http://ansinet.com/itj

ITJ

ISSN 1812-5638

INFORMATION TECHNOLOGY JOURNAL

ANSInet
Asian Network for Scientific Information
308 Lasani Town, Sargodha Road, Faisalabad - Pakistan

OPEN ACCESS Information Technology Journal

ISSN 1812-5638
DOI: 10.3923/itj.2017.51.61

Research Article
Strategic Decisions in the Implementation of Information Technology Governance to Achieve Business and Information Technology Alignment Using Analytical Hierarchy Process

Uky Yudatama, Bobby A.A Nazief and Achmad Nizar Hidayanto

Faculty of Computer Science, Universitas Indonesia, Depok, Indonesia

Abstract

Background and Objective: Nowadays, many organizations or companies begin to use the principles and working procedures of IT governance in carrying out its organizational activities to achieve business and IT effectiveness and alignment. It is, therefore, necessary to have an in-depth understanding of the process in determining the right strategy for implementing good and clear IT governance referring to the circumstances of each organization. This study aims to determine and obtain strategic steps in an organization, especially for upper-level stakeholders, in making decisions so that business and IT alignment can be achieved efficiently and effectively. **Methodology:** The model is developed based on effective IT governance practices, consisting of 3 domains: Process domains (4 sub-domains), structure domains (5 sub-domains) and relational-mechanism domains (2 sub-domains) that qualitatively and quantitatively have Identified through extensive literature reviews as well as discussions with local experts. This study uses the AHP approach to determine strategic steps in IT governance practices. **Results:** The results of this study found that the process domain to get the highest end value compared with other domains was at 0.402818. This means that process domain is more important than structures and relational mechanism domains. As for the results of each domain, the structure domain for sub-domains in IT governance function with the final value of 0.403726 becomes the main thing to get special attention. For the process domain, the sub-domain of portfolio management section with the final value of 0.2348 becomes important, in the Relational Mechanism domain in the sub-domains. Senior executive management provides a good example leading the final score of 0.599254 becomes important. **Conclusion:** The strategic step is important in an organization and needs to be done to accelerate the pace or movement in achieving good IT governance practices.

Key words: Information technology, governance, alignment, business, analytical hierarchy process

Received: January 24, 2017 Accepted: March 02, 2017 Published: March 15, 2017

Citation: Uky Yudatama, Bobby A.A Nazief and Achmad Nizar Hidayanto, 2017. Strategic decisions in the implementation of information technology governance to achieve business and information technology alignment using analytical hierarchy process. Inform. Technol. J., 16: 51-61.

Corresponding Author: Uky Yudatama, Faculty of Computer Science, Universitas Indonesia, Depok, Indonesia

Competing Interest: The authors have declared that no competing interest exists.

Data Availability: All relevant data are within the paper and its supporting information files.

INTRODUCTION

Information Technology (IT) is not only seen as a tool for data entry but also has been evolved into a business tool for creating sustainable business innovation[1,2]. To achieve this, business and IT management cannot be separated. IT must be oriented in the organization's business strategy[3]. There are many success stories about how IT can improve business performance and vice versa, where the use of IT will be a waste o f resources for the organization. Effective use of IT depends on good IT governance. If IT governance is all wrong, the results can be devastating. Just as the fall of Eron in 2001 and a year later in 2002, the Sarbanes-Oxley Act in the United States[3]. There are some interesting facts that become the latest trend related to IT strategy decisions[1,4,5]. In many organizations, Information Technology becomes an important part in supporting sustain ability and business growth[5]. The use of this technology has become a high dependency and therefore requires special attention in IT governance, which in turn can maintain and expand the organization's strategy and objectives[3,6,7].

There is a positive relationship between IT governance practices and business and IT alignment[1,8,9]. To achieve effectiveness, business and IT alignment needs to be understood in depth in the process of formulating a good and clear IT governance strategy and measurement strategy referring to the situation and condition of the company divided into several categories[9] (A) Governance based on organizational structure, (B) Governance by process and (C) Governance based on human relationships.

A good organization is an organization that has a clear purpose based on the vision and mission agreed upon by its founder[3]. To achieve that goal, it requires a way of achieving what is commonly referred to as strategy[6], prepared plans, policies for achievement and action programs[10]. Each organization has a plan and knows the term of strategic planning[3,6] where it can help to evaluate periodically to achieve goals, help the company grow and expand and can enlarge its market share amidst its competitors[2,5,11-13]. One of the keys to the success of corporate strategic planning in the modern era is to use well-planned IT-management[3,4,6,11]. The effective use of IT relies heavily on good IT governance, unless, one can destroy it[14-16].

