Steps Towards the Implementation of Sustainable Enterprise Resource Planning Systems

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A number of organisations are beginning to embed sustainability into the business processes in order to contribute to reducing environmental problems. They need to align the sustainability strategy with the business value chain. To achieve effective strategic alignment between sustainability and business processes, organisations require Sustainable Enterprise Resource Planning (S-ERP) systems to integrate all sustainable business activities. This integrated system helps practitioners collect, process, evaluate, and report data and information. However, the implementation of the S-ERP systems is very complex and needs an integrated approach to its implementation. The practitioners need guidelines that provide details of the process for implementing the S-ERP systems. The literature search revealed just limited guidelines that provide various steps to implement S-ERP systems. This stimulates the present study to develop S-ERP implementation guidelines using conceptual research methods. The conceptual research method involves three major steps including a collection of steps and their activities from previous studies, classification and review of the steps and activities, and the specifications of the guidelines. The analysis results reveal that the guidelines consist of three main components including implementation steps, decision-making levels, and activities. The implementation steps including initiating, planning, executing, monitoring/controlling, and closing. The level of decision-making contains strategic, tactical, and operational. The activity involves a number of action plans related to implementation steps and decision-making levels. The results of the study will enrich the growth of research in S-ERP subjects. In addition, developed guidelines should benefit practitioners in guiding them to implement the S-ERP systems in their organisations.

1. Introduction

Humans today face numerous environmental problems, such as pollution, climate change, natural resource depletion, and global warming, which effect on public health (Lu et al., 2017). This problem has arisen since the industry transformed their traditional production into mass production that requires substantial resources (Chofreh et al., 2014). In response to this problem, local and international governments impose manufacturing organisations through regulation to move their businesses towards sustainability (Heinrichs and Schuster, 2017).

Sustainability has been acknowledged as a concept that aims to balance and manage the environmental, economic, and social needs for the welfare of current and future generations (Emas, 2015). This concept encourages people to conserve resources and solve environmental issues. Sustainability has been globally adopted by regional and international governments in their policies and regulations (Laurian et al., 2017). They enforce communities and organisations to move towards sustainable outcomes through policies and regulations. Sustainability implementation in organisations requires a strategic alignment between sustainability and business. They need to link the sustainability plans and actions toward an organisation's business process. This enables organisations to effectively implement sustainable business processes within their value chains. To provide reliable data and information, organisations should utilise integrated information systems, such as

Sustainable Enterprise Resource Planning (S-ERP) system, for sustainable process integration. S-ERP system allows practitioners to centralise data and activities among business functions within an organisation into a single database, proceed the data, and provide reports containing the sustainability and governance performance.

S-ERP software has been developed by various software vendors, such as Systems, Applications and Products in Data Processing (SAP) (Hopkins, 2010). However, practitioners face difficulties during the implementation of S-ERP systems as there is a limited number of guidelines that provide a course of action to implement the system (Chofreh et al., 2017). The S-ERP systems have not been effectively implemented in many organisations. This problem stimulates this study to propose S-ERP implementation guidelines that provide numerous steps in assisting the organisations to implement S-ERP systems.

Conceptual research methods are applied to develop guidelines by reviewing two areas of study, namely guidelines for sustainability implementation and guidelines for Enterprise Resource Planning (ERP) systems implementation, as they are the basis of the S-ERP systems. The conceptual research method involves three main steps including a collection of steps and their activities, the classification and review of steps and activities, and the specification of guidelines.

The results presented in this study demonstrate that the guidelines consist of three main components including implementation steps, decision-making levels, and activities:

1) The implementation steps consist of initiating, planning, executing, monitoring/controlling, and closing.

2) The decision-making levels contain strategic, tactical, and operational.

3) The activities involve numbers of actions plan that is linked to the implementation steps and decision-making levels.

The novelty of the present study is twofold. From the theoretical viewpoint, the S-ERP system research is a new subject and there are still just a few studies which investigate the implementation of the S-ERP systems in organisations. This study is proposing the S-ERP guidelines and stems to advance the research on S-ERP system subject. From the practical viewpoint, the developed S-ERP guidelines could be applied as a new method that can help the practitioners to implement the S-ERP systems in their organisations.

2. Literature overview

This study examines two areas of study including sustainability implementation guidelines and Enterprise Resource Planning (ERP) guidelines to gain knowledge gaps and ideas in developing S-ERP guidelines. Each area of study is further explained in the following sub-sections.

