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GROUP DECISION MAKERS-BASED MODEL FOR EVALUATING THE FEASIBILITY OF INFORMATION AND COMMUNICATIONS TECHNOLOGY PROJECT (CASE STUDY : LOCAL GOVERNMENT OF MUSI RAWAS)

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ABSTRACT

Feasibility study of information and communications technology (ICT) project becomes more and more important due to the significant growth of ICT project investment as well as its complexity analysis, especially in term of benefit estimation. Recently, *Advanced Information Economic (AIE*) has been proposed for evaluating the ICT project feasibility, which considers the benefit and cost analysis. In spite of its easiness, AIE remains weakness relating to the subjectivity factor while determine the expected benefit and risk value. This drawback potentially brings the unreasonable result, such as the extremely high value of Return on Investment (ROI). In addition, AIE has not incorporated the group of decision makers, which is practically considered as the main influence factor of project appraisal.

This paper substantially discusses the new variant of information economic that considers the group decision maker for evaluating feasibility of ICT project, namely Group Decision Making Information Economic (GDM IE). This method also includes the benefit and risk template to enhance the applicability of GDM IE, where the benefit and risk related value is derived from the actual and practical references gathered from the several local governments in South of Sumatera. Further more, three kinds of models are involved in GDM IE for evaluating the benefit and risk value. First method (i.e., model A) selects the benefits and risks value based on the existing value of the template. Second method (i.e., model B), compares the selected reference value (template) with the new benefit value, which is entered by the user. The last method (i.e., model C), the user can directly entered the value of benefit and risk to evaluate the feasibility of ICT project. To investigate its applicability, this paper also utilized GDM IE for evaluating the ICT projects in Musi Rawas District.

Keywords: *GDM IE, ICT Project, AIE, Benefits, Risks*

1. INTRODUCTION

Feasibility study in the ICT project is basically conducted by comparing the benefit gained and the investment required for implementing the project. However, this feasibility study becomes more and more complex due to its wide range applications, which brings difficulties in term of benefit analysis. Currently, the benefit terms have been extensively defined based on the ICT application, for example it is correlated with competitive advantage, increase in brand knowledge, motivation, profit as well as organizational performance(e.g. [2,5,6]).

Several of methods (e.g., balanced score card, real options, economics value added and information economics) have been proposed to evaluate and measure the feasibility of ICT projects [3,4], which is fundamentally developed based on the financial and non-financial approach or its combinations. Furthermore, the evaluation methods evolved from the system level to the system efficiency, and then to the multi-dimensional evaluation, as considered in the information economic and balanced score card methods [7].

Relating to the methods development, Ranti (2008) proposed Advanced Information Economic

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(AIE) by developing the business value identification method, and its template for classifying and quantifying the business value of information technology. This template presents a generic identification and classification of tangible, quasi and intangible business value. It has also been grouped into thirteen (i.e., 13) categories with a hundred and ninety-five (i.e., 195) benefits, which are derived from the practical ICT investments in Indonesia. However, the application of AIE still remained several drawbacks such as: (a) the value of benefit, which is previously defined, was not available; (b) the subjectivity factors were unavoidable, which potentially brings the unreasonable result, such as extreme value of Return on Investment (ROI).

This paper then discusses a Group Decision Making Economic Information (GDM IE) method, which is put significant extensions of AIE. Since the decision making process of ICT project practically involves the several of stake holders, the GDM IE thus accommodates the group of decision makers, which is not considered in AIE. Moreover, GDM IE provide–benefits template along with its percentage value, where each template has been grouped into thirteen (i.e., 13) categories with a hundred and ninety-five (i.e., 195) benefits. In order to cope with the uncertainty, GDM IE also incorporates three (3) risks references and nine (9) categories of risk value. To measure its applicability, these references and values are derived from and applied in the ICT project evaluation of Musi Rawas District, Musi Banyu Asin District, Pagar Alam City and Sumatera Selatan Province.

Furthermore, GDM IE is also equipped by three methods for evaluating the benefits and risks of ICT project. First method (i.e., model A) selects the benefits and risks value based on the existing value of the template. Second method (i.e., model B), compares the selected reference value (template) with the new benefit value, which is entered by the user. The last method (i.e., model C), the user can directly entered the value of benefit and risk to evaluate the feasibility of ICT project.