From the aforementioned description, it is very important for companies or organizations to have a solid plan to develop strategies that will be implemented[2]. The solid plan can be a strategic step that should be taken to be more concentrated and prioritize certain parts referring to the circumstances of the organization. The parts to be considered including[3,5,6]: IT steering committees, IT governance functions, security/risk/officers, IT project steering committees, portfolio measurement of IT performance management, cost re-arrangement, service level agreements, budget control and IT reporting, knowledge management and senior executive managers that can provide a good example[9]. Determining the choice referring to the circumstances of the organization becomes an important issue, therefore, it requires a special strategy[2,14-16]. Therefore, this study aims to search and find an important part as a priority in IT governance practices for the stakeholders to prioritize/concentrate more on portions which are appropriate to the organization's circumstances in order to improve business and IT alignment. Analytical Hierarchy Process helps get the final value used as a recommendation and speed up the process in order IT governance practice be able to achieve the desired achievement. AHP has the advantage of being able to analyze with consistency and objectivity based on comparative matrix pairs[14-18].

IT governance: The ITGI defines IT governance in general as "Responsibility executives and directors involving the leadership, organizational structures and processes to ensure that IT is supporting and driving strategies to achieve the organizational goals"[2,9]. Governance of IT is the application of corporate governance in the IT field[4,11,13,19]. Complementing the previous definition, IT governance is defined as "The implementation of governance mechanisms, which include the structures, roles, processes/procedures and communication mechanisms to ensure that IT is managed in accordance with the needs and organizational strategy"[9]. Governance of IT itself has been defined or interpreted differently in various articles and books on the topic of IT governance, the general definition of IT governance, namely:

- IT governance is the responsibility of the executive and board of directors, which involves a consistent leadership, organizational structure and process referring to the support for IT companies and is included in the strategy and objectives of the organization[1,2,9]
- IT governance specifically explaining the correct decisions and being accountable framework to support the goals of desirable behavior in the use of IT[2]
- IT governance is the strategic alignment of IT with the business such as the maximum value of the business reached the stage of thinking that the development and maintenance of IT control are parts of the effectiveness and accountability, executive management and risk management[3-5]

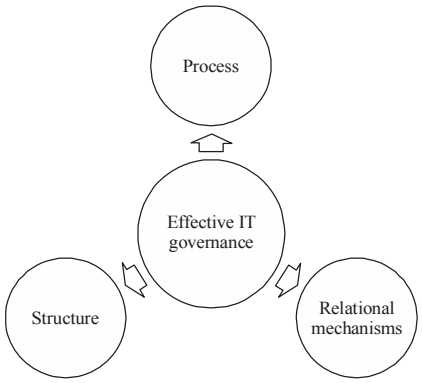

Fig. 1: Model of IT governance practices

Basically, IT governance focuses on the relationships and integration of organizational alignment[10]. IT governance reflects the use of the principles of organization and focus on the activities of the management and use of IT to the achievement of organizational values[3]. IT governance is the responsibility of executive management and top management comprised by the leadership and organizational structures ensuring that IT is in accordance with the organization's goals and develop strategies[1-2,4,9,10]. The IT governance is the application of the directive procedures of organizational setting to support the IT management as an integral and follow the goals and strategies of the organization who have responsibilities.

IT governance can be implemented by combining the structures, processes and relationship mechanism[4,6,10,13,18-20]. Each domain is essential for the success in the implementation of the framework of IT governance in an organization (Fig. 1). The structure involves the existence of clear roles and responsibilities of the steering committee and the IT strategy committee[9]. The process refers to the strategic decision maker, IT systems strategy planning, management and supervision[9] and mechanism-based to support relationship that should exist in IT and organization. These mechanisms include the active participation of executives and IT management organizations, dialogue, training, exchange of experiences, knowledge and communication throughout the organization[3].

The decision making in the proper use of IT is a way to achieve IT and Business alignment[9]. In this study, there are three most effective things in the IT governance namely: Structure in decision making, process alignment and approach communication/relational mechanisms[4,13,20-22]. This relationship is shown in Fig. 1.

Analytical Hierarchy Process (AHP): Analytical Hierarchy Process is a method to solve an unstructured complex situation into several components in a hierarchical composition, the highest value is usually used as a priority recommendation[14-16].

Analytical Hierarchy Process is one of the models for decision-making frameworks that can help people. This method was originally developed by Thomas L. Saaty in the 70 sec. AHP basic thinking is the process of establishing numerical score to compile the ranking of each alternative decision that should be based on how the alternative was matched with the criteria of decision-makers[14-16]. Each criterion will be compared to have a weight as shown in Table 1.

The steps in AHP are as follows[14-16]:

- Add the values of each column in the matrix
- Divide each column with a total value of the column in question to obtain a normalization matrix

$$\sum_{j=1}^{n} aij = 1 \quad (1)$$

Where:
a = Matrix of pairwise comparisons
I = Rows of a matrix
j = Columns of a matrix

- Add up the values of each matrix and divided by the number of domains to obtain an average value.

$$W_i = \frac{1}{n}\sum_{j}^{n} aij \quad (2)$$

Where:
n = Number of criteria
W_i = Average ith row

Eigenvalue and eigenvector: If the decision maker has included assessment for each comparison among criteria within the level, the determination of which criteria are most preferred, or most importantly, compiled a comparison matrix at each level.

Consistency test and rate index: One of the main AHP model that distinguishes it from other models is that decision-making is not their absolute consistency requirement. The polls among the factors to another are free of each other and this can lead to inconsistencies of the answers by respondents. However, too many inconsistencies are also undesirable.

