

Determining Multi-Criteria Supplier Selection towards Sustainable Development of IT Project Outsourcing

Prashaya Fusiripong¹, Fauziah Baharom², Yuhanis Yusof³

^{1,2,3}*School of Computing, College Arts and Sciences, Universiti Utara Malaysia
Sintok, 06010 Universiti Utara Malaysia, Kedah, Malaysia*

¹*prashaya.f@rsu.ac.th*

²*fauziah@uum.edu.my*

³*yuhanis@uum.edu.my*

¹*College of Information and Communication Technology, Rangsit University
Muang-Ake, Pathumthani 12000, Thailand*

Abstract— Due to competitiveness in the global business, many organizations have sought alternative to improve their businesses and operations by outsourcing projects and this includes Information Technology (IT) projects. Selecting the most suitable IT supplier is important to ensure sustainable development of the projects. Supplier is selected based on a set of criteria used in the decision process. The criteria can be comprised into tangible and intangible criteria. Many studies have attempted to determine the criteria to be used in selecting IT supplier, nevertheless, it has yet to be reported on a standardize set of criteria to be used in IT outsourcing projects. Thus outsourcing decisions are often made under uncertainty and incomplete information which leads to weak decision and high risk of project's failure. Therefore, the study aimed to determine multi-criteria for supplier selection in order to ensure the sustainable development of IT outsourcing projects. The criteria were identified using comprehensive review approach that utilizes searching information related to multi criteria supplier selection in IT outsourcing and successful criteria of IT outsourcing projects. As a result, the identified criteria is proposed as a standardize criteria in selecting supplier for IT outsourcing projects. Such a contribution is hoped to benefit businesses for various IT outsourcing projects.

Keywords— *IT outsourcing, multi-criteria, supplier selection, sustainable development.*

1. Introduction

Project outsourcing can simply be defined as turning over a part or full tasks of a project to the selected supplier for providing products or services [1, 2]. The IT products and services that can be outsourcing are software development, data center operation, help desk, network management, disaster recovery and web hosting [3, 4].

Outsourcing involved a contractual business between an organization and selected supplier. Currently, due to competitiveness in the global business, many organizations have sought alternative to improve their businesses and operations strategy through outsourcing [5]. According to Bahli and Rivard [6], the global market of IT project outsourcing will grow approximately \$US320 billion in 2015. Organizations applied various perspectives of IT project outsourcing such as on-shoring [7, 8] and off-shoring [9], Enterprise Resource Planning (ERP) [10], and software testing [11].

There are some reasons for outsourcing of IT projects and these include enabling the organization to focus on its core business, overcome the lack of knowledge and skills within the organization, improve the quality and services, increase productivity and reduce cost [3, 12]. However, Karami and Guo [3] claimed that half of all outsourcing agreements in United States are failed. This is supported by, Smuts, et al. [13] who highlighted that only half of 192 respondents satisfied with the outsourcing which referred to their case study research in the United Kingdom, United States and Australia. These finding indirectly show that outsourcing decision for selecting a qualified supplier is complex. According to Karami and Guo [3] outsourcing decisions are often made under uncertainty and incomplete information, and also lack of comprehensive decision models which leads to wrong decision and results in loss of core competencies and exposure to unexpected risks. Hence, many studies were conducted to improve the supplier selection process for outsourcing. As stated in [14] the supplier selection can be done either based on single criterion decision making or multi-criteria decision making.

In Single Criterion Decision Making (SCDM) approach, the decision process for selecting the

suitable supplier is simple as the task involved with evaluating only one criterion which generally cost-benefit or financial based criterion [14]. However, SCDM cannot support the real practice as a wide range of criteria is employed to select the qualified supplier [15]. As a result, Multi Criteria Decision Making (MCDM) approach was introduced. In MCDM, suppliers are selected based on both tangible and intangible criteria [8]. The tangible criteria is referred to quantitative criteria such as price [16]. Whereas intangible criteria is referred to qualitative criteria such as financial, technical capability and expert, delivery and performance history [9]. Each criterion will influence the selection process via an equal or different weighting factor.

This study aims to propose standardized multi-criteria for selecting supplier of IT project outsourcing which constituted tangible and intangible criteria. The criteria will be used to improve the effectiveness of supplier selection to ensure the sustainable development of IT projects outsourcing. Sustainable development was defined as “development that meets the needs of the present without compromising the ability of future generations to meet their own needs” [43]. According to Eskerod and Huemann in [43] the sustainable development theories are mainly focused on environment, economic and social dimensions when making decisions in organizations and societies [43]. These dimensions are interrelated and influence each other.

The organization of this paper is as follows. Section 2 presents the review of literature on IT outsourcing, multi-criteria and success criteria in IT outsourcing. Section 3 discussed the research methodology used to achieve the specified goal. Discussion on the finding are provided in section 4 while the last section describes the conclusion and future work.

