Sustainable enterprise resource planning systems implementation: A framework development

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ABSTRACT

The permeation of sustainability concept into the main programme of local, regional, and international governments affecting a global transformation of various types of the industry towards a sustainable future. The government enforces the organisations to embed sustainability into their vision, mission, and business strategy. To effectively implement the sustainability initiatives, the organisations need to integrate the data, information, and processes from all sustainable business functions into a consolidated database. This integration process can be executed by a Sustainable Enterprise Resource Planning (S-ERP) system, which allows practitioners to centralise all sustainable business activities of an organisation into a single system so that they can monitor their sustainability performance. However, the implementation of this system is a challenging task. Ineffective S-ERP systems implementation can increase the implementation time, cost, and even lead to failure. A master plan consisting of a roadmap, framework, and guidelines is required to lead the practitioners in implementing the S-ERP systems. Previous studies had underscored the important idea of the S-ERP systems as well as the development and evaluation of the S-ERP roadmap. This study aims to develop a framework that offers various aspects that need to be considered in the implementation of S-ERP systems. A conceptual research method, which is a fundamental method in grounded theory, is used to formulate the structure of the S-ERP framework as there is no available S-ERP framework in the literature. The S-ERP framework includes two main components including sustainability paradigm (society, environment, and economy) and decisional paradigm (strategic, tactical, and operational levels). These components are identified by incorporating various concepts including sustainability indicators, conventional strategic management, sustainability strategic management, success factors of the ERP systems implementation, and project management. The proposed S-ERP framework would assist the practitioners to capture the important aspects of the S-ERP systems implementation and facilitate them to effectively implement the systems.

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1. Introduction

Sustainability has become a main concern of the academic and the business world (Goni et al., 2015). Its notion has been coined since the environmental issues such as resources depletion (Ingrao et al., 2017), climate change (Lee et al., 2017), and pollution (Liu et al., 2017) affect the human life. The United Nations World Commission on Environment and Development stated that the fundamental concept of the sustainability is the need to maintain an ecological balance, prevent the exploitation of resources, and respect for the environment (Chofreh et al., 2016b).

There were several local and international conferences that emphasise the importance of the sustainability initiative. However, the majority of academic and practice often refer to the Brundtland Commission in 1987 as a formal declaration that interlink environmental issues with economic development and social responsibility (Alwan et al., 2017). The outcome of this commission was a publication of a Brundtland Report that summarises several achievements from the discussion and provides a formal definition of sustainability (Campagna et al., 2017). Since this period, the sustainability idea acquired political interest from the people all over the world (Paul, 2008).

The next conference that underscores the importance of the

sustainability concept is the Rio Earth Summit in 1992. Paul (2008) mentioned that this conference is considered the largest historical event held by the United Nations, which gathered 10,000 representatives from 178 countries. The main results of this conference were the Commission on Sustainable Development, Rio Declaration, and Agenda 21, which underscored the critical issues in sustainability and collect an agreement of leaders to move towards sustainable future (Paul, 2008). This event is the root of a global business transformation to deliver significant sustainability outcomes through an embedment of sustainability into the government programmes and regulations in national, regional, and international levels (Goni et al., 2017).

Enforcement of government regulations to integrate sustainability into business practices and increasing customer demand for sustainable products force the organisations to change their method of doing business (Stafford-Smith et al., 2017). They need to incorporate the sustainability initiatives into their business functions and activities to achieve sustainable outcomes (Goni et al., 2013b). Melville and Whisnant (2012) stated that effective sustainability implementation and valid sustainability reports entail accurate and reliable data and information. However, the sustainability reporting activities and its performance evaluation are still manually managed using spreadsheets. This technique is not effective and efficient when the practitioners need to provide a frequent basis report to the stakeholders. As sustainability became a key aspect of strategy and operations, the emergence of a new generation of enterprise systems would advance the business processes (Chofreh, 2015). The management of sustainability data, processes, and reporting need to be integrated into Sustainable Enterprise Resource Planning (S-ERP) systems, which enable the practitioners to coordinate the sustainable business activities (Odenwald and Berg, 2014). The S-ERP system simplifies the data collection, calculation, evaluation, and reporting processes across sustainable business functions (Chofreh et al., 2014a).

The implementation of the S-ERP systems is favourable for organisations; however, it needs a broad endeavour as well as multiple skills and knowledge. The practitioners require having a holistic plan that guides them to implement the system. In the first part of the study, Chofreh et al. (2016a) had presented an S-ERP master plan concept that shows a strategic plan and action to implement the S-ERP systems. It comprises of three interlocking components including a roadmap, framework, and guidelines. The roadmap provides process groups to complete the S-ERP implementation. The framework offers numerous aspects that need to be included in the system implementation. The guidelines provide sequential activities that need to be executed throughout the system implementation.

