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Preface

It is our pleasure to introduce you to the Proceedings of 2019 The 9th International Conference on Information Communication and Management (ICICM 2019). The conference was held on August 23-26, 2019 in Prague, Czech Republic. The aim of ICICM is to create a linkage between industry and academia, to build a multidisciplinary discussion platform for researchers. We also hope that the conference results in significant contributions to the knowledge base in these scientific fields. The conference has been held in Singapore, Hong Kong, Paris (France), Geneva (Switzerland), Paris (France), Hatfield (England), Moscow (Russia), and Edinburgh (Scotland) in the past 8 years.

The conference program was put together as a result of much hard work and dedication by many people. All papers were evaluated by anonymous reviewers who are qualified in the field of information communication and management. Divided into 7 chapters, the 39 papers published in the conference proceedings focus on multiple and diverse aspects of the development and application of information and communication technology. The 7 chapters were devoted to the following themes: software testing and development; computer and information technology; signal and image processing; information system design and management; digital communication and network security; information education and management and e-commerce platform design and application.

The conference has also been highlighted by the guest speakers: Prof. Alexander Balinsky, Cardiff University, UK; Prof. Jalel Ben-Othman, University of Paris 13, France; Prof. Atour Taghipour, University of LeHavre, France; Prof. Kazumasa Oida, Fukuoka Institute of Technology, Japan and Prof. Hiroyuki Kameda, Tokyo University of Technology (TUT), Japan. Thanks for their contributions and support to this conference.

Last but not at least, we would like to express our gratitude to conference chairs, program chairs, steering committee, publicity chair, session chairs, the technical program committee members as well as all participants, who dedicated to make the conference run smoothly and properly, and ensure the proceedings quality.

We truly believe the participants will find the discussion fruitful, and it is our sincere hope that you will enjoy the conference and we also hope ICICM will one day become the leading conference in this specific academic area.

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Prof. Alexander Balinsky,

Cardiff University, UK

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Extending IT-based Competitive Strategy Framework using Architecture Vision and Business Architecture of TOGAF Architecture Development Method (ADM)

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ABSTRACT

Aligning IT solutions with business requirements has been and continues to be a major problem in IT management. Despite the variety of the comprehensive IT business alignment frameworks available, many enterprises struggle with the implementation because of the excessive resource requirements and the high complexity processes. The difficulties of applying the existing frameworks and/or methodology are even more challenging for small and medium-sized enterprises (SMEs) because of the limited resources and capabilities in SMEs. Yet, the right IT implementation in SMEs provides the same benefits as in large enterprises.

This study aims to develop a specific and practical IT-business alignment framework to assist IT-business alignment efforts in SMEs. The proposed solution is the extension of IT-based competitive strategy framework using Architecture Vision and Business Architecture of TOGAF Architecture Development Method (ADM). The methodology follows the design-science research, i.e., designing the framework extension and evaluating the framework application in six SMEs in Indonesia. The results of the framework application demonstrate the framework suitability to address SMEs' needs and constraints. The stakeholders' assessment also confirms the benefit of the framework. The proposed framework is easy to understand and to use, and the outcomes are generally applicable for SMEs.

CCS Concepts

•Applied computing →BusinessIT alignment •Applied computing→Enterprise architecture frameworks •Social and professional topics→Management of computing and information systems.

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Keywords

IT-business alignment; IT-based competitive strategy framework; IT management framework; small and medium-sized enterprises; framework extension; TOGAF ADM.

1. INTRODUCTION

Recent advancement of information technology (IT) implementation in business has created a highly complex and competitive business environment [1], [2]. IT has revolutionized the way enterprise conducts its business at an exponential pace. IT enables business operational excellence, drives enterprise innovation, supports customer and supplier intimacy, and improves decision making [3]. For small and medium-sized enterprises (SMEs) that tend to be late technology adopters, IT enhances SMEs capabilities to carry out the business, improves SMEs' competitiveness to level the playing field with larger enterprises, and increases the business growth and the chance of survival [4].

