

## Development of a Framework for the Implementation of Sustainable Enterprise Resource Planning

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Sustainable Enterprise Resource Planning (S-ERP) is an enterprise system that designed to integrate sustainability activities between corporate sustainable business functions. This system enables practitioners to effectively practice sustainability in an organisation. Systemanalyse und Programmentwicklung (SAP), Oracle, and Microsoft have designed the S-ERP system for various types of industry. However, a number of organisations still have a problem of implementing the S-ERP system as it is a multifaceted system that needs managerial and technical skills to implement. Therefore, they need a master plan that provides a comprehensive guidance for practitioners to implement this system. According to a literature, there is no available master plan that assists the organisations to implement the S-ERP system. This issue will obstruct the implementation process. Therefore, this issue motivates the researchers to develop an S-ERP master plan that encompasses three parts: roadmap, framework, and guidelines. A study focused on the development of an S-ERP roadmap has been performed in the earlier work entitled “A master plan for the implementation of sustainable enterprise resource planning systems (part II): development of a roadmap” (Chofreh et al., 2016b). In addition, the S-ERP roadmap has been evaluated in the work entitled “A master plan for the implementation of sustainable enterprise resource planning systems (part III): evaluation of a roadmap” (Chofreh et al., 2016c).

Subsequently, this study aimed to summarise the development process of the S-ERP framework. This framework would give a comprehensive perspective to implement the S-ERP system. A conceptual research method is used to develop this framework by reviewing two related areas on sustainability and Enterprise Resource Planning (ERP) system implementation and exposing the knowledge gap. The literature revealed that there are diverse dimensions considered in the sustainability and ERP implementation frameworks. These dimensions are generally considered two main paradigms including sustainability paradigm and decisional paradigm. The sustainability paradigm consists of three sustainability dimensions including environment, social, and economic. The decisional paradigm consists of three decision-making levels in an organisation including strategic, tactical, and operational. The S-ERP framework is developed by integrating these two paradigms and unites them into one holistic structure. The breakdown of each component and level of the paradigms is identified according to the relevant literature. Concisely, this framework would be a potential guidance for practitioners to distinguish various perspectives that need to be considered for the S-ERP system implementation. The framework hopefully can assist the practitioners to mitigate the problems during the S-ERP system implementation.

### 1. Introduction

Sustainability notion has emerged since early of the 20<sup>th</sup> century to solve the economic, environmental, and social issues (Goni et al., 2015). This concept becomes well recognised after several policy documents have been produced by international and local government, such as Brundtland Report, to assert the importance of sustainability (Čuček et al., 2015). Through enforcement from the international and local government, various organisations embed sustainability idea into their business strategy (Küçüksayraç, 2015).

Chofreh et al. (2014) stated that organisations face to segregation issue related to sustainability data and activities. This problem effects on the ineffectiveness of managing the sustainability practices. To solve this problem, therefore, a Sustainable Enterprise Resource Planning (S-ERP) system is introduced as a new generation of an enterprise system. This system facilitates the practitioners to integrate the sustainable data and activities across different business functions in an organisation.

Systemanalyse und Programmentwicklung (SAP), Oracle, and Microsoft have designed the S-ERP system for various industries (Chofreh, 2015). However, the practitioners in organisations still have difficulty in implementing this system since it is a massive and multifaceted system. It needs a combination of technological and managerial skills to be implemented. Therefore, there is a need of a master plan which has a role to direct the practitioners in implementing the S-ERP system in organisations.

Chofreh et al. (2016a) have introduced the S-ERP system master plan in their previous work. The structure of the master plan consists of three interlocking parts including roadmap, framework, and guidelines. The S-ERP roadmap "provides stages that involve effective processes that need to be completed throughout the life cycle of the project". The S-ERP framework "refers to an essential structure underlying the dimensions that demonstrate a perspective of an issue that has to be considered in S-ERP system implementation". The S-ERP guidelines "provide steps that determine a course of action for the completion of the S-ERP system implementation".

Chofreh et al. (2016b) have developed the S-ERP implementation roadmap. To complete the structure of the S-ERP master plan, therefore, this study intends to develop the S-ERP framework. The next section presents a review of prior studies in the related field. The methodology used to develop the framework is provided in Section 3. Section 4 explains the development process of the S-ERP roadmap. A conclusion of the study and recommendation of potential research is described in Section 5.