2. Literature Review

2.1 IT Outsourcing

Today, IT outsourcing is an important a part of IT management strategy for organizations which includes the improvement both internal and external operations and their business performance [17]. The trend of IT outsourcing has been growing due to the reduction of expenditure, increasing productivity and services, knowledge sharing, advantage of global business competitiveness [18, 19]. There are three types of outsourcing: *onshore* (within the same country), *nearshore* (within the common border) and *offshore* (countries sea

border). Each organization has a different requirement for using IT outsourcing which depends on organization’s need. For example, Thakur and Anbanandam [8] state that outsourcing in e-banking system is used for improving the system to achieve customer satisfaction. Due to the growth of advancements in information and communication technologies, organizations have employed the outsourcing strategies to improve the quality at lower cost within inadequate skilled human resources [1]. Moreover, Mukherjee and Mukherjee [9] highlighted that offshore IT outsourcing have been able to save the expenditure of the organizations more and improving overall business performance in the long run. As a result, studies were conducted to determine criteria for improving outsourcing decisions in selecting qualify supplier. Supplier selection has been focused by academicians since 1960s where the early research is largely focused on financial implication and single criterion assessment. Due to imprecise decision, many researchers have proposed multi criteria for supplier selection and this includes the price, quality, delivery time, supplier financial and performance criteria

2.2 Multi-Criteria Supplier Selection in IT Outsourcing

MCDM considers both tangible (measurable) and intangible (immeasurable) [8, 16] criteria. The performance criteria of a supplier were proposed by Dickson [20] who identified 23 criteria such as quality, delivery and performance history, and so on. Yang and Huang [21] stated that criteria being used in the IT outsourcing decision process should rely on the organization’s requirement and must affect to the organization’s benefit. They provided five criteria such as management, strategy, technology, economics, and quality. These criteria in the decision process were selected by experts or decision makers [22, 23]. For instance, Wang, et al. [24] listed strategy, economics, risk, environment, and quality required to IS outsourcing decision problem. Likewise, Chen, et al. [25] suggested seven decision criteria were applied as experience, reputation, flexibility, technical capability, quality, management, and price. Moreover, Chen and Wang [26] provide ten criteria, that are technical capability, financial performance, performance history, quality, price, flexibility, reputation, delivery time, experience, and market share, with the interview of the five Taiwan-based computer information manufacturers. Meanwhile, Morais, et al. [4] using group decision maker selected three criteria apply in the IT service outsourcing selection process.

Successful Criteria	Reference No	[38]	[39]	[40]	[37]	[36]	[35]	[13]	[41]	[34]	[33]	[11]	[42]
Quality and Service Performance			X	X	X		X	X	X		X		X
Cost / Financial Management			X	X			X	X		X	X		
Knowledge			X			X			X	X	X	X	X
Flexibility								X		X	X		
Technology / Physical Infrastructure			X				X						X
Multi-Culture and Language						X	X					X	
Reputation			X									X	X
Risk Management and Assessment											X		X

In addition, for IT services outsourcing determined successful criteria to the achieve customer satisfaction. According to Bairi and Manohar [41] pointed out five critical success factors for the customer satisfaction in IT service outsourcing. Likewise, Lin [42] identified critical success criteria to select an Application Service Provider (ASP) for travel intermediaries in Taiwan which it comprised system integration, labor cost, corporate awareness, information security, professionalism, rapid implementation of IS. Moreover, the public universities conducted success criteria to point out the successful IT outsourcing through internal interview [38]. Of which, the significant criteria have two criteria that are: the understanding client’s objection and the top management’s support and involvement. Furthermore, there are some researches providing success criteria based on survey of 357 IT managers [39] and IT outsourcing theories [40]. The summarized of successful criteria in IT outsourcing can be illustrated as the Table 2.

3. Research Methodology

This study is performed through comprehensive review approach. First the study began by defining the keywords to be used in searching articles related to IT outsourcing. The search keyword used are “IT outsourcing”, “IT outsourcing project”, “IT

supplier/vendor/provider selection”, “IT off-shoring”, “IT on-shoring”, “IT service supplier/vendor/provider”, “Software outsourcing”, “ERP supplier/vendor/provider”, “Supplier Selection Problem”, “Success Factors”, “Critical Success Factors” and “Multi-Criteria Decision Making”. The reviewed papers were from various resources including publication in Web of Science database such as IEEE Explore, ScienceDirect, Emeralds, Springer as well as ACM journal. This study used the “Count” approach as adopted from Khan and Faisal [10], Chang, et al. [12] to order the criteria for supplier selection process. Then, the study continues by determining the successful criteria for IT outsourcing. Findings obtained from these two activities were then analysed to determine a set of criteria for supplier selection in IT project outsourcing. The analysis was done through matching technique by looking on the similarity (i.e. meaning) of each criterion. According to Chang, et al. [12], they applied the similar meaning concept with grouping criteria in the same aspects and characteristic such as group of “software and hardware capacities”, it included “software technique capacity” and “hardware technique capacity”. Therefore, the flow of matching technique (refer to Figure 1) between the identified criteria; successful and multi-criteria. Finally, the proposed criteria were determined to the successful multi-criteria to be used in the IT outsourcing selection problems.