Despite the strategic roles of IT in business, designing IT solutions that meet business requirements is difficult and complicated (ref), especially for SMEs. The barriers of IT solution and implementation in SMEs are mainly caused by limited resources in human resources and capital; and lack of proper managerial practices in day-to-day operation. SMEs rarely have a dedicated IT department that manages and maintains IT implementation. Lack of capital also constrains the solution to resolve inadequate skills and knowledge in IT by hiring external consultants and experts to aid the development of IT solutions. Another barrier is the skepticism among the SMEs' executives regarding the benefit of IT implementation given its expensive cost and how to measure those benefits.

SMEs are acknowledged globally as essential drivers of national economic development and social well-being. SMEs provides main sources of employment, contributes to local welfare by bringing business activities and innovation, stimulates economic development in rural and remote areas, and enhances national economic stability. In Malaysia, the growth of SMEs' GDP at 7.2% exceeded the national GDP at 5.9% in 2017; SMEs also contributed to 37.1% of Malaysia's GDP [5]. In Organisation for Economic Co-operation Development (OECD) countries, SMEs account for averagely 60% employment and generates 50-60% value added in the OECD area [6]. In Indonesia, SMEs provided employment for over 114 million laborers and contributed to 60% of the nation's GDP in 2017 [7].

The use of IT in modern business is inevitable. Due to the lack of resources in SMEs, SMEs need to be backup up by IT to survive in a highly competitive global marketplace. The IT

implementation must be aligned with the enterprise's business vision. Prior studies have proposed methodologies, frameworks, and best practices to achieve seamless IT and business integration. However, most methodologies are not suitable for SMEs because these methodologies are too complicated to be applied in day-to-day operation, some frameworks and best practices are not applicable in SMEs, and most SMEs do not have adequate skills and resources to implement the existing methodologies. A practical and simplified tool can help SMEs initiate the development of IT solutions based on business requirements [8]. One framework that is designed specifically for SMEs is the Information Technology-based Competitive Strategy (ITCS) Framework. To enhance the functionality and applicability of ITCS framework, this study proposes the framework extension using TOGAF Architecture Development Method (ADM) phase A (Architecture Vision) and phase B (Business Architecture) [9]. Since its introduction in 1995, TOGAF has become the most widely adopted enterprise architecture (EA) framework because it provides a comprehensive method to demystify the architecture development process, and it can be integrated with other models or tools.

2. RELATED WORKS

Aligning IT solutions with business requirements has been and continues to be a major concern for IT enterprise executives [10]. There are stacks of IT management frameworks that have been developed by researchers and practitioners over the past few decades. These include Enterprise Architecture Framework (EAF), COBIT 5 [11], Information Technology Infrastructure Library (ITIL) [12], and ISO 38500 for Corporate Governance of Information Technology [13]; each with their own set of theory, rules, principles, and practices.

Enterprise architecture provides a set of knowledge bases that helps an enterprise transforms its business vision into development strategies through a clear understanding of the current state and a specific-designed solution to achieve future goals [14]. A pioneer in EAF domain, Zachman Framework, is based on the principles of taxonomy to describe the complex enterprise systems using a set of perspectives and constructed vocabularies [15]. The framework focuses on the construction of a holistic view of the enterprise rather than on the methodology for creating an architecture and its implementation. The most widely implemented EAF, TOGAF, focuses on the designing, planning, implementing, and governing an enterprise information technology architecture in four major domains: business, applications, data, and technology [9]. The framework includes a comprehensive methodology for designing and maintaining the life-cycle of an architecture enterprise in TOGAF ADM to ensure seamless integration between IT solutions and business requirements.