2. GROUP DECISION MAKING INFORMATION ECONOMICS (GDM IE)

In order to evaluate the feasibility of ICT investment, GDM IE considers three basics parameters, namely benefits, risks and costs, which are practically examined by local government in term of ICT investment project. In addition, three steps approach is proposed to figure out those parameters, namely financial approach, non-financial approach and weighted approach, which involves the group of decision makers (see Figure 1)

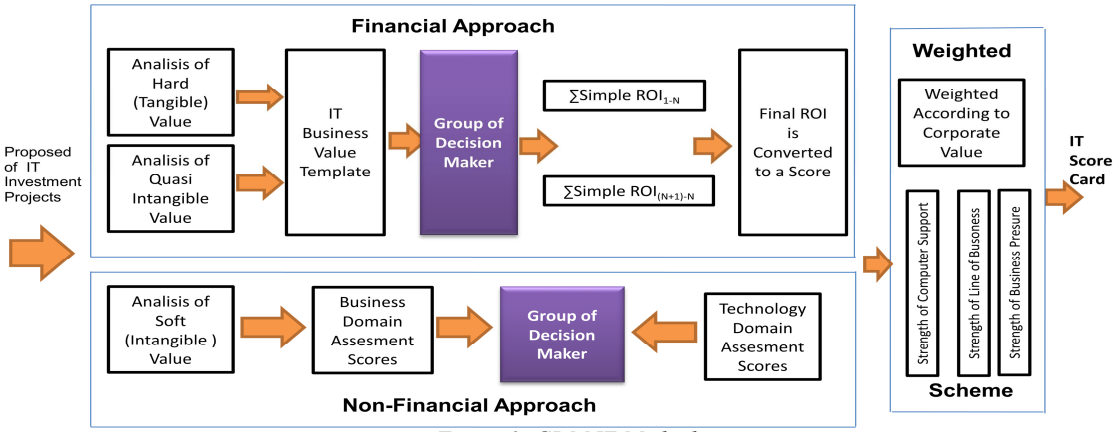

Figure 1: GDM IE Method

A financial step is derived from AIE method [7] that takes into account the cost-benefit analysis as well as the template of IT business value. By implementing the Value Linking (VL) analysis, the Value Acceleration (VA) analysis, the Value Restructuring (VR) analysis, and the Innovation Valuation (IV) analysis, the ROI value of ICT project can simply be obtained. The further step relates to non-financial approach that essentially assesses the business domain and technology domain of ICT projects.

In the last step, the group of decision makers is associated to weight the several performance indicator values, such as ROI, SM (Strategic Match), CA (Competitive Advantage), MI (Management Information), CR (Competitive Response), OR (Project or Organizational Risk), SA (Strategic Architecture), DU (Deviational

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Uncertainty), TU (*Technical Uncertainty*) and IR (*Information System of Infrastructure Risk*). The incorporation of group of decision makers, which practically applied in the evaluation of ICT project, is potentially minimized the subjectivity factor as well as eliminated the evaluation bias [8].

Before implementing the GDM IE, two initial parameters should be handled, which are the benefits reference value in the IT business value templates and the risks reference value on the business and technology assessment domain. The initial benefit value is deducted from the interview survey of stake holders, in which the respondents is selected based on their responsible to the evaluation of budget and work plan. For instance, 30 selected respondents come from the Regional Development Planning Agency that mainly responsible to the project and planning evaluation.

Respondents then filled the percentage value of each benefit (i.e., 0% - 100%) to estimate the percentage benefit obtained compared to the investment cost for implementing the ICT project [1]. This estimation is applied to the case of Musi Rawas, Musi Banyu Asin, Pagar Alam dan Sumatera Selatan local goverment. Table 1 shows the result example of benefit reference value from the group of benefit to reduce the cost.