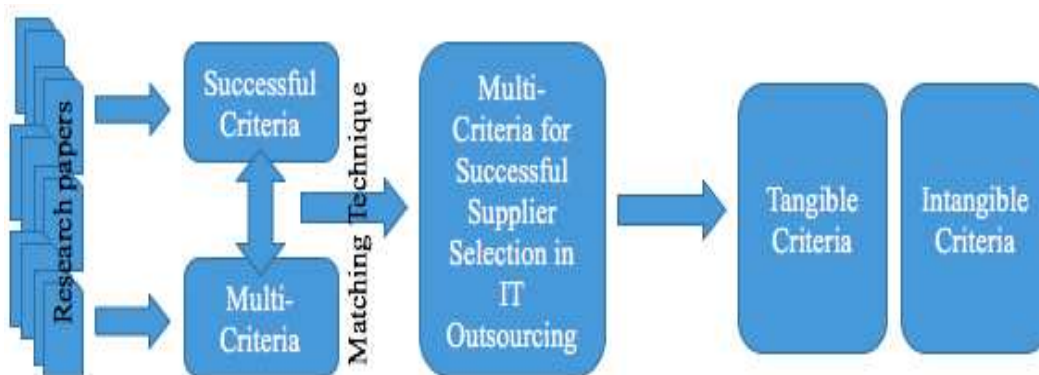


Figure 1. Proposed Flow in determining multi criteria for effective supplier selection in IT project outsourcing

4. Result and Discussion

The result determined a set of the suitable criteria being used in IT outsourcing selection problem. These criteria were sought from literature as multi-criteria and successful criteria in IT outsourcing. Therefore, this section explained into three subsections, namely ordering the identified criteria in IT outsourcing, success criteria of IT outsourcing, and multi-criteria for effective supplier selection in IT outsourcing.

4.1 Ordering the Identified Criteria

The study adopted the “Count” approach to determine the significance of criteria being used in IT outsourcing selection problem. Therefore, the approach can be applied to determine multi-criteria and successful criteria with a number of contribution in the literature of IT outsourcing. Thus, the results of both criteria show in Figure 2 and Figure 3 respectively.

In Figure 2, the criteria in IT outsourcing selection problem which were collected from literature and through the “Count” approach. As a result, it can identify criteria into twenty-nine criteria being used in the selection process. There are four criteria which were considered as first priorities to be used in IT outsourcing selection problem which are; quality (16 times), cost/price (12 times), flexibility

(9 times), and technical capability and expert (8 times) criteria respectively.

The contributed number of each criterion obtained by the different perspective of the experts, decision-makers, and organization’s need to use IT outsourcing. For instance, The quality criteria being used in IT outsourcing selection comprised with quality of IT service [4], quality conformance product [27], quality of management [31], quality and reliability of product [12], and information quality [30]. In addition, the critical criteria significantly impacted to organizations are that cost/price criteria. Hence, it has become to the second priority of IT outsourcing selection process. This is due to hiring of IT outsourcing project have the various outsourced, resulting there are the various expenditure perspectives such as service cost [30, 31], operation and set-up cost [30] as well as general cost/price [7, 8]. Likewise, flexibility criteria, organizations and suppliers should have between them in term of operation that is: adjustment of fees, adjustment of services, adjustment of the deadline for the delivery solution, and the ability of increase/decrease services [12, 29]. The last of top four criteria being used in IT outsourcing selection and evaluation process is that technical capability and expert. The number of contribution of the criteria obtained by considering the higher quality technical staff and ability in the solving technical problem [9].

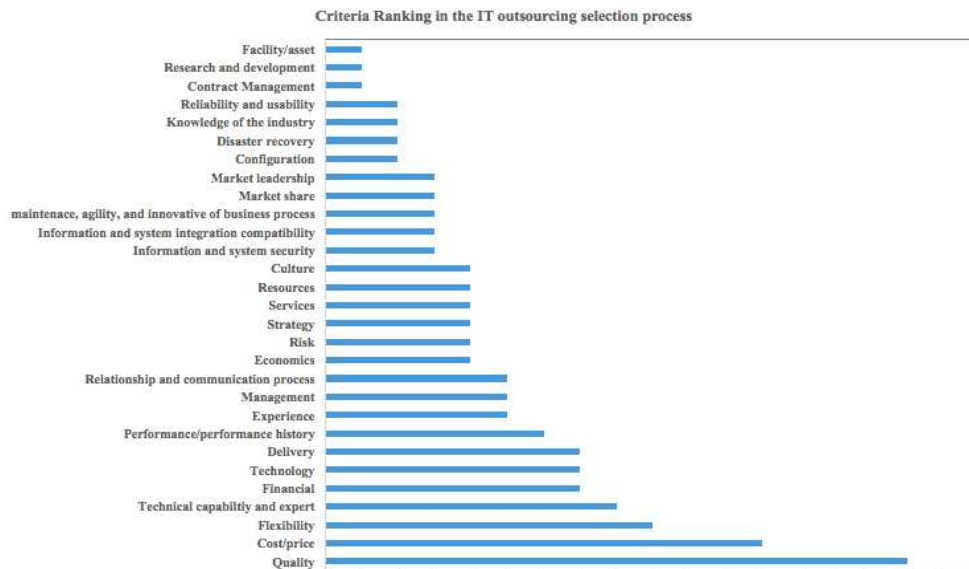


Figure 2. Criteria ranking in the IT outsourcing selection process

Unfortunately, most researchers also neglect risk criteria in the IT outsourcing selection process such in Figure 2. There is solely four times to be used with by considering in the selection process. This might be negative result to the process due to the

risk criteria can indicate to likelihood and expectation IT outsourcing project outcome based on a review of the existing system, culture differences, lack of expertise of the supplier as well as the lack of experience with project management