The design of the S-ERP roadmap has been formulated by Chofreh et al. (2017a) in the second part of the study adapting the project management concept. As an outcome, the roadmap comprises of three phases including pre-implementation, implementation, and post-implementation. Chofreh et al. (2017b) validated the content of the S-ERP roadmap using experts' review, which is the third part of studies. They found that the initial structure of the S-ERP roadmap needs to be reformed. It needs to be divided into two main parts including sustainable enterprise and sustainably integrated enterprise roadmaps. The sustainable enterprise roadmap concerning the process groups to transform an organisation from unsustainable to the sustainable organisation. The sustainably integrated enterprise roadmaps concerning the process groups that need to be completed to achieve a sustainably integrated organisation.

The fourth part of the study is completing the formulation of the S-ERP master plan concerns on the development of an S-ERP framework. This study would target to answer a question of "What are the aspects that need to be considered in the implementation of the S-ERP systems. To answer the research question, a conceptual research method is used to design the structure of the framework. This method emphasises on the literature review to build a new concept. In this regard, four research areas are examined: (i) sustainability implementation frameworks, (ii) Enterprise Resource Planning (ERP) implementation framework, (iii) decisional paradigm, and (iv) project management. The analysis revealed that the S-ERP framework comprises two main perspectives including sustainability (environment, economic, and social) and decisional (strategy, tactic, and operation) paradigms.

2. Literature review

Chofreh et al. (2016c) claimed that the implementation of the S-ERP systems is not trivial and it needs a considerable effort to accomplished. The process involves a wide range of knowledge covering managerial and technology. Practitioners require a holistic framework to ascertain the important aspects of the S-ERP system. To obtain the holistic framework, the present study investigates four related research fields containing sustainability implementation frameworks, ERP implementation frameworks, decisional paradigm, and project management. The literature analysis of these four areas is presented in the following sub-sections.

2.1. Sustainability implementation framework

Research interests in the sustainability area have been significantly growing. A number of studies have investigated the sustainability implementation from various viewpoints, such as sustainability reporting (Ahmed and Sundaram, 2012), Process Integration (Chofreh et al., 2014a), sustainability implementation in higher educations (Goni et al., 2017), supply chain (Bendul et al., 2016), and operations (Font, 2017). Different research perspectives have different approaches, strategies, and methodologies to solve the problem and the phenomena under investigation. In getting a general idea to develop the S-ERP framework, the present study examines numerous existing studies that highlight the development of sustainability implementation frameworks from various viewpoints. This technique is convenient since there are limited studies that observe the S-ERP system implementation.

British Standards Institution (BSI) (2003) introduced a management framework for the implementation of sustainability in organisations. They argued that the sustainability implementation means embedding sustainability into the primary business processes in order to improve and preserve five capitals including natural, human, financial, social, and manufactured capitals. Burke and Gaughran (2007) developed a framework for managing sustainability in small manufacturing companies. The outcomes of the case study revealed that the top management support and contribution of all staffs are the key aspect of successful sustainability management in organisations. The framework was valuable for the practitioners in enhancing the efficiency of operations. Loorbach et al. (2009) introduced a conceptual framework to manage the business transition from unsustainable organisations towards sustainable organisations. They claimed that the transition process needs persistent process and structural alterations in culture, technology, economy, and organisational aspects. They used a transition management and complex systems theories, then, relate it to the government policy to formulate the framework.

Ahmed and Sundaram (2012) introduced an integrated framework as a part of the sustainability transformation systems for implementing the sustainability reporting. In the analysis, they used various concepts, such as sustainability systems and business process engineering, to provide an integrated approach that links

the sustainability modelling to the sustainability reporting. Hahn et al. (2015) introduced a systematic framework to manage the tensions in sustainability implementation. They argued that the sustainability implementation need s to be seen as an integrative process in which the sustainability dimensions (environmental, social, and economic) need to be integrated simultaneously at all levels of an organisation. They found that the framework should have three main aspects including context, change, and level. This framework was then used to analyse the tensions emerged during the sustainability transformation. Panagiotakopoulos et al. (2016) analysed a Viable System Model (VSM) framework introduced by a manufacturing company to align the sustainability standards with the business process of an organisation. The development of the VSM framework adopted the viable system model theory. It contains three main aspects including environment, management, and operations. The authors analysed the content and relationship between elements of the framework. Nawaz and Koç (2018) proposed a conceptual framework for managing the sustainability transformation at the organisational level. They claimed that the proposed framework is valuable as it involves numerous important aspects, such as stakeholders, transparency, and assessment systems. Table 1 presents a summary of the literature analysis.