Table 1: Benefit Reference Value from the Group Benefits to Reduce the Cost (KM 01) Musi Banyu Asin

Benefits	Code	Benefits Value (%)
Reduce labor costs	M01	64,3
Reducing the cost of stationery including cartridges, etc.	M02	71,4
Reduce cost of telecommunications	M03	70,7
Reduce travel expenses	M04	72,9
Reducing the cost of renting workspace and archives	M05	61
Reduce shipping costs	M06	66,2
Reduce system maintenance costs	M07	54,5
Reduce printing costs	M08	66,6
Reduce operating costs	M09	62,7
Reduce training costs	M10	64,9
Improving the integration of the old system	M11	69
Reduce inventory costs	M12	66,5

Benefits value (%) is the value of the benefits of ICT projects compared with investment cost of ICT projects . Benefits value (%) obtained from the research that has been done before. Suppose benefits M1 was 64.3 % , and the investment cost of ICT projects Rp.100.000.000 then the value of the benefits of M1 is 64.3 % x Rp.100.000.000 = Rp.64.300.000.

The similar approach is utilised for estimating the risk reference value. The risk value is filled in the range 0 to 5 for nine different risks reference, where the different characteristics of region are carefully taken into account. The interview result is used to estimate the average risk value by dividing the total value of each risk category with the total respondents. The average value of each risk is then divided into six different levels, namely, very high risk, high risk, medium risk, low risk, very low risk and extremely low risk. The very high risk level describes the maximum possible risk, which will potentially be experienced if the project is implemented. On contrary, the extremely low risk level shows the lowest risk or the highest success rate in terms of implementation of ICT projects. To determine the highest risk of ICT investment projects, all the results assessment is summing up, including the nine categories of risk. The range and level of risk can be seen in Table 2.

Table 2: The range and Level of Risk

Catagories and Level	Catagories and Level	Catagories and Level
SM (Strategic Match) 0: very high risk 1: high risk 2: medium risk 3: low risk 4: very low risk 5: extremely low risk	**SA (Strategic IS Architecture)** 0: very high risk 1: high risk 2: medium risk 3: low risk 4: very low risk 5: extremely low risk	**CA (Competitive Advantage)** 0: very high risk 1: high risk 2: medium risk 3: low risk 4: very low risk 5:extremely low risk
DU (Definitional Uncertainty) 0: extremely low risk 1: very low risk 2: low risk 3: medium risk 4: high risk 5: very high risk	**MI (Management Information)** 0: very high risk 1: high risk 2: medium risk 3: low risk 4: very low risk 5: extremely low risk	**TU (Technical Uncertainty)** 0:extremely low risk 1: very low risk 2: low risk 3: medium risk 4: high risk 5: very high risk
CR Competitive Response) 0: very high risk 1: high risk 2: medium risk 3: low risk 4: very low risk 5: extremely low risk	**IR Infrastruktur Risk)** 0: extremely low risk 1: very low risk 2: low risk 3: medium risk 4: high risk 5: very high risk	**OR (Project Or Organizational Risk)** 0:extremely low risk 1: very low risk 2: low risk 3: medium risk 4: high risk 5: very high risk

Source: (Parker,1989)

Table 3: Criteria and Weighting Values of Strategic Match (SM)

Weight (W)	Criteria (C)
0	The project has NO direct or indirect relationships to the achievement of stated corporate (or departemental) strategic goals.
1	The project has no direct or indirect relationships to such goals, but will achieve improved operational

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	efficiencies.
2	The project has no direct or indirect relationships to such goals, but the project is prerequisite system (precursor) to another system that achieves a portion of corporate strategic goal.
3	The project has no direct or indirect relationships to such goals, but the project is prerequisite system (precursor) to another system that achieves of corporate strategic goal.
4	The project has directly achieves a portion of a stated corporate strategic goal.
5	The project has directly achieves a stated corporate strategic goal.

Table 4: The Entire Value Recapitulation Musi Rawas Group of Risk

SM	CA	MI	CR	OR	SA	DU	TU	IR
Business Domain					Technology Domain			
1,20	1,00	2,60	3,30	0,50	2,90	2,70	1,73	2,40

As it has been mentioned before, GDM IE provides three methods (i.e., model A, B and C) for evaluating the benefit and risk of ICT project, where all kinds of model are implemented in the case of Musi Rawas, Musi Banyu Asin, Pagar Alam and South Sumatra local government. More over, the t-test is invoked to test the value which is entered by user. The Hypothesis is stated that the reference value is better than new value entered by user (i.e., H_o); and on contrary the new value inputted better than the reference value (i.e., H_a). For example, the user selects benefits reference of Musi Rawas local government, and then include four new values (n = 4), namely, M1 = 45; M4 = 50; M5 = 30; M14 = 23. Average value of benefits reference is then estimated as M1 = 50; M4 = 45; M5 = 70; M14 = 40. By considering the correlation value (TK) and the t-test value (T) thatis equal to 0.374, -0.13053301, respectively, it is can be concluded that the hypothesis Ho is fulfilled (i.e., (T) < (TK)). Hence, the value of the reference benefits is used.