Another global framework in IT governance, COBIT, provides a set of best practices and tools to support strategic IT-business alignment and the creation of business value from IT investment. The framework defines a set of generic processes of IT management in four domains (namely Plan and Organize, Acquire and Implement, Deliver and Support, and Monitor and Evaluate); a set of best practices for IT governance; and a set of control processes of information systems and technology. The next standardized methodology based on best practices in IT Service Management, ITIL, aims to accomplish the delivery of high-quality IT Service by managing the service life-cycle [12].

Yet, despite the variety of comprehensive frameworks available, many enterprises struggle with the framework application because of the excessive resource requirements and the high complexity processes. As a comprehensive framework, applying COBIT involves a large number of processes, objects, and the related relationships resulting in a highly complex and difficult implementation [16]. In EAF implementation, the major challenge is transforming the theoretical foundation and abstraction into a set of practical applications [8], [17]. The problems in ITIL application are lack of practical guidance on what process to implement, the complexity of the methods, and highly devoted commitments from the management and all staff [18].

The difficulties of applying the existing frameworks and/or methodology are even more challenging for SMEs. Therefore, enterprises need simplified and practical frameworks or methodologies to assist the initial stage of IT-business alignment. One of the frameworks that is designed specifically for SMEs is IT-based Competitive Strategy (ITCS) Framework. The framework focuses on the practical approach to translate the enterprise vision and business requirements into IT-based enterprise strategy [19]. Based on the initial evaluation, i.e., interview and survey with experts and framework application results in five SMEs in Indonesia, ITCS framework is considered lacking in methodology. Reviews on the framework simplicity are also mixed. Some participants acknowledged the practical approach, but others found it confusing because it was oversimplified [19].

3. EXTENSION OF ITCS FRAMEWORK USING TOGAF ADM PHASE A ARCHITECTURE VISION AND PHASE B BUSINESS ARCHITECTURE

3.1 Methodology

This study aims to correct the weaknesses and to enhance the functionality of the ITCS framework. The methodology follows the design-science research [20]: designing the framework extension and evaluating the framework application in selected SMEs. Pilot studies, extensive paper reviews, and logical reasoning were performed to select the reference framework, to identify relevant components and procedures from the reference framework, and to design the extension of the ITCS framework. This study employed observational case studies in six SMEs in Indonesia (i.e., two SMEs operate in manufacturing, two SMEs operate in trade, one SME operates in agriculture, and one SME operates in healthcare service) to evaluate the applicability of the proposed framework.

3.2 Identification of Relevant Constructs

The ITCS framework, as shown in Figure 1, offers a practical framework to initiate IT-business alignment efforts in SMEs. The first element is the enterprise's vision and mission. The second element is the business perspective part that is derived from the first element. It comprises the definition of value driver of IT implementation, the identification of business competitive factor, and the analysis of the enterprise's Strength, Weakness, Opportunity, and Threat (SWOT). The business perspective components then underlie the formulation of IT-based competitive strategy. The established strategy includes strategic planning and technical operation.

Drawing on the ITCS framework evaluation results from prior study [19], this study proposes the extension of ITCS framework using TOGAF framework. TOGAF has been considered as the *de*

facto EAF standard worldwide. The framework was first introduced in 1995 by The Open Group and has been upgraded since then. It contains a detailed method and a set of supporting tools for developing and managing enterprise architecture. The TOGAF method is described in TOGAF Architecture Development Method (ADM). The architecture development cycle in ADM comprises preliminary and eight phases, i.e., Preliminary, Architecture Vision, Business Architecture, Information Systems Architectures, Technology Architecture, Opportunities and Solutions, Migration Planning, Implementation Governance, and Architecture Change Management. TOGAF ADM adoption can be modified or tailored to suit the enterprise's specific requirements.