Table 1: Pairwise comparison assessment scale

Intensity interest	Description
1	The both domains are equally important
3	One domain is slightly more important than another domain
5	One domain is more important than another domain
7	One domain is absolutely more important than other domains
9	One domain is absolutely more important than other domains
2, 4, 6, 8	Values between two considerations adjacent
Opposite	If the activity i got one point compared with activity j, then I have a value opposite compared to j

Table 2: Random value index (RI)

n	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
RI	0.000	0.000	0.580	0.900	1.120	1.240	1.320	1.410	1.450	1.490	1.510	1.480	1.560	1.570	1.590

Repetition of interview on the same number of respondents is sometimes necessary if the degree of consistency is not great. Saaty has shown that the consistency index of the matrix order n can be obtained by the Eq. 3[14-16]:

$$CI = \frac{(\lambda max - n)}{(n-1)} \quad (3)$$

Where:
CI = Ratio of deviation consistency index
λmax = The eigen value of a matrix of order n
n = Order matrix

If CI is zero, the pairwise comparison matrix is consistent. Inconsistency limit that has been set by Thomas L. Saaty is determined using Consistency Ratio (CR), which is the ratio of random consistency index value (RI) were obtained from an experiment by the Oak Ridge National Laboratory developed by the Wharton School and shown in Table 2. This value depends on the order matrix n. Thus, the ratio of Consistency can be formulated as follows:

$$CR = \frac{CI}{RI} \quad (4)$$

Where:
CR = Consistency Ratio
CI = Ratio of deviation consistency index
RI = Random index

MATERIALS AND METHODS

In this study, the model used to determine the strategic steps in the practice of IT governance is by using AHP. The AHP is a model that can determine the best choice of various criteria (domain) and alternative (sub-domain) based on mathematical calculation.

Identification of criteria (domains) and alternatives (sub-domains): The identification of criteria (domains) and alternatives (sub-domains) to determine strategic steps in IT governance practices begins with collecting appropriate literature and soliciting opinions local experts from Indonesian who master IT governance. The results of this identification found 3 domains: Structure, process and relational mechanisms. As for the sub-domains of each domain are 4 sub-domains on the domain Structure, 5 sub-domains on the process domain and 2 sub-domains on the relational mechanism domain.

Construct hierarchical structure: To build a hierarchical structure of the criteria (domain) and alternative (sub-domain), based on the identification that has been obtained. The structure starts from the criteria and proceeds with alternatives that compose from each criterion (domain). The complete hierarchical structure is shown in Fig. 2.

Quantitative data collection: Quantitative data were obtained from interviews of several local experts from Indonesian who master IT governance, so the data could be accounted for. This data is obtained within a period of 2 months between January-February of 2017, then processed in accordance with existing rules on the AHP model and most studies were analyzed by means of personal knowledge, experience, judgment and statistical software[15-16,23-25].

Calculation process: The data that have been obtained from the data collection, then proceeded to start by looking for weight then normalize it, followed by finding eigenvector and eigenvalue, then check the consistency, until finally the vector priority is found. The result of this vector of priorities is a reference as a determinant of strategic steps in the practice of IT governance.

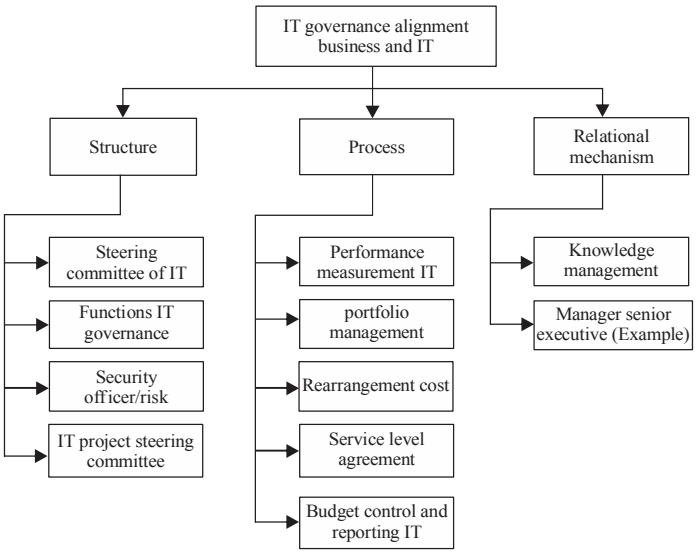

Fig. 2: Hierarchy of criteria/domain and alternative/sub-domain

RESULTS AND DISCUSSION

The AHP has the ability to break the problem of multi-criteria based on a comparison of the preferences of each domain in the hierarchy. The criteria referred to in this study are the criteria (domains) available within IT governance practices[4,13,20-22], namely (1) Structure, (2) Process and (3) Relational mechanisms. The intakes of these 3 domains are used as criteria for an essential component in which an organization to effectively implement IT governance[2,9,24]. The alternative is taken from instruments available in IT governance practices. Among 33 instruments, only 11 essential instruments are in accordance with the results of research conducted by De Haes and Van Grembergen[9]. The recommendation made to the implementation of IT governance to improve business and IT alignment is good, it then needs to pay attention to the parts such as[3,9]: (1) The IT Committee steering, (2) The function of IT governance, (3) The security/risk, (4) The steering committee of IT projects, (5) The measurement of IT performance, (6) Portfolio Management, (7) The reorganization of the cost, (8) Service level agreements, (9) IT budget control and reporting, (10) The management of knowledge and (11) Senior executive manager that provides a good example, which then those eleven instruments of this section are alternatives, because this section will be the recommendations as a priority choice. The relationship between the criteria of the alternatives is shown in Fig. 2.