3. RESULTS AND DISCUSSIONS

To investigate the applicability of proposed model, the method is applied to the actual work plan and budget system of Musi Rawas local government in 2015/2016 fiscal year. Benefit reference values is gained from the Musi Rawas template, where the model A is used as the evaluation method. Four ICT projects that are used as case study can be summarised as follow:

1. Development of Settlement Information System (Project A)
   Handled by the Department of Population and Civil Registration with a budget ceiling Rp.200.000.00 including tax and the operation and maintenance cost for one year of Rp. 20.000.000.
2. Procurement for ICT Equipment (Project B)
   Handled by Regional Planning Agency with a budget ceiling Rp. 350.000.000 including tax and auction cost, and the operation and maintenance cost for one year of Rp. 35.000.000.
3. Development of Instructor Information Systems (Project C)
   Handled by Agri culture and Live stock Agency with a budget ceiling Rp. 45.000.000 including tax and the operation and maintenance cost for one year of Rp. 4.500.000.
4. Development of Rural Internet (Project D)
   Handled by Department of Transportation and Information with a budget ceiling Rp. 250.000.000 including tax and the operation and maintenance cost for one year of Rp. 25.000.000.

In this case, five decision makers (DM) acts as evaluator of 4 projects above, such as regional secretaries, assistant in charge of the project investment, chair of agency who proposed the project, the Department of Revenue Finance and Asset Management (DPPKAD) and Chair of Musi Rawas District. By utilising Model A and benefit reference of Musi Rawas, the benefit value and its percentage can simply be summarised as follow:

Table 5: Benefits and Value for each Project and Decision Makers

Decision Maker 1
Benefit of A Project a. Reduce cost of telecommunications (40%) = Rp. 80.000.000 b. Reduce inventory costs (10%)=Rp.20.000.000 Benefit of B Project a. Reduce costs due to service failure (15%) =Rp.6.750.000 b. Reducing cost of subscriptions (25%)= Rp.11.250.000 c. Reduce over time costs (35%) = Rp. 15.750.000 Benefit of C Project a. Accelerated changes of employee data (35%) = Rp. 122.500.000 b. Accelerate exchanges of information among employees (35%) = Rp.122.500.000 Benefit of D Project a. Improving the quality of information (15%) = Rp. 37.500.000 b. Improving relationships with stakeholders (55%)= Rp.137.500.000
Decision Maker 2
Benefit of A Project a. Reduce cost of money (30%)=Rp. 60.000.000 b. Deacreasing number of operating losses (25%)= Rp. 50.000.000

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Benefit of B Project
a. Speeding up the process of consolidation of financial statements (15%)= Rp. 6.750.000
b. Speed up the transaction process (20%)=Rp. 9.000.000
c. Reducing leakage state budget (15%)= Rp. 6.750.000
Benefit of C Project
a. Reducing leakage state budget (35%)= 122.500.000
Benefit of D Project
a. Saving time (55%) = Rp. 137.500.000

Decision Maker 3

Benefit of A Project
a. Reduce cost of money (10%)=Rp. 20.000.000
b. Increasing productivity of performance (55%)= Rp. 40.000.000
c. Increasing productivity of performance (5%)= Rp. 10.000.000
Benefit of B Project
a. Accelerate the decision-making process (10%)= Rp. 4.500.000
b. Speeding up the process of consolidation of financial statements (23%)=Rp. 10.350.000
Benefit of C Project
a. Accelerate the decision-making process (40%)= Rp. 140.000.000
b. Improving accuracy of data and information (25%)=Rp. 87.500.000
c. Improving quality of information (20%)= Rp. 70.000.000
Benefit of D Project
a. Improving accuracy of data and information (60%)= Rp. 150.000.000
b. Improving relationships with stake holders (51%)= Rp. 127.500.000