[3, 31]. The result of the criteria emphasized to the assessment for efficiency and ability of suppliers and organizations in the implementation IT project. In other words, this approach was preferred to use in determining the criteria of successful IT outsourcing projects, the result is showed in Figure



Figure 3. Criteria ranking in the successful IT outsourcing projects

Hence, most number of contribution of successful criteria were concerned with the overall management criteria. The relationship and communication management criteria was crucial factor for successful IT outsourcing project. This is due to the good relationship between client and supplier directly impacted to their cooperation. Therefore, the contributed number obtained from the criteria involved the collaboration between client and supplier. The high impact criteria to the successful IT outsourcing project is that supported by executive management level. This is the reason that it included the negotiation, decision, commitment as well as contract management process between the parties. Moreover, most researchers claimed that the human resource management criteria have significantly become to lead to IT outsourcing project success. This is because it can point out to the good staff and IT professional management which also included their competency. Beside these criteria are mentioned above, another criterion also referred to the performance of outsourced and supplier for identifying the IT outsourcing success. However, there is only one criterion which is somewhat neglected from the list of the successful criteria noticeable that is risk management and assessment. Obviously, the relationship and management criteria being used between outsourcer and supplier have significantly involved with the successful IT outsourcing rather than the overall performance of supplier. In contrast, the IT outsourcing selection process in case study also emphasizes to the performance criteria both outsourcer and supplier such as quality of product and service, cost/price as

3. From the result, the researchers mentioned to the relationship and management criteria both the IT project management and staff communication and management between outsourcer and the selected supplier.

well as technical capability.

4.2 Success Criteria of IT Outsourcing Project

The criteria identified in the previous section includes all criteria, regardless if they are from successful or unsuccessful projects. Hence, this study proposed to consider the criteria from successful IT outsourcing projects. The successful criteria can be defined with the different meaning on different perspective of IT outsourcing projects as listed in Table 3.

These successful criteria are able to point out both organization and supplier for providing the IT outsourcing project success. Indeed, both parties should concern the good relationship and communication management due to the mostly outsourced project required the activities collaboration and some information exposure of outsourcer with the selected supplier. Therefore, team-workers, which comprised staff and management team, are necessary in the efficient communication. Especially, if the selected supplier has a different culture and different language, the organization should be concerned the miscommunication and misunderstanding of team-workers between organization and supplier. In contrast, the good communication will lead to the accurate information for the management team to make a decision. In addition, the management team can as be using this information for negotiating with supplier and tracking project progress. In other words, outsourcers should recognize the

extendable contract of the supplier when the outsourcer require adjusting requirement or business process. Meanwhile, the selected supplier need an understanding the business environment of outsourcer; resulting IT process changed. However, all of the adjusting will depend on the cost/financial of each organization acceptance. Hence, the successful IT outsourcing still relies on the cost/financial management capability in each

organization. In other words, the economic and financial stability is also the key indicator both organization and the selected supplier. This is because of the factor is the high impacted to the decision making and quality of products and services for obtaining from the supplier. Furthermore, it is still able to point out the ability to hire the high quality of IT professional.

Table 3. Criteria Meaning based on Successful IT outsourcing projects

Successful Criteria	Meaning	References No
Relationship and Communication Management	<ul style="list-style-type: none"> - Both parties have the collaborative activities, build relationship among co-worker of organization and supplier, confidence and trust. - Effective communication between organization and supplier which included among staff and management group. 	[13, 33-35]
Executive Management Level Support	<ul style="list-style-type: none"> - The identification, evaluation, and decision the suitable IT projects for outsourcing. - The negotiation and commitment business process within IT environment based on employee or customer operation information. - The follow up IT projects are to the execution plan and contract. 	[11, 33, 34]
Professional Human Resource / Staff Management	<ul style="list-style-type: none"> - The supplier must prepare quality staff and good staff management practices and provide superior technical expertise. 	[13, 33-35]
Quality and Service Performance	<ul style="list-style-type: none"> - To provide good qualities and services which include after sale services and service guarantee in the time commitment (service level agreement). - Improving quality and services performant continuously 	[13, 35, 42]
Cost / Financial Management	<ul style="list-style-type: none"> - The sensible cost / price on a suitable of quality of product and service will receive from supplier. 	[13, 33, 35]
Knowledge	<ul style="list-style-type: none"> - Understanding business process on aspect of each organization with IT knowledge of supplier. - The supplier must have an ability for transferring knowledge to the organization. 	[33-35]
Flexibility	<ul style="list-style-type: none"> - Both parties have a flexible for the business and technology changing. - Organization can the extendable a suitable during time for solution delivery and project contract. 	[13, 33]
Technology / Physical Infrastructure	<ul style="list-style-type: none"> - The supplier must provide novel innovative of technology for organizations - The readiness of physical infrastructure fundamental such as Internet access, power/electric supply, Telecom, and so on - Sufficient resources including hardware and software to maintain large development projects 	[13, 35]
Multi-Culture and Language	<ul style="list-style-type: none"> - Different culture between organization and supplier that included onshore and offshore supplier. - Different working time when using offshore outsourcing. - Language for communication. 	[11, 35]
Reputation	<ul style="list-style-type: none"> - Supplier's portfolio has been recognized from many organization, market leadership, and higher market share in the global business. 	[11]
Risk Management and Assessment	<ul style="list-style-type: none"> - Handle the project failure on various perspective such as over budget, over project delivery time, and more client's requirement. 	[33]