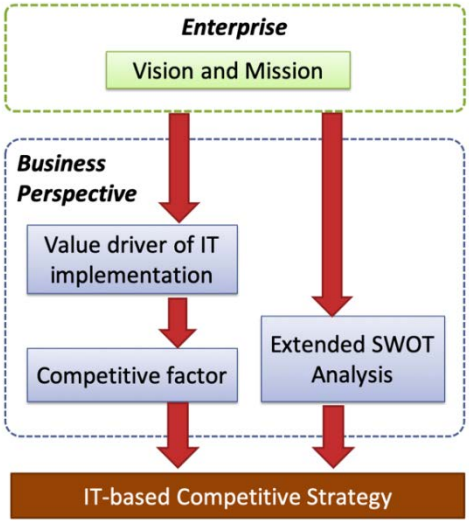

Figure 1. ITCS Framework (modified from [19]).

3.2.1 Enterprise Vision

The first step to extend the ITCS framework is reviewing the applicability of TOGAF ADM phases. Not all phases are used in the framework extension to preserve its simplicity. Since the original ITCS framework focuses on the enterprise's vision and business' competitive factors to formulate the IT strategy and does not include technical details on IT implementation, the proposed framework extension only adopts phase A (Architecture Vision) and phase B (Business Architecture). In TOGAF ADM, phase A defines the architecture scope, addresses the business requirements and the stakeholders' concern; ensures that the architecture effort obtains a proper acknowledgment and supports from the executives [9]. Phase B describes the baseline business architecture, develops the target business architecture, and identifies the gap between the baseline and the target architectures.

One of the problems in the original ITCS framework is lack of guidance on how to derive the element from the prior construct and how to identify or formulate the detailed of the corresponding element. For example, how to identify the value driver of IT implementation from an enterprise's vision and/or business goals. To correct this issue, the extended framework adopts two steps from TOGAF ADM phase A, i.e., defining the business requirements and identifying the business driver, and uses these steps to specify the enterprise element.

The extension of enterprise element consists of four constructs: the enterprise vision and mission, the definition of business requirements, the identification of strategic business drivers, and the formulation of value driver of IT implementation. The definition of business requirements includes business goals, stakeholders and their concerns, and all requirements that must be met to run the business; these definitions underlie the formulation of other elements in the framework. The business driver refers to all resources, activities, and entities that are vital to the growth and the success of an enterprise. Its identification is derived from the business requirements. Common business drivers are superior products, excellent customer service, effective marketing, and consumer growth. Since running the business today relies on the IT systems, IT-business alignment must be manifested at the beginning of IT implementation and management initiatives in SMEs. The initial step of the alignment effort is formulating the value driver of IT implementation that supports the business. The value driver of IT implementation refers to all contributing factors that enhance the business value by implementing IT solutions. It also serves as the foundation to develop information systems and technology solutions that best fit business requirements.

3.2.2 Business Perspective

The second element, the business perspective, in the extended ITCS framework has been modified from the original framework. In the extended framework, the value driver of IT implementation is part of the enterprise vision. The new business perspective part adopts and modifies three steps from TOGAF ADM phase B, i.e., developing the baseline architecture, developing the target architecture, and identifying business capabilities. For the new proposed framework, the architecture is represented as the business process. The business process describes all linked and structured ongoing activities or tasks conducted by stakeholders to accomplish business goals. It also includes the description of exchanged data/information between activities and between enterprise and external entities. Although the business process is a subset of many elements that construct an architecture, it captures the essential elements to specify the definition of what, who, where, when, and how of enterprise activities.

The business perspective in the extended ITCS framework consists of the definition of baseline business process, the identification of business competitive factor, the identification of target business process, and the evaluation of business capability. The enterprise must understand its baseline business process and needs to specify the target business process before formulating the right IT strategy. To transform the baseline into the target business process, the enterprise identifies the required competitive factors. The competitive factor defines key attributes and specific capabilities that determine enterprise performance in a competitive environment [21]. Each SME may have different competitive factors depending on the enterprise characteristics, the industry where enterprises/SMEs operate, and stakeholder perspectives [19]. Some examples of competitive factors are human resource factors, e.g., highly skilled workers and effective teamwork; business factors, e.g., logistics capabilities, multichannel excellence, integrated supply chain, and operational excellence; technology factors, e.g., distributed networking, technology infrastructure, and enterprise data analytics.

