

The adoption of information technology as decision support system in SMEs

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Abstract. The purpose of the study is to develop the information systems (IS) for SMEs as well as to investigate the factors that influence the decision of SMEs to adopt information technology (IT). Using a development research approach, it focuses on developing the Web-based Decision Support System (DSS) IT on SMEs, with the Waterfall model's implementation. Structured interview (by phone) was conducted with 120 SMEs, and the results were tested using Confirmatory Factor Analysis. It shows that the implementation of the Web-based DSS for SMEs provides benefits for them as a database for management decision-making tools. In addition, it is also beneficial to the Indonesian policy makers in regards to the empowerment of SMEs. The findings of the study confirm the Technological, Organizational and Environmental (TOE) framework, that the decision to adopt IT by SMEs in Indonesia are influenced by technological factors including consideration of benefits, compatibility, and costs; organizational factors include the readiness of companies to adopt technologies including technological infrastructure readiness, relevant systems, and technical skills; environmental factors include customer/supplier pressures and competitor pressures. The findings also show that different sector of SMEs (manufacturing and service sectors) has different considerations in deciding the implementation of IT.

1. Introduction

IT is one of the tools used to support a company's competitiveness [1], while IS includes technologies which assist decision making process, provide interfaces between users and provide the information of company's operations for managers [2]. The development of IS for SMEs gives benefits for themselves, particularly for management's decision maker, for the SMEs' policy maker, and for researchers to conduct research related to the SMEs' phenomena and its scientific solutions. Practically however, it is still difficult to obtain comprehensive data about SMEs in Indonesia since the utilization of IT in SMEs are mostly for marketing activities (e-commerce) only.

The low adoption of IT in SMEs is due to several factors including skills access and usage access barriers [3], SMEs generally do not have sufficient resources to manage the IT adoption process [4,5], they are unaware of the contribution of IT in supporting business processes [6], unable to conduct



research and planning before implementing new technologies [7]. Therefore, an integrated IS such as DSS is therefore required.

The purpose of this research is to develop a practical Web-based DSS, in addition to investigating the factors that influence the decision of SMEs to adopt IT. The Web-based DSS for SMEs provides a database of SME profiles, provides information about marketplaces containing product/service profiles generated as featured products, which can be accessed online. The Web-based DSS is expected to benefit decision makers and management information systems in both SMEs and governments, supporting the decision-making steps necessary in achieving the network's strategic objectives [8,9].

2. Review literature

2.1. Adoption of information technology

TOE Framework (Technology; Organization; Environment) was developed by Tornatzky and Fleischer [10], who asserted that the decision to adopt information technology, could be categorized into three contexts namely technology, organization and environment [10,11]. The context of technology includes consideration of benefits, compatibility, and costs. The organization's context encompasses the readiness of companies to adopt technologies, including technological infrastructure readiness, relevant systems, and technical skills. The context of the environment includes customer pressure, supplier and competitor's pressure [12]. The TOE framework is used to test the influence of these three contexts on the adoption of technology [10]. Previous research explained that technological factors, organizational factors, and environmental factors are the SMEs' consideration to decide to use IT [12-14]. Technical capabilities, types of corporate ownership, and inter-organizational dependence are aspects determining the technology implementation (e-business) [11]. Another research found that management support, competitor's pressure, relative excellence are factors driving the adoption of information technology. While government support, customer pressure, and partners are not the factors of consideration in adopting IT [15].

2.2. Decision Support System (DSS)

Initially, the Decision Support System (DSS) was studied as part of operations research and management science, and its purpose is on the optimal use of some of the company's resources with various constraints [16]. In its development, DSS evolved to include OLAP (On-Line Analytics Processing), a visualization technology for large volumes of data, with an easier model. Recently, the optimization-based decision support system made it possible to build and complete collaborative models [17]. When vendors propose web based DSS, they refer to computerized systems as a decision support tool for managers, business analysts, or customers. Web-based means that the application is implemented using web technology; the important parts of the application such as the database are on the server, and the application can be accessed and displayed in the browser [18].