2.1 Sustainability implementation guidelines

Wefering et al. (2014) stated that guidelines are designed to describe and explain important steps and activities to develop and implement a plan. Sustainability implementation guidelines are required to provide a clear and practical direction for practitioners to contribute to sustainability and provide practical solutions that organisations can use to solve environmental problems. There are numerous sustainability implementation guidelines published in the literature that had been proposed by a number of scientists and practitioners. Lambrechts et al. (2009) developed guidelines for implementing sustainability in university. They used a case study method to develop the guidelines, which include integration process and various initiatives. The guidelines comprise of vision and mission development, identification of steering committee, integration strategies, sustainability implementation evaluation, reporting, and certification. Association of Professional Engineers and Geoscientists of British Columbia (APEGB) (2013) released sustainability guidelines that include five main steps consisting retaining the sustainability knowledge, integrating sustainability into the practical environment, collaborating with professionals from concept to completion, develop and prepare clear justifications to implement sustainable solutions and assess sustainability performance and identify opportunities for improvement. The objective of the guidelines is to assist the stakeholders to comprehend sustainability considerations as a fundamental part of the proper practice of professional engineering and geosciences. It shows responsibilities related to the environment and society and inspires practitioners to deliver sustainability outcomes.

Welfering et al. (2014) introduced guidelines for urban transport and mobility practitioners to implement a sustainable urban mobility plan. The main objective of the guidelines is to provide a process to move towards sustainable urban mobility, which is focused on people to enhance accessibility and quality of life, economic viability, and health and environmental quality. The guidelines consist of four phases including preparation, goal setting, elaboration, and implementation.

Global Reporting Initiative (2015) proposed sustainability guidelines that have been commonly used by organisations as a reporting standard for sustainability. The GRI sustainability guidelines include a number of principles describing the report content and ascertaining the information quality. The guidelines integrate

standard disclosures that comprise of sustainability performance indicators and particular technical issues in sustainability reporting. Johannsdottir and McInerney (2018) identified five phases to implement environmental management strategies using qualitative study. These phases including commitment, configuration, core business, communication, and continues improvement.

2.2 Enterprise resource planning guidelines

Enterprise Resource Planning (ERP) systems are considered as the foundation of the S-ERP systems. The ERP systems are generally implemented by various organisations to integrate all business functions and processes within an organisation. Organisations should have flexibility and agility to rapidly change following the increasing consumer demands and the changing of the business. The implementation of ERP systems is necessary to assist the organisations in managing their business.

Successful ERP systems implementation can be achieved if the organisations have its implementation guidelines. There are various ERP guidelines have been introduced by academics and practitioners. Malik (2009) developed guidelines for the implementation of ERP systems that consists of three phases including pre-implementation, implementation, and post-implementation. Each phase contains a number of implementation activities that provide a direction for practitioners to implement the system.

Sahran et al. (2010) proposed guidelines for implementing ERP systems in small and medium enterprises. The guidelines include management direction, recruitment of end-users, recruitment of project team members, study the business requirement, management decision to implement ERP systems, project kick-off, project planning, consultant selection, business and operational analysis, ERP vendor and software selection, business process re-engineering, pre-implementation training, ERP software installation, map the business requirement, system integration and testing, user acceptance and testing, data migration and testing, documentation, post-implementation training, communication, go-live, post-implementation support, and system maintenance and upgrade. Henn (2016) introduced an SAP Activate methodology to implement ERP within organisation. The method envelopes various phases including discover, prepare, explore, realise, deploy, and run.

The literature search reveals that the majority of the guidelines adopt various concepts including decision-making levels, sustainability paradigm, strategic management, and project management. However, they do not consider all important components of the particular concepts. For instance, decision-making approach should consider three levels of management including strategy, tactic, and operation. Project management should consider ten project management groups (initiating, planning, executing, monitoring/controlling/, and closing) and knowledge areas (integration, scope, time, cost, quality, human resource, communication, risk, procurement, and stakeholder). Table 1 provides the summary of previous studies that proposed sustainability and ERP implementation guidelines with their adopted concept.

Table 1: Overview of studies in sustainability and ERP implementation guidelines

Reference	Research field		Applied concept
	Sustainability	ERP	
Wallace and Kremzar (2001)		√	Decision-making levels and project management
Lambrechts et al. (2009)	√		Decision-making levels, sustainability paradigm, and strategic management.
Malik (2009)		√	Decision-making levels and project management
Sahran et al. (2010)		√	Strategic management and project management
APEGB (2013)	√		Sustainability paradigm, strategic management
Welfering et al. (2014)	√		Sustainability paradigm, strategic management
Global Reporting Initiative (2015)	√		Decision-making levels, sustainability paradigm, and project management
Sun et al. (2015)		√	Project management
Henn (2016)		√	Decision-making levels and project management
Johannsdottir and McInerney (2018)	√		Sustainability paradigm, strategic management

The literature revealed that the majority of previous studies considered various concepts including decision-making levels, sustainability paradigm, strategic management, and project management. Decision-making levels consist of strategic, tactical, and operational levels. Sustainability paradigm refers to environmental, economic, and social. Project management comprises of several steps in project management groups consisting initiating, planning, executing, monitoring/controlling, and closing. However, the available guidelines did not consider all concepts in their guidelines.