Competitive factors must be incorporated when designing the target business process. The enterprise may not have developed all required competitive factors in the present. The capability evaluation analyzes the gap between current and target enterprise capabilities to develop the required competitive factors and the target business process. There are many tools available to perform the capability evaluation, such as the simple SWOT analysis, gap

analysis, 2*2 map of capability mapping, and multiple perspectives process maturity assessments.

3.2.3 IT-based Competitive Strategy

Information technology has changed the nature of the way enterprise runs its business and the competition in the market. IT provides the source of competitive advantages, such as operational excellence, improved decision making, innovative products and services, and access to the global market, but the achievement of competitive advantages depends on how the enterprise use IT. Having an IT strategy that sets the direction of IT implementation in an enterprise is necessary for the current competitive business environment. Therefore, the formulation of IT strategy in ITCS framework is preceded by the identification of competitive factors and enterprise capabilities to ensure the strategy outcomes enhance the current capabilities and support the achievement of sustainable competitive advantage.

One practical and quick way to formulate IT-based competitive strategy for SMEs is conducting an extended internal Strength and Weakness, and external Opportunity and Threat (SWOT) analysis and mapping the competitive factors to one or more SWOT component [19]. An example of IT-based competitive strategy formulation based on SWOT analysis and competitive factors is presented in Table 1. Other approaches to formulate the IT-based competitive strategy are Dynamic Simulation Models [22] and IT Capability Maturity Framework [23], and IT Strategy Implementation Framework [24].

Table 1. Example of IT-based competitive strategy

Competitive Factor	IT Strategy
Strength (S)	
CF1 Excellent product / service quality	Using automated inspection tools to improve the quality assurance.
	...
CF2 Customer intimacy	Managing social media accounts for customer service and brand engagement.
	Employing data management and analytics to address customers' needs and preferences individually.
	...
Opportunity (O)	
CF3 Continuous business growth	Providing custom products / services via social media platform.
	Opening official stores in popular e-marketplaces to expand the market.
	...

Finally, the enterprise develops a detailed information system and technology solution based on the formulated IT strategy. Information systems solutions for SMEs, especially small-sized enterprises, may not involve the development of information system applications because of the limited budget on IT investment. SMEs can utilize available third-party information system applications such as the e-marketplace to manage sales and marketing. Similarly, SMEs can employ cost-effective technology solutions, such as using cloud-computing service and subscription-based applications.

The extended ITCS framework using TOGAF ADM's Architecture Vision and Business Architecture is presented in Figure 2.

4. THE FRAMEWORK APPLICATION IN CASE STUDIES

This study followed the case study approach to evaluate the framework. For the preliminary evaluation, we applied the proposed framework to initiate the IT-business alignment effort in six SMEs (four small-sized enterprises and two medium-sized enterprises) in Indonesia. During the process, all SMEs owner/managing director and representatives observed the framework application process. The framework application activities were as follows: assisting the formal statement of vision and mission for two small enterprises, defining the business requirements, identifying business drivers and value drivers of IT implementation, modeling the baseline process and analyzing the target business process, identifying the competitive factors, evaluating the enterprise's capability, formulating the IT-based competitive strategy, and developing the information and technology solutions. The outcomes of the framework application were listed in the document of IT-based competitive strategy framework application that described all activities performed in details and the output for each activity.

