.597.700.000	-9.918.040.000	6.933.770.000
ROI 1 YEAR			2%
ROI			4%

The table above explains the ROI calculation process that has been 2 years after the implementation of ERP. ROI calculation is obtained through the company's cash flow for 2 years. Return on investment for 2 years is 4%.

- Measurement Enhanced ROI

$$\text{Enhanced ROI} = \left(\frac{\text{Yearly cash flow}}{\text{Year}} \right) \times 100\% \quad (3)$$

$$\text{Enhanced ROI} = \left(\frac{\text{Rp. 598.430.000}}{2} \right) \times 100\%$$

$$= 2\%$$

Table 3.4 Predicate ROI

SCORE	0	1	2	3	4	5
SIMPLE ROI	<0%	1%- 299%	300%- 499%	500%- 699%	700%- 899%	>900%

The results of Enhanced ROI calculations are generated that in the last 2 years is worth 2%, if ROI is a whole is worth 4%. These calculations are the result of tangible and quasi tangible benefits in ERP implementation. Below is a score determination of ROI score. The value of ROI in the implementation of ERP 2% then the score on the implementation of value 1 with the quadrant of ROI value (1% - 299%). These results indicate that the value of Return on Investment is too small in the implementation of ERP conducted for 2 years.

C. Intangible Benefit

For data not directly related to finance, but related to the benefits obtained organization related ERP implementation. In this study, non financial data consists of two things namely questionnaire and determination of company domain weight.

- Result of Questionnaire

Table 3.5 Result of Questionnaire

FACTOR	SCORE
BUSINESS DOMAIN	
STRATEGIC MATCH (SM)	3,3
COMPETITIVE ADVANTAGE (CA)	4,3
MANAGEMENT INFORMATION (MI)	4
COMPETITIVE RESPONSE (CR)	3,7
PROJECT/ORGANIZATIONAL RISK (OR)	2,3
TECHNOLOGY DOMAIN	
STRATEGIC IS ARCHITECHTURE (SA)	4,3
DEFINITIONAL UNCERTAINTY (DU)	0,3
TECHNICAL UNCERTAINTY (TU)	2
IS INFRASTRUCTURE RISK (IS)	1,7

The table above shows the results of a questionnaire consisting of 2 business and technology domains that are disseminated, the questionnaire is filled in by at least 3 parties who have authority in ERP implementation

- Company Domain Weight

The weighting of the firm's factors is the determination of the organization's quadrant position. This determination is done by interviewing several related parties and determining the company's line culture. Results of interviews about the organization in quadrant 2 (strategy). The table below shows that the ERP assessment indicator has been adjusted to the conditions of the company. Here is an indicator of ERP valuation according to the value of each sub domain in table 3.6.

Table 3.6 Quadrant Strategy

	LIKELY VALUE	SCORE
BUSINESS DOMAIN		
A. ROI	Medium	2
B. STRATEGY MATCH	High	4
C. COMPETITIVE ADVANTAGES	High	6
D. MANAGEMENT INFORMATION	Medium	2
E. COMPETITIVE RESPONSE	High	4
F. PROJECT/ORGANIZATIONAL RISK	Low	-1
TECHNOLOGY DOMAIN		
A. DEFINITIONAL UNCERTAINTY	Medium	-2

B. TECHNICAL UNCERTAINTY	Low	-1
C. STRATEGIC ARCHITECTURE	Low	1
D. IS INFRASTRUCTURE RISK	Low	1
TOTAL SCORE		20
TOTAL RISK		-4

$$(2,5 \times 20) + (2,5 \times -4) = 40 \quad (5)$$

- The lowest value is achieved when all variable value (20) reaches the lowest value (0) and the risk variable (-4) reaches the highest value (5).

$$(0 \times 20) + (5 \times -4) = -20 \quad (6)$$

Based on Likert scale with already know the highest value, the lowest value, and the middle value hence the table predicate score of the project.