Decision Maker 4

Benefit of A Project
a. Reduce the cost of telecommunications (15%)=Rp. 30.000.000
b. Improving the efficiency of reporting documents (20%)= Rp. 110.000.000
Benefit of B Project
a. Reducing leakage state budget (40%)= Rp.18.000.000
Benefit of C Project
a. Reducing leakage state budget (3%)=Rp. 10.500.000
b. Improving quality of information (25%)=Rp. 87.500.000
Benefit of D Project
a. Improving quality of information (30%)= Rp. 75.000.000
b. Improving accuracy of data and information (20%)= Rp. 50.000.000

Decision Maker 5

Benefit of A Project
a. Avoiding the risk of loss and delay costs (5%)= Rp. 10.000.000
b. Avoid losses (15%)= Rp. 30.000.000
Benefit of B Project
a. Assist to improve and enhance the work ethic (15%)= Rp. 6.750.000
b. Improving quality of information (45%)=Rp. 20.250.000
Benefit of C Project
a. Reducing leakage state budget (20%)= Rp. 122.500.000
Benefit of A Project
a. Saving Time (35%)=Rp. 87.500.000
b. Improving accuracy of data and information (20%)= Rp. 50.000.000

Furthermore, 4 steps analysis (i.e., value acceleration, value linking, value restructuring and innovation valuation) is applied for evaluating the project cost and benefit. Value acceleration analysis employs the benefit reference value of Musi Rawas as the basis process to evaluate the project benefits. The evaluation process is carried out by DM for each project (i.e., A, B, C and D). Each DM will assess the entire evaluated project. Table 6 shows the example of project evaluation by assuming 10% interest rate.

Tabel 6: Value Acceleration Evaluation by DM 5 for A Project

Description	Year 0	Year 1st	Year 2nd	Year 3rd	Year 4th	Year 5th	Year 6th
The development costs	Rp 200.000.000						
Operating costs		Rp 20.000.000	Rp 20.000.000	Rp 20.000.000	Rp 20.000.000	Rp 20.000.000	Rp 20.000.000
Interest rate 10%	1,000	0,909	0,826	0,751	0,683	0,621	0,564
Value adjustment of costs	Rp 200.000.000	Rp 18.181.818	Rp 16.528.926	Rp 15.026.296	Rp 13.660.269	Rp 12.418.426	Rp 11.289.479
Total	Rp 200.000.000	Rp 181.818.182	Rp 165.289.256	Rp 150.262.960	Rp 136.602.691	Rp 124.184.265	Rp 112.894.786
Benefits	Rp -	Rp 20.000.000	Rp 22.000.000	Rp 24.200.000	Rp 26.620.000	Rp 29.282.000	Rp 32.210.200
Interest rate 10%	1,000	0,909	0,826	0,751	0,683	0,621	0,564
Value adjustments of Benefits	Rp -	Rp 18.180.000	Rp 18.172.000	Rp 18.174.200	Rp 18.181.460	Rp 18.184.122	Rp 18.166.553

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Total benefits	Rp -	Rp 18.180.000	Rp 36.352.000	Rp 54.526.200	Rp 72.707.660	Rp 90.891.782	Rp 109.058.335
Net Present Value	Rp 200.000.000	Rp 199.998.182	Rp 201.641.256	Rp 204.789.160	Rp 209.310.351	Rp 215.076.047	Rp 221.953.121

As can be inferred from Table 6, in the 2nd year, positive value of benefits has been obtained, since the total benefit value is more than the implementation costs. The amount of benefit is estimated equal to Rp. 1.641.256, which is difference between the development costs and benefit value (see detail estimation below). The summary of evaluation result conducts by all DM for project A can be seen in Table 7.