The efficient staff of supplier was an important a part of the successful IT projects. Due to the IT project required the higher technical skill and specific skill for the implemented project. Therefore, outsourcers have anticipated obtaining the high-quality staff and technical supervisor from a supplier. Moreover, organizations have necessary to find out a suitable supplier for specific requirement of each business process such as Electronic Banking System and Enterprise Resource Planning (ERP). Each system requires the specific knowledge and experience of professional supplier, including the ability of knowledge transfer from supplier to the organization when the project was delivered to the outsourcer. Also, both capability of IT staff and good knowledge lead to

the efficient producing and improving the products and services continuously to the organization. Likewise, the troubleshoot capability and immediate responsiveness can indicate to the higher supplier's performance. Therefore, the quality and service performance is significantly a factor in the IT outsourcing project success. Besides, supplier reputation indicated to the experience and popularity in a specific area of each supplier's capability. Moreover, market leadership and market share also pointed out the reputation of each supplier on each specific area of IT outsourcing.

Furthermore, organization and supplier necessary prepare a suitable technology and infrastructure for

IT outsourcing project implementation. By organization provided the good infrastructure such as Internet access, power and electric supply, and so on. Meanwhile, the supplier prepared an appropriate and innovative technology in each project to support the business process. Thus, these criteria were mentioned above mostly no concerned to the risk such as the high turning over of experts, over budget, lack of innovative of a supplier. Therefore, the organization should consider a risk to the IT outsourcing project due to it can forecast the IT project failure or success.

4.3 Proposed Successful Multi-Criteria for Supplier Selection in IT Outsourcing

The matching technique (refer to Figure 1) is able to point out the criteria should be adopted in the selection process with the variety of IT outsourcing. This is because of these criteria were comprehensive the various perspective of literature's IT outsourcing based on case study. Of which, each criterion has the different aspects (i.e. meaning) in the selection process due to organizations have the various requirement for using IT outsourcing. Therefore, the study attempted to interpret these meaning of case study criteria through the process of matching technique with successful criteria in IT outsourcing.

Accordingly, the successful criteria illustrated the meaning in the preview section. It can indicate in the various perspective in each successful criterion. As a result, criteria in the case study can match more than one criteria to one successful criterion. For example, the manner of relationship and communication management on successful IT outsourcing project can indicate the type of communication and trust between the outsourcer and the selected supplier. Therefore, it can put on criteria of a case study that are: relationship and communication process, and reliability and usability criteria. This is due to both of them attempted to consider the relationship and cooperation between the outsourcer and the selection supplier which included outsourcer's confidence on the supplier for information sharing. In addition, the relationship and communication management criteria have also influenced to the executive management support, and multi-culture and language criteria. Thus, management, strategy, and contract management in the case study of the supplier selection problem have become an important in term of planning, decision, commitment, and management. These criteria were necessary executed with the executive management level in the consideration. Moreover, the culture and language criteria should be adopted in the selection process of IT outsourcing, particularly

offshore IT outsourcing selection problem. This is due to the hiring of offshore IT outsourcing required the working with the different culture and different language; resulting the culture and language criteria should consider in the selection process.

Furthermore, the high quality of IT outsourcing projects does not only the good relationship and management criteria but also constituted the high quality resource both human, technology, and knowledge. The technical capability and expert and resource criteria to be used in case study should be mentioned in the selection process due to this is an important mechanism for performing the successful IT outsourcing projects. Meanwhile, the group of technology, which comprised security system, integration system, configuration system, as well as infrastructure asset of an organization, be the factors should consider to the IT outsourcing selection problem. Moreover, industry knowledge and experience of supplier was an important part of the selection process. This is because the knowledge and experience criteria will lead to understanding each business process of each organization for improving the process with information technology. Also, the cost, financial stability, and economic condition of organization and supplier needed to consider in the selection problems. The financial factor can be indicated the efficient hiring high quality of IT professional, and producing and providing the high product quality. This is a result that financial and cost factors are one of the successful criteria in the IT outsourcing project.