2.2. ERP implementation framework

Enterprise Resource Planning (ERP) is the basis of the S-ERP systems in which its implementation is critical for organisations. The experience of ERP systems implementation can be applied in S-ERP systems implementation since their general idea is similar. Goni et al. (2013a) stated that the ERP systems implementation requires support by the top managers of an organisation and commitment by the project team to ensure success. A comprehensive plan, which identifies all the requirements and important aspects, is necessary for successful ERP systems implementation.

The ERP systems research has been steadily growing since 2000 (Sadrzadehrafiei et al., 2013). Its research streams were scattered into various subjects, such as success and failure factors, organisational readiness assessment, systems implementation, and systems evaluation. There are numerous studies proposing a framework for successful ERP systems implementation in organisations. Al-Mashari et al. (2003) introduced an ERP framework by combining the critical success factors with the implementation activities. They argued that the ERP benefits can be realised by aligning the technical and managerial capabilities in the implementation process. The proposed framework provided these important capabilities and reflected the essential aspects of ERP systems. Zhang et al. (2005) developed a framework for successful ERP systems implementation in China. They adapted numerous existing frameworks from various related studies for the

formulation of the framework. The relationship between variables in the developed framework was then assessed using a case study method.

Sahran et al. (2010) proposed a framework for the implementation of ERP systems in small and medium organisations. According to the literature analysis, the framework should have three important aspects including success factors, implementation activities, and implementation methodologies to attain effective ERP systems implementation. Chofreh et al. (2011) developed an ERP framework based on project management approach. They observed that the ERP systems implementation is a complex project that needs to be managed by a robust project management methodology. This approach facilitates the practitioners to execute the implementation process as it provides detail flow of the project implementation. Table 2 encapsulates the research analysis on ERP implementation frameworks. Further explanation concerning the conceptual research method is given in Section 3.

2.3. Decisional paradigm

As revealed in the prior section, the decisional paradigm is a decision-making structure of management consisting of strategic, tactical, and operational levels. Chofreh and Goni (2017) argued that the decisional paradigm needs to be systematically influenced by the operational activities of an organisation. In this regard, the operational analysis and activity are planned and executed based on the specific level in the paradigm. Each decision-making level creates decisions that impact the long-term business.

Montana and Charnov (2008) briefly explained the strategic, tactical, and operational levels in decision-making. Strategic level refers to activities and decisions associated with the strategic goals and objectives of an organisation. It determines how the business linked to the external and internal organisation. The strategic activities and decisions should be performed by top managers as they will influence the entire business processes in an organisation.

Tactical level refers to activities and decisions concerned with planning development to attain the strategic goals and objectives defined by the top managers. The tactical activities and decisions are performed by middle managers in an organisation. The characteristic of the strategic activities and decisions are general since they are pertinent to all departments. Conversely, the characteristic of the tactical activities and decisions are more explicit and action-oriented. These activities and decisions can be made faster and continuously changed.

Operational level refers to activities and decisions involved in the daily operations of an organisation. The characteristic of these activities and decisions is short-term and administrative. The operational activities and decisions are planned to complete the implementation of the strategic and tactical decisions. They can be

Table 1
Research analysis on sustainability implementation frameworks.

Reference	Area of research emphasis
BSI (2003)	Sustainability integration into business practices in organisations.
Burke and Gaughran (2007)	Sustainability management in small manufacturing organisations.
Loorbach et al. (2009)	Business transitions towards sustainability systems in organisations.
Ahmed and Sundaram (2012)	Sustainability modelling and reporting systems implementation.
Hahn et al. (2015)	Tensions analysis in sustainability implementation.
Laurenti et al. (2016)	Sustainability systems implementation in organisations.
Panagiotakopoulos et al. (2016)	Sustainability transformation in manufacturing organisations
Gallotta et al. (2016)	Sustainability systems implementation in organisations.
Sroufe (2017)	Sustainability integration in organisations.
Blanco-Portela et al. (2017)	Sustainability transformation in higher education institutions
Nawaz and Koç (2018)	Sustainability management in organisations.
Adams et al. (2018)	Sustainability transformation in higher education institutions

Table 2
Research analysis on ERP implementation frameworks.