This developed information system architecture was adopted from Competitive Intelligence (CI) for SMEs [19], a web service technology for building Decision Support Systems, presented through a portal-based interface. Decision makers then, were able to perform an analysis based on the data presented on the web. Its architecture allows multiple users to dynamically congregate in network's groupings.

3. Methods

The study uses development research design, with a focus on developing information systems for SMEs as Web-based Decision Support System (DSS) applications. The Waterwall method in table 1 is used for sequential software development processes, through analysis, design, development, and testing stages.

Table 1. Waterfall method.

Step	Stages	Activities
1	Requirement	Data collection (interview with end users) Initial data analysis
2	Design	Designing the Web-Based Decision Support System includes database design activities, Screen Layouts, Processes, and Report Layouts.
3	Development	Coding or coding programs
4	Implementation	Apply the information system that has been built for user use, including install system, prepare user id.
5	Evaluation	Evaluate the system according to the results of the analysis, and make improvements if necessary
6	Maintenance	Perform maintenance on the running system, as well as perform backup and recovery.

In addition to the development of an application design, this study was also conducted to investigate the factors that determine the adoption of information technology, using the TOE framework. TOE Framework in table 2 consists of the technological context, organizational context, and environmental context.

Table 2. TOE framework.

Context	Factors
Technology	Benefits Compatibility Cost
Organizational	Infrastructure Relevant systems Special skills
Environment	Customer pressure Supplier pressure Competitor pressure

Table 2 also describes the factors used in the technological, organizational and environmental context. The data was collected based on the structured interviews with 121 SMEs (response rate 78%) by telephone, and then analyzed using the Confirmatory Factor Analysis and ANOVA.

4. Results and discussion

4.1. Web-based Decision Support System

The design of the Web-based Decision Support System is presented in figure 1. SMEs login to the application and enter their profiles starting from the business' name, business form, business's sector etc. All data entered by SMEs will be proceed and analyzed, so that it becomes information for both the SME's themselves as well as other users. In addition the products or services produced will enter marketplace portal to be accessed by suppliers or customers.

This Web-based Decision Support System developed which is based on information technology and its application involves several users, such as:

4.1.1. *Government.* The role of the government is as an administrator in the implementation of this information system (in this case the Cooperative and SME Local Government Office), who provides

infrastructure, manages all data from users, and processes data for the preparation of policies or SME development.

4.1.2. Small and Medium Enterprises (SMEs). The SMEs are the primary users of the DSS web-based information system. The SMEs' operator enters the SMEs' profile's data. Profiles are categorized into 2 parts. The first part includes the information on business name, business form, business sector, product/service, length of business, owner/manager name, number of labour, and raw materials. While the second part includes capital, turnover, marketing area. The first part of this data is set for public, where the data is accessible to all users in the system. While the second part of data, can only be accessed by SME's operators and administrators. Especially for the products/services produced by the companies, SME operators need to fill the profile of the product's characteristics, such as product specifications, product photos, sale price, after-sales guarantee, which will be published later on the marketplace page.