Basically, IT governance focuses on the relationships and integration of organizational alignment. IT governance reflects the use of the principles of organization and focuses on the activities of the management and use of IT to the achievement of organizational values. IT governance is the responsibility of executive management and top management comprised by the leadership and organizational structures ensuring that IT is in accordance with the organization's goals and develop strategies. IT governance is the application of the directive procedures of organization setting, to support IT management as an integral and follow targets and strategy of the organization which has overall responsibility.

IT governance can be implemented by combining the structures, processes and relational mechanisms. Each domain is essential for the success of the implementation in the framework of IT governance in an organization. The structure involves the existence of clear roles and responsibilities of the steering committee and the IT strategy committee[9]. The process refers to the strategic decision maker, IT systems strategy planning, management and supervision[9] and relational mechanisms supporting a relationship that should exist between IT and business organization. These mechanisms include the active participation of executives and IT management organizations, dialogue, training, exchange of experiences, knowledge and communication throughout the organization[9].

Weighting criteria (Domain): Weighting is conducted by preparing a matrix of pairwise comparisons weighting the data obtained from interviews. In this study, we took data from a combination of several organizations working in education in Indonesia as research objects.

The results of matrix weight factors for all Hierarchical Criteria before simplification are: (a) Pairwise comparison between domain structure with domain process = 1/5, (b) Pairwise comparison between domain relational mechanism with domain structure = 1/3, (c) Pairwise comparison between domain relational mechanism with domain process = 1/3. Meanwhile, the results after simplification are (a) Pairwise comparison between domain structure with domain process = 0.2, (b) Pairwise comparison between domain relational mechanism with domain structure = 0333 and (c) Pairwise comparison between domain relational mechanism with domain process = 0.333. Therefore, the results of the total number for the domain structure: 6.33333, the domain process: 1.533333 and on the domain relational mechanism: 7.

The results of normalized Eigenvector are: (a) Domain structure: 0.238966983, (b) Domain process: 0.623406342 and (c) Domain relational mechanism: 0.137626675.

Furthermore, the maximum eigenvalues (λ maximum) were found by adding the result of multiplying the number of columns the eigenvectors. The maximum eigenvalue that can be obtained are:

$$\lambda \text{ maximum} = (6.33333 \times 0.238966983)+(1.533333 \times 0.623406342)+(7 \times 0.137626675)$$
$$= 3.432734009$$

The order of 3 matrix (i.e. consisting of 3 criteria), consistency index values were obtained:

$$CI = (\lambda \text{ max-n})/(n-1)$$
$$= (3.432734009-3)/(3-1)$$
$$= 0.432734009/2$$
$$= 0.216367004$$

For n = 4, RI = 0.580 (Saaty Table), then:

$$CR = CI/RI$$
$$= 0.216367004/0.580$$
$$= 0.373046559, <0.100$$

The CR <0,100 meant that the respondent preferences were consistent.

The results of the priority vector matrix are, (a) Domain structure with domain structure: 1, with domain process: 0.2 and with domain relational mechanism: 3, (b) Domain process with domain structure: 5, with domain process: 1 and with domain relational mechanism: 3, (c) Domain relational mechanism with domain structure: 0.3333, with process domain: 0.3333 and with domain relational mechanism: 1.

Thus, it can obtain vector priorities, namely:

$$= \sqrt[4]{1 \times 0.2 \times 3} = 1.431569$$
$$= \sqrt[4]{5 \times 1 \times 3} = 1.732051$$
$$= \sqrt[4]{0.3333 \times 0.3333 \times 1} = 1.136219$$

If the total number to Σ = 4.299839, the end result of the priority vectors is:

- Structure: 1.431569/4.299839 = 0.332935 (Priority 2)
- Process: 1.732051/4.299839 = 0.402818 (Priority 1)
- Relational Mechanisms: 1.136219/4.299839 = 0.264247 (Priority 3)

From the results of the AHP calculations, it appears that the domain in the process of obtaining the highest final score, so in this organization, more concentrated on the domain process to get the attention/priority over all the other domains.

Henceforth, after knowing the criteria or the domain of IT governance practices in order to achieve alignment, the next step is looking for an alternative or parts contained in each domain. Before doing the calculations, the observations/interviews had been conducted to some leaders in the organization to know the parts which will be a priority of each alternative or each section. By using a comparison, the matrix of data was obtained as in Table 3 and 4.

Weighting structure domain: With the domains in each column divided by the total number in the column in question, it obtained relative normalized weights .The value of eigenvectors was generated from the average value of the relative weights for each row. The results can be seen in Table 5.