Reference	Area of research emphasis
Al-Mashari et al. (2003)	Critical success factors for ERP systems implementation.
Bajwa et al. (2004)	ERP systems implementation in organisations.
Yusuf et al. (2004)	Important dimensions of ERP systems implementation in large manufacturing organisations.
Zhang et al. (2005)	ERP systems implementation in China.
Basoglu et al. (2007)	General ERP systems implementation.
Pellerin and Hadaya (2008)	Business process redesign towards ERP systems implementation.
Sahran et al. (2010)	ERP systems implementation in small and medium organisations.
Chofreh et al. (2011)	ERP systems implementation form project management perspective.
Goni et al. (2012)	Segments and elements influencing the ERP systems implementation.
Jayawickrama et al. (2016)	ERP systems implementation in the United Kingdom industry.
Jagoda and Samaranayake (2017)	An integrative approach to ERP systems implementation.

implemented quickly by junior managers in an organisation. Fig. 1 illustrates the decisional paradigm of an organisation.

Information flow in an organisation is formally structured. The employee that is allowed or obliged to participate in a decision-making process is generally defined by the rules of the organisation. Kezar (2012) specified that two information processing and knowledge sharing strategies that are commonly used in the systems consist of the top-down and bottom-up process. The top-down process enables top management levels to control the flow of information and ensures that each employee in the bottom level has required information to complete the relevant tasks. The bottom-up process needs input from multiple levels for making the final decision. The top managers will inform and discuss the options with the lower-level managers. Nobel (2010) stated that ERP systems a decentralising technology that enables lower-level managers to make decisions without consulting their top managers. This strategy can be reflected in the S-ERP system as these systems have a similar concept.

The decisional paradigm has been considered in a number of studies on sustainability and ERP implementation frameworks. However, the majority of them did not concurrently include the three decision-making levels. For example, Gallotta et al. (2016) only considered the tactical and operational activities and Zhang et al. (2005) only considered the strategic implementation activities. The application of this concept depends on the determined scope of the study.

Chofreh and Goni (2017) stated that decision-making activities and decisions at all levels of management are important for a system implementation. They are a process of making an alternative through ascertaining a decision, collecting data and information, and evaluating possible solutions. In S-ERP systems implementation, the decision-making activities and decisions are important processes to achieve defined goals. They are a sequential process starting from the identification of the problems until the systems implementation begins. The participation of all management levels is necessary to manage the S-ERP systems implementation. Based on this perspective, therefore, the decisional paradigm needs to be incorporated as one of the main aspects of the S-ERP systems framework.

2.4. Project management

Project Management Institute, Inc. (2017) has definedthe project management concept as "*the application of knowledge, skills, tools, and techniques to project activities to meet the project requirements*". This concept has been frequently applied to manage various types of projects. The formal structure of the project management consists of two main components including five process groups and ten knowledge areas. Fig. 2 presents the general idea of the project management concept.

The project is an identified process that is carefully planned to accomplish a specific goal (Project Management Institute, 2017). Its implementation involves people from internal and external organisations with a variety of roles and responsibilities. For this reason, the project needs to be proficiently managed by experts using a specific tool, such as project management.

Chofreh et al. (2015) mentioned that the project management is not only a tool for practitioners but also an important capability that the project implementation experts should have. It enables the experts to coordinate and manage a project within the specified schedule and budget. Application of the project management has a positive impact on organisation results and society.

In the academic perspective, the project management concept has been adopted in various studies, such as sustainability and ERP systems implementation. It can be understood from the work of Gallotta et al. (2016) in sustainability implementation study and Sahran et al. (2010) in ERP implementation study. It can be concluded that the application of project management concept is significant and it cannot be ignored particularly in the systems
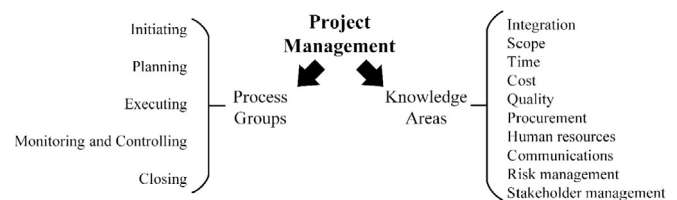

Fig. 1. Decisional paradigm.

Fig. 2. Project management concept.

implementation. Consequently, this concept is necessary to be applied in S-ERP systems implementation as it considered as a multifaceted project requiring a holistic managerial concept.