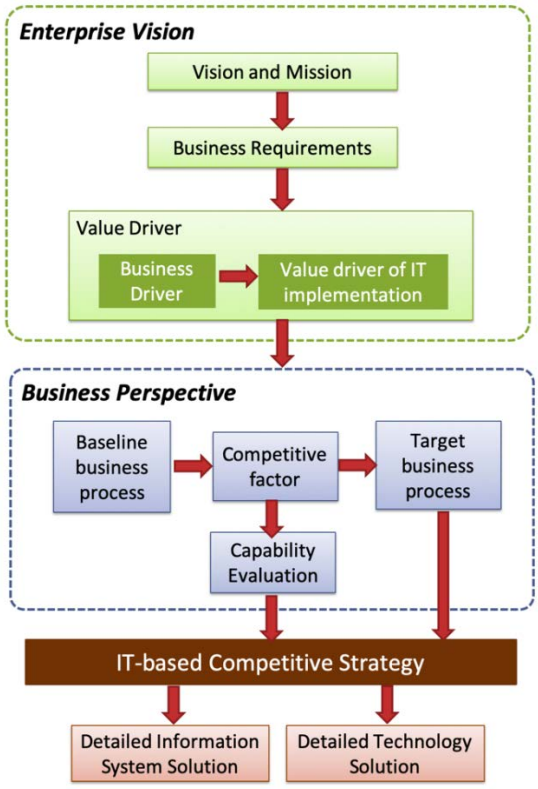

Figure 2. The Extension of ITCS Framework for SMEs.

To evaluate the framework application in six SMEs, we conducted an assessment survey. The participants were six SMEs' owner/managing director and one representative from each small enterprise and two representatives from each medium-sized enterprise. All participants were involved in the framework application activities and had examined the documentation. The question in the assessment survey consisted of the learnability of

the framework, the ease of use of the framework application, the simplicity of the framework, the suitability of the outcomes with the enterprise needs, and the applicability of the outcomes [19]. Table 2 presents the assessment results.

The majority of the participants considered learning and using the extended ITCS framework as easy. On the other hand, four participants from small enterprises perceived the framework as difficult. The difficulty arose because the participants were not familiar with the terminologies used in the framework. In the case of simplicity, although the majority of the participants appraised the framework simplicity, some participants rated it as complicated, particularly the business perspective part. They had never had experience with IT management frameworks before, thus they were not aware of comprehensive frameworks, such as COBIT 5, ITIL, and TOGAF. Most participants agreed that the framework was suitable for their enterprises. One participant from the medium-sized enterprise argued that the framework should include financial attributes when developing IT strategies and solutions. Most participants also acknowledged the framework applicability. Some outcomes could be adopted as is, and the rest required modification before implementation.

Table 2. The initial assessment result of the preliminary framework evaluation

Criteria	Result (N=14)			
Framework learnability	Very difficult	Difficult	Easy	Very Easy
	0 (0%)	4 (28.6%)	7 (50%)	3 (21.4%)
Ease of use of the framework application	Very difficult	Difficult	Easy	Very Easy
	0 (0%)	4 (28.6%)	9 (64.3%)	1 (7.1%)
Simplicity	Very Complicated	Complicated	Simple	Very Simple
	1 (7.1%)	4 (28.6%)	6 (42.9%)	3 (21.4%)
Suitability	Not suitable	Slightly suitable	Moderately suitable	Strongly suitable
	0 (0%)	6 (42.9%)	6 (42.9%)	2 (14.2%)
Applicability	Not applicable	Slightly applicable	Moderately applicable	Strongly applicable
	0 (0%)	5 (35.8%)	7 (50%)	2 (14.2%)

5. CONCLUSION

This study proposes an extension of IT-based competitive strategy framework to address the difficulty of IT-business alignment effort in SMEs. The extension adopts the steps from TOGAF ADM Architecture Vision and Business Architecture. The extension corrects the issues in the original framework, i.e., loose in methodology and lacking explanation on procedures and the relation between the framework elements. The application of the extended framework demonstrates the framework suitability to address SMEs' needs and constraints. Another improvement is the framework applicability. The proposed framework is easy to use, and the outcomes are generally applicable to be adopted by SMEs. While the results support the goal of this study, there are some weaknesses that need to be corrected in future studies, i.e., the validation of the extended framework, the small number of case studies for framework application, and the methods on the adoption of TOGAF ADM steps into the proposed framework.

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