Table 3: Matrix weighting factor for structure domain

Alternatives (Part)	Steering committee of IT	Functions IT governance	Security officer/risk	IT project steering committee
Steering committee of ITs	1	1/3	5	3
Functions IT governance	3	1	5	3
Security officer/risk	1/5	1/5	1	1/3
IT project steering committee	1/3	1/3	3	1

Table 4: Matrix weighting factors hierarchy for simplified structure domain

Alternatives (Section)	Steering committee IT	Functions IT governance	Security officer/risk	Steering committee of IT project
Steering committee IT	0.333333	1	3	3
Functions IT governance	3	1	5	3
Security officer/risk	0.333333	0.2	0.333333	1
Steering committee of IT projects	0.333333	0.333333	3	1
Σ	3.999999	2.533333	11.33333	8

Table 5: Matrix Weighting factors hierarchy for normalized structure domain

Alternatives (Section)	Steering committee of IT	Functions IT governance	Security officer/risk	IT project steering committee	Eigenvectors the normalized
IT steering committee	1	0.333333	3	3	0.262987013
Functions IT governance	3	1	5	3	0.501082251
Security officer/risk	0.333333	0.2	1	0.333333	0.076839827
IT project steering committee	0.333333	0.333333	3	1	0.159090909

Table 6: Matrix of vector priorities for each section in the structures domain

Alternatives (Section)	Steering committee of IT	Functions IT governance	Security officer/risk	Steering committee of IT project
Steering committee of TI	1	0.333333	3	3
Functions IT governance	3	1	5	3
Security officer/risk	0.333333	0.2	1	0.333333
Steering committee of IT projects	0.333333	0.333333	3	1

Furthermore, the maximum eigenvalues (λ maximum) was found by adding the result of multiplying the number of columns in the eigenvectors. The maximum eigenvalue that can be obtained are:

$$\lambda \text{ maximum} = (4.66666 \times 0.262987013)+(1.86666 \times 0.501082251)+(12 \times 0.076839827)+(7.33333 \times 0.159090909)$$
$$= 4.2513682331$$

Because the order matrix 4 (i.e., consisting of 4 criteria), consistency index values were obtained:

$$CI = (\lambda \text{ max-n})/(n-1)$$
$$= (4.2513682331-4)/(4-1)$$
$$= 0.2513682331/3$$
$$= 0.083789411$$

For n = 4, RI = 0.900 (Saaty Table), then:

$$CR = CI/RI$$
$$= 0.083789411/0.900$$
$$= 0.0930993456, <0.100$$

Because CR<0.100 meant that respondent preferences were consistent.

To obtain the priority vector, each domain and each line in Table 6 was multiplied and then taken root rank n. The results of each line were then divided by the sum of each row.

Thus, it can obtain vector priorities, i.e.,:

$$= \sqrt[4]{1 \times 0.33333 \times 3 \times 3} = 1.012741$$
$$= \sqrt[4]{3 \times 1 \times 5 \times 3} = 1.18985$$
$$= \sqrt[4]{0.3333 \times 0.2 \times 1 \times 0.33333} = 0.74458$$
$$= \sqrt[4]{0.3333 \times 0.33333 \times 3 \times 1} = 0.893154$$

If the total number of Σ = 2.947172, so that the end result of the vector priorities was:

- IT Steering Committee:
  1.012741/2.947172 = 0.34362 (Priority 2)
- Functions of IT governance:
  1.732051/2.947172 = 0.403726 (Priority 1)
- Security Officer/Risk:
  0.74458/2.947172 = 0.252642 (Priority 4)
- IT Project Steering Committee:
  0.893154/2.947172 = 0.303055 (Priority 3)

The results of calculation of AHP shows that the domains in the structure namely the function of IT governance obtained the highest final value at 0.403726. Therefore, this organization is more concentrated on the function of IT governance to gain attention/priority of the other sections.

Weighting process domain: Table 7 shows the results data from interviews of several sources on the weight of the process sub domain, after some simplified changes as shown in Table 8.

Table 7: Weighting matrix factor for process domain

Alternatives (Section)	Performance measurement IT	Portfolio management	Cost rearrangement	Service level agreement	Budget control and reporting IT
Performance measurement IT	1	1/3	5	3	1/3
Portfolio management	3	1	5	3	3
Cost rearrangement	1/5	1/5	1	1/3	1/3
Service level agreement	1/3	1/3	3	1	1/5
Budget control and reporting IT	3	1/3	3	5	1

Table 8: Weighting matrix factors hierarchy for simplified process domain

Alternatives (Part)	Performance measurement IT	Portfolio management	Cost rearrangement	Service level agreement	Budget control and reporting IT
Performance measurement IT	1	0.333333	3	3	0.333333
Portfolio management	3	1	3	3	3
Cost rearrangement	0.333333	0.333333	1	0.333333	0.333333
Service level agreement	0.333333	0.333333	3	1	0.333333
Budget control and reporting IT	3	0.333333	3	3	1
Σ	7.666666	2.333332	13	10.33333	4.999999