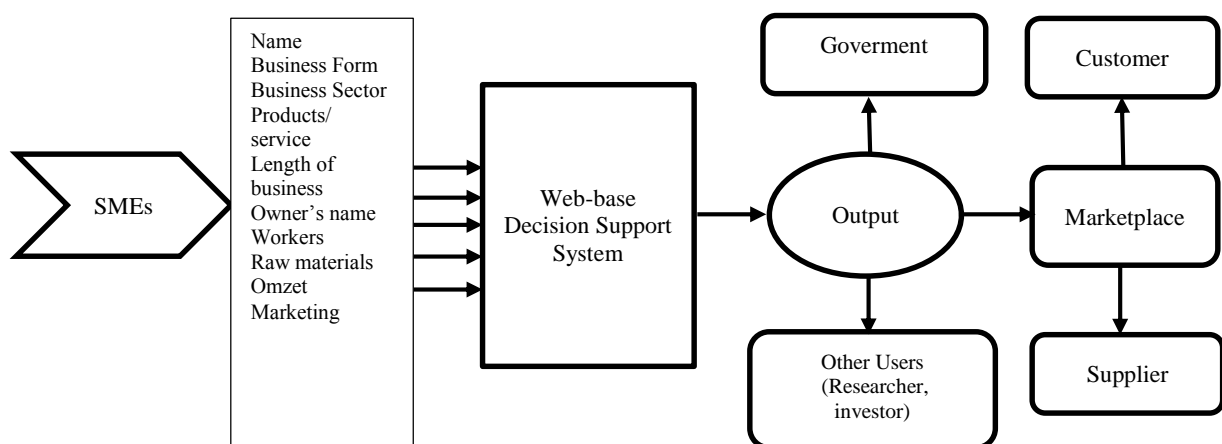


Figure 1. Design Web-based Decision Support System in SMEs.

4.1.3. Other users. Other users are the users who wish to utilize this information system. They need to register as a user. Upon registered successfully, the user can access the available data in the information system. The example of other users are customers, suppliers, researchers, or other parties who are interested in SMEs.

4.2. Factors influencing the adoption of information technology

The result of Confirmatory Factor Analysis (CFA), using SPSS software about the factors considered by SMEs in using information technology are shown in table 3.

Table 3. Confirmatory factor analysis.

TOE Framework	Measurement	Loading Factor*
Technology	Benefits	0.765
	Compatibility	0.806
	Cost	0.816
Organizational	Infrastructure	0.720
	System	0.768
	Skills	0.777
Environment	Customers	0.641
	Supplier	0.652
	Competitors	0.772

*Criteria: Loading factor > 0.6

The CFA analysis in table 3 shows that the technological context which consist of the benefits, compatibility, and costs are factors that are considered by SMEs in adopting information technology. The interviewed participants expect to utilize IT if it gives benefits for their business and has compatibility to be developed in the future. Among these three factors, cost is the most important factor for SMEs in applying information technology (loading 0.816).

Furthermore, to this, for the organizational context such as technology infrastructure, relevant systems, and technical skills, are considered as factors to support the implementation of IT in their companies. Technical skills in operating information technology are the most considered factors by SMEs (loading 0.777). This is in accordance with the condition in practice which shows that generally, SMEs do not have expert resources in using IT.

The environmental context that becomes the considerations for SMEs for implementing IT is due to pressure from customers, pressure from suppliers and competitors who have implemented IT. It turns out that pressure from competitors who have IT will encourage SMEs to take part in implementing IT in running their business (loading 0.772).

Another finding from the result of analysis is that the manufacturing sectors of SMEs consider more on technological factors, such as benefits, compatibility, and cost on adopting information technology. While for service sector, they are more concerned with the customer pressure's factor as a factor affecting the IT's implementation.

5. Conclusion

The result of the study confirms the Technological, Organizational and Environmental (TOE) framework, that the decision to adopt IT by SMEs in Indonesia are influenced by technological factors including consideration of benefits, compatibility, and costs; organizational factors which include the readiness of companies to adopt technologies including technological infrastructure readiness, relevant systems, and technical skills; environmental factors include customer/supplier pressures and competitor pressures.

The information system developed can be utilized by SMEs, because it may provide benefits for them, have compatibility and low cost, since they do not need to spend money for developing the information system by themselves.

This information system can be implemented by Indonesia government, particularly the Minister of Cooperatives and SMEs, in order to provide valid data on SME on their respective works area, both on provincial and central levels. This data also can be used as Decision Support System data for SMEs, in order to empower the SMEs themselves.

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