## 2. Literature review

A research in S-ERP system field requires a multi-disciplinary area of works. The S-ERP research is also a new topic, which has limited source of literature references (Chofreh et al., 2014). To develop the S-ERP framework, therefore, this study reviews literature in three related fields including sustainability implementation framework, ERP implementation framework, and decision-making levels. The explanation of each field is presented in the sub-sections.

### 2.1 Sustainability implementation framework

According to Kobryn (2000), a framework is a conceptual structure for managing multifaceted topic. It consists of main components and their relationship that show a method for a system development. Practitioners in organisations need to have a framework to implement the S-ERP system. It should combine various key dimensions that need to be considered in the system implementation.

This study reviews a number of existing sustainability implementation framework. Heemskerk et al. (2002) identified a framework that aimed to design and manage sustainability reporting. In their study, they underscored the importance of integrated sustainability management and reporting for an advancement of sustainability practices in organisations. They, in addition, introduced numerous benefits of sustainability reporting for organisations. The outcome of their study is a framework that provides two main processes including integrated management process and sustainability reporting process.

British Standards Institution (BSI) (2003) proposed a sustainability transformation framework, which is named as SIGMA management framework, to direct practitioners for transforming their organisations towards sustainable future. This framework consists of a four-phase cycle to manage and incorporate sustainability issues within core organisational processes.

Loorbach et al. (2009) observed a method to analyse sustainability transformation, which culminated into a transformation management framework. They used a transition management theory and argued that practitioners need to consider three transition management levels for the transforming their organisations towards sustainability. These three transition management levels including strategic, tactical, and operational.

Ahmed and Sundaram (2012) proposed a sustainability transformation and reporting framework that includes five interacted components. These components consist of discovering and learning, strategizing, designing, transforming, and monitoring/controlling.

From the existing literature, it shows that there are various dimensions identified in the sustainability implementation frameworks. These dimensions generally considered two main paradigms including sustainability paradigm and decisional paradigm. The sustainability paradigm is adopted from the concept of a triple bottom line that comprises of three dimensions including environment, social, and economic. The decision-making paradigm is adopted from the concept of decision-making levels in an organisation that consist of strategic, tactical, and operational.

## 2.2 ERP implementation framework

This study reviews a literature on ERP system, which is considered as a root of S-ERP system. Chofreh et al. (2014) highlighted that the ERP system was coined by Gartner in 1990s and it was progressively applied by organisations to integrate business functions within internal and external value chain of an organisation. By applying this system, the practitioners in an organisation enable to collect, proceed, and report the data and information across all business functions into a single platform.

In order to get an idea to develop an S-ERP framework, numerous studies on ERP implementation framework are reviewed. Al-Mashari et al. (2003) focused on the development of a framework that underscores critical success factors for ERP system implementation. They defined the framework into three phases including setting-up, implementation, and evaluation with each of their components. The expected outcome of the framework is a successful ERP system implementation and the benefits realisation for organisations.

Bajwa et al. (2004) proposed an ERP implementation framework that considers an involvement of internal and external stakeholders of an organisation. The framework consists of a number of implementation phases with their business and technology constructs.

Yusuf et al. (2004) developed a framework for successful ERP system implementation according to their observation in a famous automotive manufacture. The framework consists of three main phases and each of them has several key activities related to the system implementation.

Pellerin and Hadaya (2008) introduced an ERP framework by adopting business process reengineering (BPR) concept. They combined the existing BPR framework and the AcceleratedSAP ERP implementation methodology from SAP in order to develop their new ERP system implementation framework.

Sahran et al. (2010) formulated an ERP implementation framework for small and medium enterprises. They developed a holistic framework by integrating three important components that need to be considered during ERP system implementation include ERP critical success factors, ERP implementation methodology, and ERP implementation activities into one cohesive framework. The applicability of the framework was then evaluated through a case study.

Chofreh et al. (2011) developed a framework for the implementation of ERP system by adapting project management concept. This concept is considered as an important method for completing a project. Therefore, the authors integrate project management process groups, knowledge areas, and implementation activities into one cohesive framework.