3. Research methodology

Research in S-ERP systems implementation is still at the preliminary stage. There are a few researches that proposed the S-ERP implementation guidelines for the organisational level. A conceptual research method as a foundation of a grounded theory study is applied to the development of the S-ERP guidelines. It involves several activities comprising gather the identified steps and activities in the existing guidelines, analyse and identify the concepts used in the previous studies, classify the steps and activities according to the adopted concepts, and design the S-ERP guidelines.

To prove the reliability of the developed S-ERP guidelines in contributing to the energy saving, a number of experts are involved to evaluate the guidelines using the in-depth interview. The objective of this step is to validate the content and reliability of the guidelines by evaluating the relationships between the implementation steps, decision-making levels, and activities of the guidelines. The results of the interview are then qualitatively analysed using Atlas.ti software as it is a qualitative analysis software that can systematically analyse complex and unstructured data (de Melo et al., 2018).

4. Sustainable enterprise resource planning guidelines

The objective of the present study is to develop S-ERP guidelines that offer implementation steps, decision-making levels, and activities for implementing the S-ERP systems. The present study analyses the literature on sustainability and ERP implementation guidelines for getting the idea to develop the S-ERP guidelines.

The S-ERP implementation guidelines need to deliver the following objectives: 1) Perform efficient and effective implementation process, 2) Integrate relevant activities into a cohesive implementation process, 3) Emphasise on main problems to implement the S-ERP systems. With the above objectives and using the input from several references, the S-ERP guidelines are specified into three main components including implementation steps, implementation levels, and implementation activities. The implementation steps are adopted from process groups in project management concept, the implementation levels are adopted from decision-making levels, and implementation activities are adapted from strategic management and project management concepts.

The implementation activities of the S-ERP guidelines are mapped on the implementation steps and implementation levels. This approach is adapted from the project management concept that maps project management processes on the process groups and knowledge areas. An overview of the structure of the S-ERP guidelines is depicted in Figure 1.

Figure 1: An overview of the formulation S-ERP guidelines

Strategic level refers to implementation activities that should be performed by the top managers and executives of an organisation. These activities are generally related to the identification of sustainability and business strategies and planning. The tactical level consists of implementation activities that are related to the planning and system's execution. These activities are generally completed by middle managers of an organisation, who need to transform the strategic activities into the planning and implementation activities. Operational level refers to the implementation activities that should be done by the operational managers. They need to manage the S-ERP system project so that it would be successfully implemented within the identified time, scope, and budget. Table 2 presents the developed S-ERP guidelines.

Table 2: S-ERP implementation guidelines

Implementation steps / Implementation levels	Initiating	Planning	Executing	Monitoring/ controlling	Closing
Strategic level	- Identify the external environment - Identify the internal environment - Forecast the future environment - PESTLE Analysis - Stakeholders Analysis - SWOT Analysis - Vision and mission development	- Formulation of appropriate strategies by TOWS Matrix - Select the appropriate strategies	- Alignment of strategies with sustainability Balanced Score Card (SBSC) - Getting execution right	- Review and evaluate the performance	- Close the strategic level phase
Tactical level	- Define stakeholders' commitment to the project - Analyse required skills - Identify training requirements and materials - Analyse current business processes - Align S-ERP strategies with organisational strategies - Predict process & system changes	- Design the stakeholders' commitment management plan - Design the recruitment process of required experts - Design the training plan - Design the blueprint of integration processes - Identify the required technology	- Assign the stakeholders - Recruit the experts - Select the project team members - Execute the strategic alignment process - Execute training	- Review and monitor the system implementation process - Evaluate the system performance	- Provide feedback - Create documentation for further improvement
Operational level	- Develop project charter - Identify stakeholders	- Develop project management plan - Collect S-ERP requirements - Define implementation scope - Define activities - Determine budget	- Direct and manage project execution - Execute integration process - Perform quality assurance - Manage stakeholders	- Monitor and control S-ERP project implementation - Report the risks - Report the S-ERP performance	- Close the project implementation

5. Conclusions

The present study proposes S-ERP guidelines to effectively implement S-ERP system within the organisation. A conceptual research method is used to develop the guidelines by analysing various studies in sustainability and ERP guidelines. The S-ERP guidelines integrate various important concepts in the systems implementation. These concepts including decision-making levels, sustainability paradigm, strategic management, and project management. These concepts are adopted to formulate the structure of the S-ERP implementation guidelines. The implementation of the developed S-ERP guidelines would assist the practitioners to effectively implement the S-ERP system in organisations, which contributes to the reduction in administrative and manufacturing costs up to 50% as all sustainable data and information would be integrated to streamline the sustainability activities

within an organisation. The ability to integrate data and activities from different business functions accelerates sustainable business operations by eliminating the possibility of data redundancy and overlap, and energy consumption until 40 %.

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