2.5. Summary of literature review

Research in S-ERP systems has been in the initial phase (Chofreh et al., 2014a). There is a few studies that observe the implementation of the system. This limitation urges the present study to observe related research areas in sustainability and ERP implementation to get a hint for developing the S-ERP framework. The existing sustainability and ERP implementation frameworks have been analysed. It found that the majority of the studies adopted sustainability paradigm, decisional paradigm, and project management concepts. However, they did not consider the whole aspects of the concept. This gap stimulates the present study to formulate the structure of the S-ERP framework by incorporating all aspects of sustainability paradigm, decisional paradigm, and project management concepts. The S-ERP framework needs to deliver the following features:

1) It should combine and relate the relevant aspects into a cohesive form,
2) It should provide a general perspective for implementing the S-ERP systems,
3) Each aspect should have a work breakdown structure.

3. Research methodology

Various research methods were adopted in previous sustainability and ERP implementation framework studies ranging from conceptual researches, case studies, interviews, peer reviews, or combination of these methods. The selection of the research methods depends on the research question that the researcher seeks to answer. For instance, Morse and Richards (2012) stated that the conceptual research methods are generally used to answer process questions about changing experience over time or its stages and phrases such as "What is the process of becoming … ?" or understanding questions such as "What are the dimensions of this experience … ?".

A conceptual research method is generally combined with case studies and peer reviews to evaluate the developed concept. Yin (2013) argued that the case study methods implicate in-depth analysis and observation of similar circumstances in different organisations, where the research problem is similar to the experience of the organisations. The case study method helps researchers to answer 'why', 'what', and 'how' research questions. Interview methods are a technique for collecting relevant data and information for the purpose of research through verbal conversation (Wilson, 2013). This method allows the interviewer to explore the interviewee's viewpoint on a specific idea. Tavakoli (2012) mentioned that peer review methods are generally used to improve the research process and outcomes by involving a number of qualified experts. For example, this methods can be applied to evaluate the usability of a developed framework. Table 3 presents the overview of research methods that have been applied in the previous studies.

The present study intends to respond to a question of "What are the aspects that need to be considered in the implementation of S-ERP systems?". To answer the question, a conceptual research method is considered appropriate as claimed by Xin et al. (2013), it assists the researchers to develop a new concept. It is a basic methodology in the theory-building research providing in-depth literature analysis (Chofreh, 2015). However, there is a lack of standard process to perform the conceptual research methods.

The present study has defined two main processes in developing the framework: review the relevant studies and design the structure of the framework. Four related research areas are reviewed consisting sustainability implementation framework, ERP implementation framework, decisional paradigm, and project management. The literature search revealed that there are various aspects and methods considered in the previous studies. These aspects are collected and analysed to find the concept used for the development of the S-ERP framework. As a result, knowledge gaps and contradictions in the literature are defined.

As the next step, this study develops the structure of the S-ERP framework by integrating various important concepts that need to be reflected in implementing the S-ERP systems. These concepts include sustainability paradigm (environmental, social, and economic) and decisional paradigm (strategic, tactical, and operational), which are further elaborated in Section 4. Fig. 3 illustrates the development procedure of the S-ERP framework.

4. Development of the S-ERP framework

This section elaborates the development procedure of the S-ERP framework that entails several steps of literature analysis. As mentioned in Section 3, there are two main processes to develop the framework comprising review the relevant studies and design the structure of the framework. The detail steps of each process are explained in the following sub-sections.

4.1. Concept analysis

This study reviews two research areas in sustainability and ERP implementation frameworks to find the concept used in the previous studies. In this regard, all important aspects considered in the previous frameworks are gathered and analysed. Tables 4 and 5 shows the identified aspects in the literature.
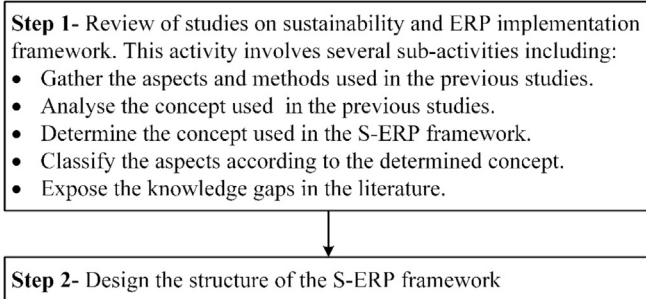
Table 4 indicates that there are various aspects identified in the sustainability and ERP implementation frameworks. The sustainability frameworks normally applied two concepts comprising sustainability and decisional paradigms. The sustainability paradigm refers to environmental, social, and economic perspectives of preservation and transformation towards a better future. Afgan and Carvalho (2010) interpreted it as knowledge and metrics that are potential for human social development. The decisional paradigm refers to a decision-making structure of management encompassing strategic, tactical, and operational levels. It is an approach used to categorise various decisions that affect and shape the business direction of an organisation.