Goni et al. (2012) proposed an ERP implementation framework that includes four main capabilities including functional, managerial, implementation, and technological. They argued that these capabilities are crucial to achieving ERP implementation success.

They have been found various concepts in the literature review that have been adopted by the researchers in developing an ERP framework. The selection of the concept was generally based on the perspective of the researchers in solving what issue in ERP implementation. For instance, Al-Mashari et al. (2003) highlighted ERP critical success factors in developing the framework as it showed that many organisations experienced in failure for implementing ERP system.

In addition, Pellerin and Hadaya (2008) used BPR concept for developing the framework since the researchers believed that implementing ERP system is about re-engineering an old system in an organisation with the ERP system.

## 2.3 Decision-making levels

Decision-making levels are commonly one of the fundamental concepts adopted in developing the sustainability implementation framework. The application of this concept can be seen in the work of Loorbach et al. (2009). According to their point of view, the decision-making levels concept needs to be considered in the sustainability implementation framework as it shows the managerial levels that should involve in the transformation process towards a sustainable organisation.

Montana and Charnov (2008) stated that the decision-making levels in an organisation consist of three main levels including strategic, tactical, and operational. Each level has its own responsibility in making a decision for the organisation. The strategic decision is a complex decision made by top level management that is related to strategic plans and goals of an organisation.

The tactical decision is a decision made by middle-level management that is related to the planning development of the identified strategic plans and goals. The operational decision is a daily basis decision made by junior managers. This decision is generally related to the technical decision of an organisation. Figure 1 illustrates an overview of the decision-making levels concept of an organisation.

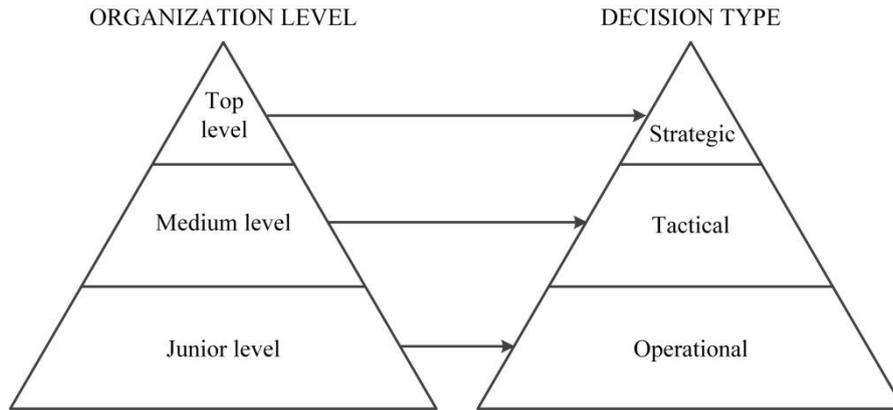


Figure 1: Decision-making levels of an organisation (Chofreh and Goni, 2017)

**3. Research methodology**

This study applied a conceptual research method to develop an S-ERP implementation framework. This method is generally used by numerous researchers in developing a conceptual framework. It relies mainly on the literature including sustainability implementation framework, ERP implementation framework, and decision-making levels to develop the structure of the S-ERP framework. The development process of the S-ERP framework is provided in Figure 2.