In addition, supplier portfolio was necessary for the organizations in the consideration. The portfolio is the supplier history that is: quality of product and service, solution delivery, performance and performance history, and satisfaction criteria. These criteria occurred to the supplier success in the performing IT outsourcing project. Likewise, the number of contribution using each supplier of organization point out to favor in the outsourcing firm. This can indicate to the criteria that are: market leadership and market share in the global business of IT outsourcing. Therefore, it can be referred the reputation factor in the IT outsourcing project success. In the other hands, the changing incidence of all factor will be necessary to concern due to the changing have impacted to the successful IT outsourcing project. Therefore, the risk and flexibility criteria have become to the prevention IT project nonsuccess. As a result, both of them needed to be considered in the selection process of IT outsourcing project. Consequently, the study can interpret all the case study criteria into successful criteria in the IT outsourcing project with the meaning as listed in Table 4.

Table 4. Similarity Meaning of Multi-Criteria based on Successful Criteria

Successful Criteria	Multi-Criteria
- Relationship and Communication Management	- Relationship and communication process - Reliability and usability
- Executive Management Level Support	- Management - Strategy - Contract management
- Professional Human Resource / Staff Management	- Technical capability and expert - Resource
- Quality and Service Performance	- Quality - Service - Delivery - Performance/Performance history - Maintenance, agility, and innovative of business process - Satisfaction and responsiveness
- Cost / Financial Management	- Cost/Price - Financial - Economic
- Knowledge	- Knowledge of the industry - Experience
- Flexibility	- Flexibility
- Technology / Physical Infrastructure	- Technology - Information and system security - Information and system integration compatibility - Configuration - Research and development - Facility/asset
- Multi-Culture and Language	- Culture
- Reputation	- Market leadership - Market share
- Risk Management and Assessment	- Risk

Finally, the result of the technique can be determined as the successful standardized multi-criteria to be used in the selection process of the various IT outsourcing. It can be represented followed by Table 5.

Table 5. Successful Standardized Multi-Criteria for Supplier Selection in IT Projects Outsourcing

Successful Standardized Multi-Criteria
- Economic
- Technology capability and Expert
- Resource
- Quality
- Service
- Delivery
- Performance/Performance history
- Relationship and communication process
- Satisfaction and responsiveness
- Knowledge of the industry
- Flexibility
- Technology
- Information and system security
- Configuration
- Facility/asset
- Management
- Maintenance, and innovative of business process
- Information and system integration compatibility
- Strategy

Successful Standardized Multi-Criteria
- Culture
- Market leadership
- Reliability and usability
- Risk
- Cost/Price
- Financial
- Experience
- Market Share

4.4 Research and Practice Implication

In the previous studies, the decision-making process of IT outsourcing project in each organization have a bewildered for choosing the criteria to be used in the process. This is because most IT outsourcing decision-making process has selected the criteria from various experts with the individual point-of-view in each IT outsourcing project and/or organization requirement. Meanwhile, some case studies, criteria will be collected from the literature. Therefore, these criteria will be unable to point out the successful IT outsourcing project expectation. This is a directly impacting of the selection a suitable IT supplier. This is a result that the standardized criteria identification to be used in the selection process of IT projects outsourcing have become an importance. The standardized criteria will indicate to the variety aspects of IT project outsourcing such as supplier characteristic, the performance of outsourcer and supplier, the ability of collaboration

between outsourcer and supplier as well as internal management and risk of both of them.

There is two approaches combination for determining the successful standardized criteria that are the comprehensive and comparative approach. The comprehensive approach will be operated by keywords which it is applied in the searching process of research papers within academic databases which involved with IT outsourcing selection and IT outsourcing success. Moreover, the successful criteria were determined the meaning (such as Table 3) to be used in the verifying multi-criteria such in Table 4. In case, if organizations require new criterion to consider the IT supplier for the selection process. Then, the criterion might be either a suitable criterion or non-suitable. With the reason, organizations should apply the meaning matching technique for the investigating criterion before adopting in the selection process. The acquisition of the high-quality criteria has a directly impact on the performance measurement of IT supplier in the selection process to operate IT project outsourcing.

Finally, the result (refer to Table 5) of the study will highly impact the IT outsourcing decision-making process. Due to the multi-criteria can indicate in all perspective of the outsourcer and supplier to measure their capability such as performance, management, risk, and so on. Besides of the capability, the IT project characteristic should be contemplated as the type of IT supplier in the selection process of IT supplier. This is a result that the identification criteria for IT supplier selection of the study have affected to likelihood the successful IT project outsourcing. In other words, organizations are able to adopt these criteria in the diagnostic choosing the optimal IT supplier in each IT project.

5. Conclusion and Future Work

IT outsourcing has increased the performance of most organizations to be competitive in global business. However, the current approach in selecting supplier for IT project outsourcing does not utilizes a standard set of criteria. Thus, resulting poor decision making that later jeopardizes the sustainable development of IT project outsourcing. Therefore, this study has proposed a set of standardize criteria that is based on comprehensive information related to criteria in supplier selection in IT outsourcing and successful criteria of IT outsourcing projects. The proposed criteria can later to be used by any multi-criteria decision making techniques to select the supplier for IT outsourcing project. Moreover, in the future, the study will be extended to focus on organizing the criteria based on various dimensions of

sustainable development and constructing measures for each of the identified criteria. It is hoped that the proposed standard set of criteria will facilitate businesses in making the decision for IT outsourcing projects.