Table 9: Weighting factor matrix hierarchy for normalized process domain

Alternatives (Part)	Performance measurement IT	Portfolio management	Cost rearrangement	Service level agreement	Budget control and reporting IT	Normalized eigenvectors
Performance measurement IT	0.132743	0.151515	0.294118	0.243243	0.068493	0.178022511
Portfolio management	0.39823	0.454545	0.294118	0.243243	0.616438	0.401314958
Cost rearrangement	0.026549	0.090909	0.058824	0.027027	0.068493	0.054360294
Service level agreements	0.044248	0.151515	0.176471	0.081081	0.041096	0.0988821
Budget control and reporting IT	0.39823	0.151515	0.176471	0.405405	0.205479	0.267420137

Table 10: Matrix vector priorities for each section on the process domain

Alternatives (Part)	Performance measurement IT	Portfolio management	Cost rearrangement	Service level agreement	Budget control and reporting IT
Performance measurement IT	1	0.333333	3	3	0.333333
Portfolio management	3	1	3	3	3
Cost rearrangement	0.333333	0.333333	1	0.333333	0.333333
Service level agreement	0.333333	0.333333	3	1	0.333333
Budget control and reporting IT	3	0.333333	3	3	1

With the domains in each column divided by the total number in the column in question, it obtained relative normalized weights. The value of eigenvectors is generated from the average value of the relative weights for each row. The results can be seen in Table 9, as follows.

Furthermore, the maximum eigenvalues (λ maximum) was found by adding the result of multiplying the number of columns the eigenvectors. The maximum eigenvalue that could be obtained were:

$$\lambda \text{ maximum} = (7.666667 \times 0.178022511)+(2.33333 \times 0.401314958)+(13 \times 0.054360294)+(10.33333 \times 0.0988821)+(4.99999 \times 0.267420137)$$
$$= 5.366807027$$

Because the order of 5 matrix (i.e., consisting of five alternatives), consistency index values were obtained:

$$CI = (\lambda \text{ max-n})/(n-1)$$
$$= (5.366807027-5)/(5-1)$$
$$= 0.36680702/4$$
$$= 0.091701757$$

For n = 5, RI = 1.120 (Saaty Table), then:

$$CR = CI/RI$$
$$= 0.091701757/1.120$$
$$= 0.081876568 , <0.100$$

CR <0,100 meant that respondent preferences were consistent.

To obtain the priority vector, each domain and each line in Table 10 was multiplied and then taken root rank n. The results of each line were then divided by the sum of each row.

Table 11: Weighting Matrix factor for relational mechanism domain

	Before being simplified		After being simplified	
Alternatives (Section)	Knowledge management	Manager senior executive (Example)	Knowledge management	Manager senior executive (Example)
Knowledge management	1	1/5	1	0.2
Manager senior executive (Example)	5	1	5	1.0
Σ			6	1.2

Thus, it obtained vector priorities, namely:

$= \sqrt[4]{1\times0.33333\times3\times3\times0.33333} = 1.663994$
$= \sqrt[4]{3\times1\times3\times3\times3} = 1.898829$
$= \sqrt[4]{0.3333\times0.33333\times1\times0.33333\times0.33333} = 1.235931$
$= \sqrt[4]{0.3333\times0.33333\times3\times1\times0.33333} = 1.495349$
$= \sqrt[4]{3\times1\times3\times3\times3} = 1.792917$

If the total number of Σ = 8.087019, so that the end results of vector priorities were:

- IT Performance Measurement:
  1.663994/8.087019 = 0.205761 (Priority 3)
- Portfolio Management:
  1.898829/8.087019 = 0.2348 (Priority 1)
- Cost Rearrangement:
  1.235931/8.087019 = 0.152829 (Priority 5)
- Service Level Agreement:
  1.495349/8.087019 = 0.184907 (Priority 4)
- Budget Control and Reporting IT:
  1.792917/8.087019 = 0.221703 (Priority 2)

The results of calculation of AHP showed that the Process Domain namely the Management Portfolio obtained the highest final value at 0.2348. Therefore, this organization is more concerned on the part of Management Portfolio to get the attention/priority of the other parts.

Weighting alternative: Relational mechanisms: Table 11 shows the results data from interviews from several sources on the weight of sub domains of relational mechanisms, whereas in Table 11, it changed after simplification.

With the domains in each column divided by the total number in the column in question, it obtained relative normalized weights. The value of eigenvectors is generated from the average value of the relative weights for each row.

The results of Matrix Weight Factor Hierarchy on Domain Normalized Relational Mechanism are: (a) Total value of knowledge of domain Management = 4, with the eigenvector value = 0.25, (b) Total number of domain Senior Manager Executive (for example) = 1.3333, with eigenvector value = 0.75.

Furthermore, the maximum eigenvalues (λ maximum) was found by adding the result of multiplying the number of columns the eigenvectors. The maximum eigenvalue that could be obtained were:

λ maximum = (4×0.25)+(1.33333×0.75) = 2

Because the matrix order 2 (i.e., consisting of two alternatives), consistency index values were obtained:

CI = (λ max-n)/(n-1)
= (2-2)/(2-1)
= 0/1
= 0

For n = 2, RI = 0 (Table Saaty), then: CR was worth 0, the denominator was0. Because CI was zero, then the pairwise comparison matrix is consistent.