= Development cost – Total benefit

= Rp. 200.000.000 – Rp. 201.641.256

= Rp. 1.641.256

Table 7: Summary of Benefits Value Acceleration For The Entire Decision Maker For A Project

Decision Maker	Year 0	Year 1st	Year 2nd	Year 3rd	Year 4th	Year 5th	Year 6th
DM 1	Rp 200.000.000	Rp 227.268.182	Rp 256.169.256	Rp 286.578.460	Rp 318.371.841	Rp 351.413.720	Rp 385.540.623
DM 2	Rp 200.000.000	Rp 231.813.182	Rp 265.257.256	Rp 300.210.010	Rp 336.548.756	Rp 374.136.665	Rp 412.805.207
DM 3	Rp 200.000.000	Rp 213.633.182	Rp 228.905.256	Rp 245.683.810	Rp 263.841.096	Rp 283.244.883	Rp 303.746.872
DM 4	Rp 200.000.000	Rp 245.448.182	Rp 292.521.256	Rp 341.104.660	Rp 391.079.501	Rp 442.305.502	Rp 494.598.958
DM 5	Rp 200.000.000	Rp 199.998.182	Rp 201.641.256	Rp 204.789.160	Rp 209.310.351	Rp 215.076.047	Rp 221.953.121

From table above it also implies that DM4 has the highest value for the evaluation of project A with the total benefits value for six year is equal Rp. 2,407,058,059. The similar process conducts for evaluating value acceleration of projects B, C, and D. The results will then be summarized to determine the total value of benefits value acceleration until the 5th year project.

By implementing similar process, the benefit of value linking, value restructuring and innovation valuation can simply be estimated, where the final output value is governed by the ROI value. This value demonstrates the feasibility of investment ICT projects. The higher ROI value means the higher feasibility of ICT project, where the definition of feasibility level in ICT projects illustrated in Table 8.

Table 8: Project Feasibility Level of Project ICT Investment

Impact	ROI
Feasibility is extremely low	< 0
Feasibility is very Low	1% to 299%
Feasibility is Low	300 to 499%
Feasibility is Medium	500% to 699%
Feasibility is High	700% to 899%
Feasibility is very high	≥900%

Risk evaluation of each project will be conducted by five DMs, where the DM possible to choose the different evaluation method for each project. The result from all DM is then accumulated to evaluate the risk level of each project, in which Project C has the highest risk level than others.

Table 9: Risk Evaluation Results Whole Project By The Entire Decision Maker

Project	SM	CA	MI	CR	OR	SA	DU	TU	IR	TOTAL
	Business Domain					Technology Domain				
A	0,60	0,80	1,20	1,40	0,525	2	1,4	1,6	1,6	11,125
B	2,20	2,00	1,60	1,60	0,525	3	1,4	1,6	1,6	15,525
C	2,40	2,20	3,00	2,00	0,2	1	2,2	1,15	3	17,15
D	1,60	2,00	1,80	2,00	1	1,8	1,8	1	1,8	14,8

The entropy method is then applied for determining the weight and ranking of the evaluated projects. The initial step of the method is to create a matrix of performance rating, which is an alternative value to each criterion that not

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dependent each other. The decision matrix for each alternative criterion (X), is given as follow:

$$X = \begin{bmatrix} x_{11} & x_{12} & \dots & x_{1n} \\ x_{21} & x_{21} & \dots & x_{2n} \\ \dots & \dots & \dots & \dots \\ x_{m1} & x_{m2} & \dots & x_{mn} \end{bmatrix} \quad (3.1)$$

Where i :1,2,,,n,
j :1,2,..m,
x_{ij}: Rate of ICT project performance *i* subject to investment criteria *j*.

By using the matrix 3.1, the investment criteria (i.e.,TIK ROI, SM, CA, MI, CR, OR, SA, DU, TU and IR) can be illustrated as follows:

X =

ROI	SM	CA	MI	CR	OR	SA	DU	TU	IR
2019,74	0,6	0,8	1,2	1,4	0,525	0,525	2	1,4	1,6
944,38	2,2	2	1,6	1,6	0,525	0,525	3	1,4	1,6
8310,09	2,4	2,2	3	2	2	2	1	2,2	1,15
2238,95	1,6	2	1,8	2	2	1	1,8	1,8	1

Normalization step is firstly conducted by determining the highest value of each project on each criterion. Data normalization value of each project (i = 1,2, .., m) to the criterion (j = 1,2, .., n) is given by Equation 3.2.

$$d_i^j = \frac{x_i^j}{x_{i\,max}^j} \quad (3.2)$$

where:
x_i^j = investment value of project *I* subject to investment criteria *j* that has not been normalized.
$x_{i\,max}^j$= maximum investment value of project *i* subject to investment criteria *j* that has not been normalized.
d_i^j = investment value of project *I* subject to investment criteria *j* that has not been normalized