Table 5 shows that there are numerous aspects needed for the successful implementation of ERP systems. The majority of the frameworks applied to project management concept by considering a phase-gate process in which the ERP systems implementation is alienated into distinct phases. Goni et al. (2011) observed that the application of the project management concept is vital for a successful ERP implementation as it is a complex process requiring a combination of technological and organisational issues. For dealing with this process, the project management methods are stressed in order to manage the implementation activities from initiating until closing (Chofreh et al., 2014b). The project management considered one of the important skills that project managers and team members have to possess. The current study classifies the identified aspects according to the concepts used in the literature. The detail of this process is given in Table 6.

Based on the classification of aspects given in Table 6, the majority of sustainability implementation studies included sustainability and decisional paradigms in the frameworks. For instance, Hahn et al. (2015) considered all aspects of sustainability and

Table 3
Overview of applied research methods.

Reference	Research field		Research method
	Sustainability	ERP	
Al-Mashari et al. (2003)		✓	Conceptual research and case study
BSI (2003)	✓		Conceptual research and case study
Bajwa et al. (2004)		✓	Conceptual research and case study
Yusuf et al. (2004)		✓	Conceptual research and case study
Zhang et al. (2005)		✓	Conceptual research and case study
Basoglu et al. (2007)		✓	Conceptual research
Burke and Gaughran (2007)	✓		Interview with experts and case study
Pellerin and Hadaya (2008)		✓	Conceptual research and case study
Loorbach et al. (2009)	✓		Conceptual research and case study
Sahran et al. (2010)		✓	Conceptual research and case study
Chofreh et al. (2011)		✓	Conceptual research
Ahmed and Sundaram (2012)	✓		Conceptual research and peer review
Goni et al. (2012)		✓	Conceptual research
Hahn et al. (2015)	✓		Conceptual research
Jayawickrama et al. (2016)		✓	Interview with experts
Laurenti et al. (2016)	✓		Conceptual research and case study
Panagiotakopoulos et al. (2016)	✓		Conceptual research
Gallotta et al. (2016)	✓		Conceptual research and case study
Jagoda and Samaranayake (2017)		✓	Conceptual research
Sroufe (2017)	✓		Interview with experts
Blanco-Portela et al. (2017)	✓		Conceptual research
Nawaz and Koç (2018)	✓		Conceptual research
Adams et al. (2018)	✓		Conceptual research and case study

Step 1- Review of studies on sustainability and ERP implementation framework. This activity involves several sub-activities including:
- Gather the aspects and methods used in the previous studies.
- Analyse the concept used in the previous studies.
- Determine the concept used in the S-ERP framework.
- Classify the aspects according to the determined concept.
- Expose the knowledge gaps in the literature.

Step 2- Design the structure of the S-ERP framework

Fig. 3. Development procedure of the S-ERP framework.

decisional paradigms. A number of sustainability frameworks simultaneously adopted the concept of the sustainability paradigm, decisional paradigm, and project management, such as Ahmed and Sundaram (2012). In ERP implementation studies, Chofreh et al. (2011) envisaged full aspects of decisional paradigm and project management. The rest of the studies included just some aspects of decisional paradigm and project management concepts.

The present study adopted all aspects of sustainability paradigm, decisional paradigm, and project management concepts for the development of the S-ERP framework. This conception is necessary to provide a holistic S-ERP framework, which enables the practitioners to have multi-dimensional thinking and integrative action in implementing the S-ERP systems.

4.2. S-ERP framework design and discussion

The S-ERP framework consists of two main components consisting of sustainability and decisional paradigms. These components are then combined and linked into a visual appearance as a logical structure intended to provide a comprehensive representation of the S-ERP systems. Fig. 4 illustrates the visual appearance of the S-ERP framework.

As the next step, the identified components are then specified into numerous important aspects of the systems implementation.

For doing this process, various concepts are used to complete the structure of the S-ERP framework.

For the aspects of the sustainability paradigm, the present study uses the sustainability indicators proposed by Fernández-Sánchez and Rodríguez-López, 2010. For the aspects of strategic level, this study integrates two approaches comprising conventional strategic management from the work of Hitt et al. (2012), and sustainability strategic management from the work of Barney and Hesterly (2009). For the aspects of the tactical level, this study uses the work of Sun et al. (2005) that proposed numbers of success factors for the success of the ERP systems implementation including management, process, technology, data, and people. For the aspects of operational level, this study adopts ten project management knowledge areas introduced by Project Management Institute (2013). Fig. 5 provides the aspects of the S-ERP framework.