D. Total Score Project

Table 3.7 Total Score Project Information Economic Scorecard

Faktor	Business Domain					Technology Domain					Total
	2	4	6	2	4	-1	1	-2	-1	1	
Bobot Corpore Value Score Factor	1	3,3	4,3	4	3,7	2,3	4,3	0,3	2	1,7	
Total Score Project	2	13,2	25,8	8	14,8	-2,3	4,3	-0,9	-2	-1,7	64,6
Manfaat (+)	69,8					Risiko					-5,2

Based on the Total Score Project 3.7 table above, it is obtained the calculation value of Information Economic 64.6. Details of the value of each sub domain can be seen in the table, the value in the table shows the value of each sub domain from the benefits of implementing ERP. The benefits of implementing ERP valued at 69.8 and the risk of implementing ERP is worth -5.2, from the above value shows that the implementation of ERP can provide many benefits from the company. After getting the IE value above, it is ranked to show the feasibility of ERP implementation.

Regarding strategic quadrant, predicate is determined based on likert scale as project predicate scale. Likert scale is used to measure attitudes, opinions, and perceptions of a person or group of people. With Likert scale then the variable to be measured is translated into indicator variable.

- The highest value is achieved when all the variable values (20) reach the highest value (5) and the risk variable (-4) reaches the lowest value (0).

$$(5 \times 20) + (0 \times -4) = 100 \quad (4)$$

- The middle value is achieved when all the variable values (20) and the risk variable (-4) reach the lowest value (2.5).

Table 3.8 Predicate Project Score

PROJECT SCORE	PREDICATE
71-100	Very Influential
41-70	Influential
11-40	Quite Influential
(-21) - 10	Less Influential
(-50) - (-20)	Very less Influential

Based on the analysis of investment feasibility using Information Economic method within a period of approximately 2 years shows the total score of the ERP project (64.6). The total score of this project is derived from three aspects of benefits, namely tangible aspects, quasi-tangible aspects, and intangible aspects.

Tangible aspects and quasi-tangible aspects are aspects that are calculated by the amount of financial benefits that occur when the ERP implementation. Benefits such as project cost efficiency up to 30%, reduction of shipping costs, company operating cost savings resulting from mistakes in the preparation of financial statements. The calculation of those benefits is used to calculate the ROI value in the ERP implementation. The simple ROI of ERP implementation for two years is 4%, ROI per year reaches 2%. The value of ROI is converted into value according to ROI score table is worth. The intangible aspect is obtained from the perception aspect of employees who know ERP more and understand financially. Perception assessment is done by charging quivery consisting of business domain and technology domain. The value of the business domain 59.5 and the technology domain is 3.1, then the value of the intangible aspect is 62.6. The total project score in ERP investment is 64,6 with project predicate which is **influential** in company operation and has big benefit.

ERP implementation in a company is something that provides more benefits in the company's operations, so every company that has implemented ERP must measure the investment feasibility that has been given both before and after implementation. The measurement must use the right method to produce measurement results that have benefits and evaluation for the company. The above research shows that ERP implementation that has been done and measured using information economic methods is the right thing and can be measured by 2 types of data, financial and non-financial. In addition to this method also measures in terms of tangible, quasi tangible and intangible and the measured domain is from the business domain and domain technology.

Therefore, this method can be suggested for measuring technology investments that have been implemented.

IV. CONCLUSION

This research is to make measurement of ERP investment that has been done in the span of 2 years. Measurement is using the method of economic information to determine the feasibility of investment. The results of this study based on the analysis of investment feasibility using Information Economic method within a period of approximately 2 years shows the total score of the project (64.6). The total score of this project is derived from three aspects of benefits, namely tangible aspects, quasi-tangible aspects, and intangible aspects. These results illustrate that the implementation of ERP has a predicate project that INFLUENCES in the company's operations and has great benefits. Based on the results of measurements using the Information Economic method the company can evaluate the information system that has been applied using the method. The evaluation can be seen in terms of intangible benefits that measure several aspects ranging from strategy to the company's technology architecture. This shows that measurement using the Information Economic method is quite effective and efficient, because it provides a comprehensive evaluation in terms of tangible and intangible. Tangible and intangible aspects based on measurements have been made, for further research it is recommended to measure IS / IT investments in terms of variables that affect ERP implementation.

ACKNOWLEDGMENT

This work can not possibly be solved without the intervention of Allah SWT. I am especially like to thanks my supervisor, Dr. Apol Pribadi Head of Magister Information System for support, guidance, and motivation. Nobody has been more important to me in the pursuit of this paper than the members of my family. I would like to thank my parents and my brother; whose love and guidance are with me in the whatever I pursue. They are the ultimate role models.

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