The normalized value is then summed using equation below:

$$D_j = \sum_{j=1}^{n} d_i^j \quad (3.3)$$

D_j is total value of investment project that has been normalized for each criteria, where the result can be seen as follow:

Table 10: Results of Data Summation Already Normalized

Project	X_{max}	D
A	2019,7	2030
B	944,38	958,8
C	8310,1	8328
D	2239	2254

Entropy calculation for each criterion of ICT investment projects *j* is firstly applied j to calculate the value of e_{max}, and K using Equations 3.4 and 3.5.

$$e_{max} = ln\ m; \quad (3.4)$$

m: total number of ICT projects

$$K = \frac{1}{e_{max}} \quad (3.5)$$

By implementing above equations,

K value can be estimated as 0,721348.

Equation 3.4 is utilised for estimating the entropy calculation for each criterion of ICT project *j*

$$e(d_j) = -K \sum_{j=1}^{n} \frac{d_i^j}{D_i} \ln \frac{d_i^j}{D_i} \quad (3.6)$$

where :
e(dj) = entropy value of criteria *j for* project *i.*
$m^{d_i^j}$ = investment value of ICT project that has been normalized
Dj = total investment value of ICT project that has been normalized for each investment criteria

The calculation result of entropy for each criterion can be described as follows: e(d_1=Project A)= -0.00273; e(d_2=Project B)= -0.00532; e(d_3=Project C)= -0.00079; e(d_4=Project D)= -0.0025. The results is then used for estimating the total *entropy* (E) using Equation 3.7, where it is obtained E equal to -0.01134.

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$$E = \sum_{j=1}^{n} e(d_j) \quad (3.7)$$

After the estimation of total entropy, the weight of each criterion is then conducted. By using equations 3.8 and 3.9, it is obtained the results as follows: λ_1 = 0.249975; λ_2 =0.250619; λ_3 = 0.249489; λ_4 =0.249917.

$$\bar{\lambda}_{j=} \frac{1}{n-E}[1-e(d_j)] \quad (3.8)$$

Where j= 1,2,..n

$$\sum_{j=1}^{n} \bar{\lambda}_j = \pm 1 \quad (3.9)$$

$$\bar{\lambda}_j = \frac{\bar{\lambda}_j * w_j}{\sum_{j=1}^{n} \bar{\lambda}_j * w_j} \quad (3.10)$$

Where j= 1,2,..n,

n= total number of projects

λ_j= final weight value of entropy

w = initial weight value

The final entropy value is calculated by applying Equation 3.10, and thus the result can be summarised as follow: ProjectA(λ_1)= 0.995049; Project B (λ_2)= 0.98493; Project C(λ_3)= 0.997845and Project D (λ_4)= 0.993345. Table 11 show the result that is illustrated using *score card*, where project C is highly recommended to be implemented based on benefit, and risk analysis. Project C has a feasibility high ROI, risk level of SM is a low risk, CA is a medium risk, MI is a low risk, CR is a medium risk, OR is extremely low risk, SA is a high risk, DU is a low risk, TU is a very low risk and risk level of IR is a medium risk.

Table 11: Score Card

Project	ROI	SM	CA	MI	CR	OR	SA	DU	TU	IR	Weight	Ranking
		Business Domain					Technology Domain					
A	2019,74	0,60	0,80	1,20	1,40	0,525	2	1,4	1,6	1,6	0,995049	2
B	944,38	2,20	2,00	1,60	1,60	0,525	3	1,4	1,6	1,6	0,98493	4
C	8310,09	2,40	2,20	3,00	2,00	0,2	1	2,2	1,15	3	0,997845	1
D	2238,95	1,60	2,00	1,80	2,00	1	1,8	1,8	1	1,8	0,993345	3

4. CONCLUSION:

This paper discussed the method relating to the feasibility study of ICT project, and specifically proposed a new variant of information economic, named as GDM IE. This proposed method includes the group of decision makers, which is practically considered as the main influence factor of project appraisal. As different with previous IE method, GDM IE also incorporates three different method for evaluating the project that combines the experience, method and preference of decision maker. The method is then applied to the actual ICT projects, which can effectively evaluate the feasibility of ICT projects.

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