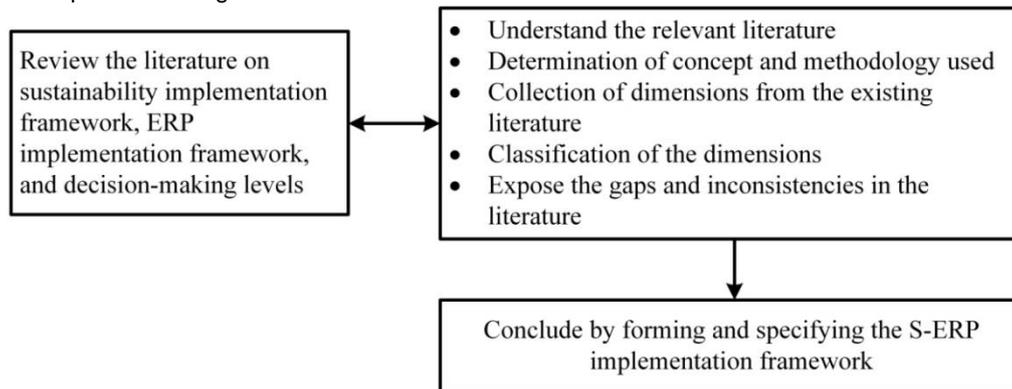


Figure 2: Development process of S-ERP implementation framework

**4. Development of the S-ERP implementation framework**

The development process of the S-ERP framework begins with a general review of the literature in sustainability and ERP implementation frameworks. The important dimensions from the related literature are collected and reviewed in order to expose the knowledge gaps in the existing literature. Finally, the next phase is continued with the formulation of the S-ERP implementation framework.

The structure of the S-ERP framework is composed of two main paradigms including sustainability paradigm (environmental, economic, and social) and decisional paradigms (strategic, tactical, and operational).

The three dimensions in sustainability paradigm need to be considered in the S-ERP implementation framework as they need to be managed and assessed to attain fully sustainability outcomes. This study uses sustainability indicators that were identified by Fernández-Sánchez and Rodríguez-López (2010) for the detail of each dimension.

For example, the environmental dimension consists of soil, water, and atmosphere. The economic dimension consists of cost, technical requirements, and heritage. The social dimension consists of culture, responsibility, and accessibility.

The decisional paradigm is adopted from the decision-making levels concept. It is generally considered in every system implementation process as well as in S-ERP system implementation. The three levels in the decisional paradigm indicate the involvement of all management levels in an organisation to implement the S-ERP system. The strategic dimension consists of activities related to the strategic management formulation. The tactical dimension consists of numerous activities for achieving the objectives of the strategic planning. The operational

dimension consists of some areas that need to be considered in completing the strategic and tactical goals and objectives.

## 5. Evaluation of the Framework

Numerous methods have been applied for the evaluation of sustainability and ERP implementation frameworks, such as survey, case study, and peer review. Selection of the method used relies on the type of research question that the study attempts to answer.

Owens (2002) stated that survey method generally involves quantitative feature. It uses a questionnaire to collect the data from a sample of individuals in a population. The main disadvantage of this method is costly and time-consuming.

Yin (2015) argued that case study method is applied to answer a research question that cannot be responded using survey method. It engages thoroughly observation of similar circumstances in organisations, where the similar problem happens. This method provides better perceptive to the researchers for creating a related theory. However, the weakness of this method is a problem of accessibility and time consideration.

Tavakoli (2012) mentioned that peer review or expert review method is applied to improve the research findings by engaging skilled and eligible experts from the related field of study. This method is generally performed to evaluate the usability of the product and to advance the reliability of a project. It used formal interview, informal conversation, or written report.

The evaluation of S-ERP framework was conducted by using peer review method. The selection of this method was decided since the S-ERP system research field is still rarely studied and the pertinent information on similar problem of research is still limited. The presented study needs data and information that revealed some prototypes concerning the theoretical development that can be acquired via qualitative approach.

The purpose of the peer review in this study is to evaluate the content and the dimensions' interrelationship of the framework and to define other important dimensions that could provide as inputs for the improvement of the framework. This study involved numerous experts from sustainability and ERP fields. A formal interview was conducted to obtain the required data and information. As a result, several modifications related to the framework's structure needs to be performed in order to advance its usability.

## 6. Conclusions

S-ERP system is necessary to be implemented by organisations in order to assist them in advancing sustainability practices. This system enables the organisations to integrate sustainability data and activities across all entities in the extended value chain. To implement this system, the practitioners need to be guided by a coherent S-ERP system master plan. The master plan comprises of three interlocking components including roadmap, framework, and guidelines. The aim of this study is to summarise the development process of the S-ERP framework.

The development of the S-ERP framework was performed by applying a conceptual research method. In this regard, numerous literature on sustainability implementation framework, ERP implementation framework, and decision-making levels were reviewed in order to get an idea of formulating the structure of the framework. A peer review method is applied to evaluate the usability of the framework.

Further studies need to be performed concerning the development and evaluation of S-ERP guidelines in order to complete the formation of the S-ERP master plan. This master plan would benefit organisations in providing guidance to implement the S-ERP system.

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