References

- [1] M. N. Faisal and S. A. Raza, "IT outsourcing intent in academic institutions in GCC countries: An empirical investigation and multi-criteria decision model for vendor selection," *Journal of Enterprise Information Management*, vol. 29, pp. 432-453, 2016.
- [2] H. Smuts, P. Kotzé, A. van der Merwe, and M. Looock, "Threats and Opportunities for Information Systems Outsourcing," in *2015 International Conference on Enterprise Systems (ES)*, 2015, pp. 110-120.
- [3] A. Karami and Z. Guo, "A Fuzzy Logic Multi-criteria Decision Framework for Selecting IT Service Providers," in *2012 45th Hawaii International Conference on System Sciences*, 2012, pp. 1118-1127.
- [4] D. C. Morais, A. P. C. S. Costa, and A. T. de Almeida, "Group Decision Model for Outsourcing IT Services," *Procedia Technology*, vol. 16, pp. 562-568, 2014/01/01 2014.
- [5] M. Rezaeisaray, S. Ebrahimnejad, and K. Khalili-Damghani, "A novel hybrid MCDM approach for outsourcing supplier selection: A case study in pipe and fittings manufacturing," *Journal of Modelling in Management*, vol. 11, pp. 536-559, 2016.
- [6] B. Bahli and S. Rivard, "Cost escalation in information technology outsourcing: A moderated mediation study," *Decision Support Systems*, vol. 56, pp. 37-47, 12// 2013.
- [7] R. Qiang and D. Li, "An Inhomogeneous Multi-Attribute Decision Making Method and Application to IT/IS Outsourcing Provider Selection," *International Journal of Industrial Engineering*, vol. 22, 2015.
- [8] V. Thakur and R. Anbanandam, "Supplier selection using grey theory: a case study from Indian banking industry," *Journal of Enterprise Information Management*, vol. 28, pp. 769-787, 2015.
- [9] S. Mukherjee and K. Mukherjee, "Selection decisions of offshore ITO service providers for strategic alliances - An AHP-based approach," *International Journal of Business Information Systems*, vol. 20, pp. 238-269, 2015.
- [10] H. Khan and M. N. Faisal, "A Grey-based approach for ERP vendor selection in small and medium enterprises in Qatar," *International Journal of Business Information Systems*, vol. 19, pp. 465-487, 2015.