The proposed S-ERP framework incorporates various important aspects for implementing the S-ERP systems. It is a part of the S-ERP master plan structure that delivers a holistic perspective of the S-ERP systems. The framework shows the important involvement of key players from all organisational levels. Each of them has roles and activities that need to be accomplished towards the systems implementation. The framework also provides numerous sustainability aspects of the triple bottom line that should be aligned with the business strategies and processes. All decisional and sustainability aspects need to be fully considered throughout the systems implementation phase. An effective assimilation and adoption of the S-ERP framework with the involvement of all stakeholders in an organisation would deliver effective S-ERP systems implementation.

5. Conclusions

The employment of the S-ERP systems is vital to improving the sustainability processes in organisations. This system in an innovation of intelligent efficiency that enables the integration of business functions across the sustainable extended value chains. It facilitates the management of an organisation to improve the business decision. The organisations require a framework providing numbers of important aspects to implement the system. For this

Table 4
Identified aspects of sustainability implementation frameworks.

Reference	Aspect	
Hahn et al. (2015)	1. Context: spatial and temporal 2. Change 3. Level: systemic, organisational, and individual	4. Sustainability dimensions (environmental, social, and economic)
Laurenti et al. (2016)	1. Plan: defining, forecasting, and organising 2. Do: demanding and executing	3. Check: controlling and coordinating 4. Act: standardising and correcting
Panagiotakopoulos et al. (2016)	1. Operations 2. Management 3. Environment	
Gallotta et al. (2016)	1. Analyse 2. Design	3. Implement 4. Monitor and control
Sroufe (2017)	1. Drivers 2. Enablers	3. Evaluators 4. Change management
Blanco-Portela et al. (2017)	1. External: stakeholder expectations, government programs, global challenges, external financing, quality certifications, social legitimacy, and credibility. 2. Connecting: top management support, stakeholder expectations, institutional policy framework, the institutional framework for sustainability, sustainability leader, office and sustainability team, sustainability in the strategic plan, and external financing available. 3. Improving participation, improvement of information, size of the institution, environmental management, interdisciplinary, leadership, committed staff, institutional culture, cooperation, and quality.	
Nawaz and Koç (2018)	1. Vision, scope, and principles. 2. Criteria, risk assessment, and objectives. 3. Sustainability initiatives for risk reduction.	4. Preparation and organisation. 5. Implement, monitor, and analyse. 6. Review and continual improvement.
Adams et al. (2018)	1. External stakeholders 2. Non-teaching staff 3. Teaching faculty 4. Students	5. Operational optimisation 6. Organisational transformation 7. Systems building

Table 5
Identified aspects of ERP implementation frameworks.

Reference	Aspect	
Al-Mashari et al. (2003)	1. Setting-up 2. Deployment 3. Evaluation	
Basoglu et al. (2007)	1. Technology 2. User	3. Organisation 4. Project management
Sahran et al. (2010)	1. Critical success factors 2. Implementation activities 3. Implementation methodologies	
Chofreh et al. (2011)	1. Initiating 2. Planning 3. Executing	4. Controlling 5. Closing
Goni et al. (2012)	1. Functional capability 2. Managerial capability	3. Implementation capability 4. Technological capability
Jayawickrama et al. (2016)	1. Improve information quality through enhancing knowledge competence. 2. Improve system quality by enhancing knowledge competence. 3. Improve individual impact through enhancing knowledge competence. 4. Improve organisational impact through enhancing knowledge competence.	
Jagoda and Samaranayake (2017)	Pre-implementation: • System options • Selection methods • ERP readiness assessment Implementation: • Partner selection and negotiation	• Preparing an ERP system implementation plan • Implementing the ERP system Post-implementation: • ERP system impact assessment

reason, the current study has been focused on the development of the S-ERP systems framework.

A conceptual research method has been applied to develop the framework. This process involves an in-depth review of several areas of study. As a result, the structure of the S-ERP framework was designed based on two main components containing sustainability and decisional paradigms. The detail aspects of the components were identified based on several concepts, such as sustainability indicators, conventional strategic management, sustainability strategic management, success factors of the ERP systems implementation, and project management.

This study gives a positive involvement to academic and practice. For academic, this study would advance the research development of the S-ERP systems research. The proposed S-ERP framework has completed the arrangement of the S-ERP master plan. For practice, the S-ERP framework presents a general guide for decision-makers to implement the S-ERP systems in organisations from various industries. The practitioners can adopt the considered aspects and their elements and align them with the business strategy and process of an organisation. An understanding of numerous important aspects enable the decision-makers from all organisational levels to have multi-dimensional thinking and integrative action in implementing the S-ERP systems.