The results of the priority vector matrix for each section in the domain relational mechanism are: (a) Knowledge management with knowledge management: 1 and with senior manager executive: 0.3333, (b) Senior manager with knowledge management: 3 and with senior manager: 1.

Thus, it obtained vector priorities, namely:

$= \sqrt[4]{1\times0.33333} = 0.759836$
$= \sqrt[4]{3\times1} = 1.136219$

If the total number of Σ = 1.896055, so that the end results of vector priorities were:

- Knowledge Management: 0.759836/1.896055 = 0.400746 (Priority 2)
- Senior Executive Management (Model): 1.136219/1.896055 = 0.599254 (Priority 1)

The results of the AHP calculations shows that the Relational Mechanisms domain namely the Senior Executive Management (Exemplary) obtained the highest final score at 0.599254. Therefore, this organization is more concentrated on this section to get the attention/priority of other parts.

IT Governance requires an alignment between Information Technology itself with the business processes running in the company, but sometimes the alignment is not as easily created[3,6,9,21]. The organizational structure, designed processes and relational mechanisms are important to ensure that the IT companies are managed optimally in supporting the achievement of the strategy and objectives of the company so that it can be said as the alignment of IT-Business Company[6,8].

In the research conducted by De Haes and Van Grembergen[9], there were 11 important parts of IT governance practices. Those eleven important parts composed of structure (4 parts), process (5 parts) and relational mechanisms (2 parts) are certainly the core parts in determining the success of achieving effective IT governance practices.

An organization or company must have conditions that vary with each other, this is a challenge for policy makers to take an attitude or decision. The implementation of eleven core factors is mandatory, however, it needs a special consideration to determine the parts that take priority. By looking at the various considerations, it will be determined which parts within each domain to be a priority concern that needs more attention. This becomes something important, a big job and requires skills and a knack for policy makers. Defining these parts as an alternative to be selected as a priority in accordance with the circumstance of the organization becomes an important issue, it needs a way or strategy to solve it[21].

This research has offered a way to assist in making or determining the decision to choose which part of a priority or concern to get more attention. Perhaps, there are many ways other than by using AHP as in this study. This is the task to think about.

The results of the research, process domain became a priority scale than the other domains. It is possible that in the organization, process is considered to be more difficult to implement than the structure and mechanism of relational. Therefore, they are more concerned to pay attention to and emphasize the process that the activities of both the beginning and the end, such as making IT strategic decisions or monitoring of IT procedures and these are considered to be major according to the needs and circumstances of the organization. Other things that are also priority are function of IT governance, portfolio management and senior executive branch that can provide exemplary management/good example. Functions of governance are directly related to corporate governance practices, so that when governance functions and works well, then, of course, the corporate governance practices run well. Therefore, the impact of the alignment between business and IT will be achieved. Similarly, portfolio management is concerned with infrastructure. Business infrastructure cannot be separated from information technology. The information technology infrastructure allows businesses to communicate and conduct transactions with customers, suppliers, also with stakeholders. This can help companies to face competition, finding new strategies and increase productivity. More important thing is that the executive manager of the senior can give good examples because by doing so, it will provide inspiration to subordinates and make the situation conducive to jointly carry out their duties with full responsibility, supporting and succeeding IT governance practices . As a result, IT governance practices could be run effectively[4-6,8,14].

CONCLUSION AND FUTURE RECOMMENDATION

This study has found a strategic step in the practice of IT governance by using AHP based on a multi-criteria decision-making methodology. The AHP can produce effective ranking results with easy calculations. The calculation process is accompanied by a systematic procedure and applying this procedure can get an accurate solution with a high level of consensus. Criteria (domains) and alternatives (sub-domain) derive from the literature review as well as discussions with local experts in Indonesia.

Finally, research results show that process domains are more important than on other domains. These results apply as a technique of finding strategic steps in the practice of IT governance that can provide effective and scientific measurements. The end result of the weight of each alternative (sub-domain) at the last hierarchical level will drive the best choice and the end result will be helpful for decision makers in determining the strategic move of IT governance practices. Future studies are expected to adopt a fuzzy multi-attribute approach, to then be compared with those presented in this study.

For further research, this design concept needs to be implemented and conducted in terms of data collection directly through observation, interviews and questionnaires involving all parties to obtain valid and tangible data, so the results really fit with the conditions and expectations of the organization or company. The AHP method can be used as a tool to overcome this problem, for further development, it can be tested using other methods such as fuzzy multi-criteria to get more objective and better results.

SIGNIFICANCE STATEMENT

This study finds important domains and sub-domains in the implementation of IT governance within an organization or company, in the form of recommendations that can be useful to determine the strategic steps to be taken in order to accelerate the achievement of business and IT alignment.