- [11] F. F. Ismail and R. Razali, "Contributing factors of successful software testing outsourcing," in *2014 8th. Malaysian Software Engineering Conference (MySEC)*, 2014, pp. 55-60.
- [12] S.-I. Chang, D. C. Yen, C. S.-P. Ng, and W.-T. Chang, "An analysis of IT/IS outsourcing provider selection for small- and medium-sized enterprises in Taiwan," *Information & Management*, vol. 49, pp. 199-209, 7// 2012.
- [13] H. Smuts, A. v. d. Merwe, P. Kotz, and M. Look, "Critical success factors for information systems outsourcing management: a software development lifecycle view," presented at the Proceedings of the 2010 Annual Research Conference of the South African Institute of Computer Scientists and Information Technologists, Bela Bela, South Africa, 2010.
- [14] R. Hermann, R. J. Baumgartner, S. Vorbach, A. Ragossnig, and R. Pomberger, "Evaluation and selection of decision-making methods to assess landfill mining projects," *Waste Management & Research*, vol. 33, pp. 822-832, 2015.
- [15] P. Adhikary, P. K. Roy, and A. Mazumdar, "Optimal Renewable Energy Project Selection: A Multi-Criteria Optimization Technique Approach," *Global Journal of Pure and Applied Mathematics*, vol. 11, pp. 3319-3329, 2015.
- [16] A. K. Digalwar, A. Borade, and B. Metri, "A Fuzzy AHP Approach for supplier selection," *Operations and Supply Chain Management*, vol. 7, pp. 46-53, 2014.
- [17] Y. Tjader, J. H. May, J. Shang, L. G. Vargas, and N. Gao, "Firm-level outsourcing decision making: A balanced scorecard-based analytic network process model," *International Journal of Production Economics*, vol. 147, Part C, pp. 614-623, 1// 2014.
- [18] V. D. H. De Carvalho, T. Poletto, and A. P. C. Seixas, "Information technology outsourcing relationship integration: a critical success factors study based on ranking problems (P.γ) and correlation analysis," *Expert Systems*, pp. e12198-n/a, 2017.
- [19] D. M. Jain and R. Khurana, "A framework to study vendors' contribution in a client vendor relationship in information technology service outsourcing in India," *Benchmarking: An International Journal*, vol. 23, pp. 338-358, 2016/03/07 2016.
- [20] G. W. Dickson, "An analysis of vendor selection systems and decisions," *Journal of Purchasing*, vol. 2, pp. 5-17, 1996.
- [21] C. Yang and J.-B. Huang, "A decision model for IS outsourcing," *International Journal of Information Management*, vol. 20, pp. 225-239, 6// 2000.
- [22] J.-J. Wang and D.-L. Yang, "Using a hybrid multi-criteria decision aid method for information systems outsourcing," *Computers & Operations Research*, vol. 34, pp. 3691-3700, 12// 2007.
- [23] O. J. Akomode, B. Lees, and C. Irgens, "Constructing customised models and providing information to support IT outsourcing decisions," *Logistics Information Management*, vol. 11, pp. 114-127, 1998.
- [24] J.-J. Wang, Z.-K. Lin, and H. Huang, "A Decision Model for Information Systems Outsourcing: Using a Multicriteria Method," *Journal of Service Science and Management*, vol. Vol.01No.01, p. 9, 2008.
- [25] Y.-H. Chen, T.-C. Wang, and C.-Y. Wu, "Strategic decisions using the fuzzy PROMETHEE for IS outsourcing," *Expert Systems with Applications*, vol. 38, pp. 13216-13222, 9/15/ 2011.
- [26] L. Y. Chen and T.-C. Wang, "Optimizing partners' choice in IS/IT outsourcing projects: The strategic decision of fuzzy VIKOR," *International Journal of Production Economics*, vol. 120, pp. 233-242, 7// 2009.
- [27] C. Kahraman, O. Engin, Ö. Kabak, and İ. Kaya, "Information systems outsourcing decisions using a group decision-making approach," *Engineering Applications of Artificial Intelligence*, vol. 22, pp. 832-841, 9// 2009.
- [28] S. Nazari-shirkouhi, A. Ansarinejad, S. Miri-nargesi, V. M. Dalfard, and K. Rezaie, "Information Systems Outsourcing Decisions Under Fuzzy Group Decision Making Approach," *International Journal of Information Technology & Decision Making*, vol. 10, pp. 989-1022, 2011.
- [29] B. Watjatrakul, "Vendor selection strategy for IT outsourcing: the weighted-criteria evaluation technique," *Journal of Enterprise Information Management*, vol. 27, pp. 122-138, 2014/02/04 2014.
- [30] C. Kahraman, A. Beskese, and I. Kaya, "Selection among ERP outsourcing alternatives using a fuzzy multi-criteria decision making methodology," *International Journal of Production Research*, vol. 48, pp. 547-566, 2010/01/15 2010.
- [31] J. Cao, G. Cao, and W. Wang, "A hybrid model using analytic network process and gray relational analysis for bank's IT outsourcing vendor selection," *Kybernetes*, vol. 41, pp. 994-1013, 2012.
- [32] W. Liu and L. Quan, "A multi-criteria decision making method based on linguistic preference information for IT outsourcing vendor selection in hospitals," in *International Conference on Information, Business and Education Technology*, 2013.

-
- [33] K. Kronawitter, C. Wentzel, and M. Papadaki, "IT Application Outsourcing in Europe: Long-Term Outcomes, Success Factors and Implications for ITO Maturity," in *2013 46th Hawaii International Conference on System Sciences*, 2013, pp. 4456-4465.
- [34] M. Alexandrova, "IT outsourcing partnerships: Empirical research on key success factors in Bulgarian organizations," *Management: Journal of Contemporary Management Issues*, vol. 17, pp. 31-50, 2012.
- [35] S. U. Khan, M. Niazi, and R. Ahmad, "Critical success factors for offshore software development outsourcing vendors: an empirical study," in *International Conference on Product Focused Software Process Improvement*, 2010, pp. 146-160.
- [36] M. Westner and S. Strahringer, "Determinants of success in IS offshoring projects: Results from an empirical study of German companies," *Information & Management*, vol. 47, pp. 291-299, 8// 2010.
- [37] U. Remus and M. Wiener, "Critical Success Factors for Managing Offshore Software Development Projects," *Journal of Global Information Technology Management*, vol. 12, pp. 6-29, 2009/01/01 2009.
- [38] E. Claver, R. González, J. Gascó, and J. Llopis, "Information systems outsourcing: reasons, reservations and success factors," *Logistics Information Management*, vol. 15, pp. 294-308, 2002.
- [39] R. Gonzalez, J. Gasco, and J. Llopis, "Information systems outsourcing success factors: a review and some results," *Information Management & Computer Security*, vol. 13, pp. 399-418, 2005.
- [40] P. Gottschalk and H. Solli-Sæther, "Critical success factors from IT outsourcing theories: an empirical study," *Industrial Management & Data Systems*, vol. 105, pp. 685-702, 2005.
- [41] J. Bairi and B. M. Manohar, "Critical success factors in gaining user customer satisfaction in outsourced IT services," *Journal of Enterprise Information Management*, vol. 24, pp. 475-493, 2011.
- [42] S.-W. Lin, "The critical success factors for a travel application service provider evaluation and selection by travel intermediaries," *Tourism Management*, vol. 56, pp. 126-141, 10// 2016.
- [43] P. Eskerod and M. Huemann, "Sustainable development and project stakeholder management: what standards say", *International Journal of Managing Projects in Business* vol. 6(1), pp. 36-52, 2013