REFERENCES

1. Bai, C. and J. Sarkis, 2013. A grey-based DEMATEL model for evaluating business process management critical success factors. Int. J. Prod. Econ., 146: 281-292.
2. ITGI., 2007. COBIT® 4.1: Framework, Control Objectives, Management Guidelines and Maturity Models. IT Governance Institute, USA., ISBN-13: 9781933284729, Pages: 196.
3. Wu, S.P.J., D.W. Straub and T.P. Liang, 2015. How information technology governance mechanisms and strategic alignment influence organizational performance: Insights from a matched survey of business and IT managers. MIS Quart., 39: 497-518.
4. Altemimi, M.A.H. and M.S. Zakaria, 2015. IT governance landscape: Toward understanding the effective IT governance decision-making. Scholedge Int. J. Bus. Policy Governance, 2: 5-17.
5. Safdar, M., G. Richards and B. Raahemi, 2015. A model of effective IT governance for collaborative networked organizations. Proceedings of the 12th International Joint Conference on e-Business and Telecommunications, July 20-22, 2015, Colmar, France, pp: 191-202.
6. Khther, R.A. and M. Othman, 2013. Cobit framework as a guideline of effective it governance in higher education: A review. Int. J. Inform. Technol. Converg. Serv., 3: 21-29.
7. Lapao, L.V., 2011. Organizational challenges and barriers to implementing "IT Governance" in a hospital. Electron. J. Inform. Syst. Eval., 14: 37-45.
8. Ali, S. and P. Green, 2012. Effective Information Technology (IT) governance mechanisms: An IT outsourcing perspective. Inform. Syst. Front., 14: 179-193.
9. De Haes, S. and W. van Grembergen, 2009. Exploring the relationship between IT governance practices and business/IT alignment through extreme case analysis in Belgian mid-to-large size financial enterprises. J. Enterprise Inform. Manage., 22: 615-637.
10. Ferguson, C., P. Green, R. Vaswani and G.H. Wu, 2013. Determinants of effective information technology governance. Int. J. Audit., 17: 75-99.
11. Xiang, W., Y. Li and Y. Shou, 2013. An empirical study of critical success factors of project governance in China. Proceedings of the IEEE International Conference on Industrial Engineering and Engineering Management, December 10-13, 2013, Bangkok, Thailand, pp: 405-409.
12. Alreemy, Z., V. Chang, R. Walters and G. Wills, 2016. Critical Success Factors (CSFs) for Information Technology Governance (ITG). Int. J. Inform. Manage., 36: 907-916.
13. Ahmad, N., N.T. Amer, F. Qutaifan and A. Alhilali, 2013. Technology adoption model and a road map to successful implementation of ITIL. J. Enterprise Inform. Manage., 26: 553-576.
14. Yudatama, U., A.N. Hidayanto and B.A.A. Nazief, 2017. Awareness and attitudes toward it governance: Empirical study. J. Theor. Applied Inform. Technol., 95: 2680-2687.
15. Yudatama, U. and R. Sarno, 2016. Priority determination for higher education strategic planning using balanced scorecard, FAHP and TOPSIS (Case study: XYZ University). IOP Conf. Ser.: Mater. Sci. Eng., Vol. 105, No. 1. 10.1088/1757-899X/105/1/012040.
16. Yudatama, U., A. Setiawan and A. Trismanto, 2017. Alignment between val IT and risk IT for choosing a business strategy by fuzzy analytical hierarchy process and TOPSIS. Adv. Sci. Lett., 23: 2492-2494.
17. Teh, D. and B. Corbitt, 2015. Building sustainability strategy in business. J. Bus. Strategy, 36: 39-46.
18. Lin, Y.M., N.H. Arshad, H. Haron, Y.B. Wah, M. Yusoff and A. Mohamed, 2011. IT governance awareness and practices: An insight from Malaysian senior management perspective. J. Bus. Syst. Governance Ethics, 5: 43-57.
19. Merhout, J.W. and D. Havelka, 2008. Information technology auditing: A value-added IT governance partnership between IT management and audit. Commun. Assoc. Inform. Syst., 23: 463-482.
20. Bianchi, I.S. and R.D. Sousa, 2016. IT Governance mechanisms in higher education. Proc. Comput. Sci., 100: 941-946.
21. De Souza Bermejo, P.H., A.O. Tonelli, A.L. Zambalde, P.A. dos Santos and L. Zuppo, 2014. Evaluating IT governance practices and business and IT outcomes: A quantitative exploratory study in Brazilian companies. Proc. Technol., 16: 849-857.
22. Al Qassimi, N. and L. Rusu, 2015. IT governance in a public organization in a developing country: A case study of a governmental organization. Proc. Comput. Sci., 64: 450-456.
23. Shadpour, P., B. Teimourpour and R. Asadi, 2013. Webometrics-based analysis and ranking of Iranian hospital websites. Int. J. Hosp. Res., 2: 77-84.
24. Miranda, F.J., R. Sanguino and T.M. Banegil, 2009. Quantitative assessment of European municipal web sites: Development and use of an evaluation tool. Int. Res., 19: 425-441.
25. Harshan, R.K., X. Chen and B. Shi, 2017. Analytic Hierarchy Process (AHP) based model for assessing performance quality of library websites. Inform. Technol. J., 16: 35-43.