The S-ERP systems implementation would contribute to the enhancement of cleaner production processes, particularly to the sustainability performance evaluation. Monk and Wagner (2012)

Table 6
Classification of the identified aspects according to the concept used in the literature.

| Reference	Research area	Concept used in the literature							
		Sustainability paradigm			Decisional Paradigm			Project Management	
		Environmental	Social	Economic	Strategic	Tactical	Operational	Process groups	Knowledge areas
BSI (2003)	Sustainability implementation	✓	✓	✓	✓	✓	✓	✓	
Al-Mashari et al. (2003)	ERP implementation		✓		✓		✓	✓	
Bajwa et al. (2004)	ERP implementation		✓		✓	✓	✓	✓	
Yusuf et al. (2004)	ERP implementation		✓		✓	✓	✓	✓	
Zhang et al. (2005)	ERP implementation		✓		✓				
Burke and Gaughran (2007)	Sustainability implementation	✓	✓	✓	✓	✓	✓	✓	
Basoglu et al. (2007)	ERP implementation		✓		✓			✓	
Pellerin and Hadaya (2008)	ERP implementation		✓		✓	✓	✓	✓	
Loorbach et al. (2009)	Sustainability implementation	✓	✓	✓	✓	✓	✓		
Sahran et al. (2010)	ERP implementation		✓		✓	✓	✓	✓	
Chofreh et al. (2011)	ERP implementation		✓		✓	✓	✓	✓	✓
Ahmed and Sundaram (2012)	Sustainability implementation	✓	✓	✓	✓	✓	✓	✓	
Goni et al. (2012)	ERP implementation		✓		✓				
Hahn et al. (2015)	Sustainability implementation	✓	✓	✓	✓	✓	✓		
Laurenti et al. (2016)	Sustainability implementation	✓	✓	✓		✓	✓		
Panagiotakopoulos et al. (2016)	Sustainability implementation	✓	✓	✓	✓		✓		
Gallotta et al. (2016)	Sustainability implementation	✓	✓	✓	✓			✓	
Jayawickrama et al. (2016)	ERP implementation		✓		✓				
Sroufe (2017)	Sustainability implementation	✓	✓	✓	✓				
Blanco-Portela et al. (2017)	Sustainability implementation	✓	✓	✓	✓				
Jagoda and Samaranayake (2017)	ERP implementation		✓		✓	✓	✓	✓	
Nawaz and Koç (2018)	Sustainability implementation	✓	✓	✓	✓	✓	✓	✓	
Adams et al. (2018)	Sustainability implementation	✓	✓	✓	✓	✓			
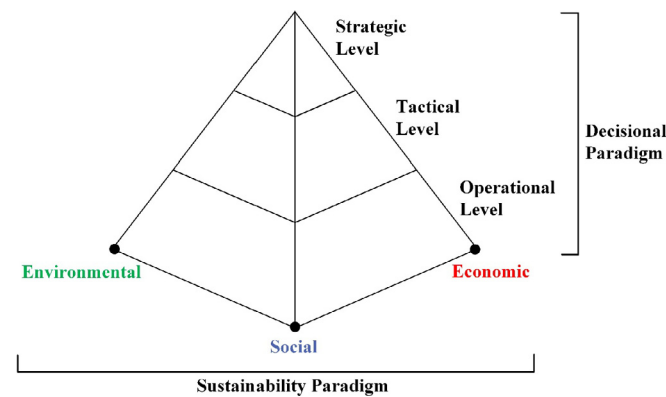
Fig. 4. Overview of the S-ERP framework.

stated that the capability to integrate the data and activities from different business functions using the sustainable integrated systems, such as S-ERP systems, speeds up the sustainable business operations and decision-making processes by eliminating the possibility of data redundancy and overlap, and reducing the energy consumption until 40%.

The constraint of the S-ERP framework is its usability and applicability that have not been evaluated. It is only limited to the conceptual description, which is derived from the existing concepts in sustainability and ERP implementation areas. Therefore, further studies need to be carried out to improve the reliability of the framework, such as an evaluation of the content of the S-ERP framework and its inter-relationship using a qualitative analysis. This future study would provide an experts' idea and confirmation regarding the reliability and usability of the framework.

The applicability of the S-ERP framework might be assessed using a case study method. However, this study is challenging as there is a limited number of organisations that have implemented the S-ERP systems. Implementing a huge system, such as S-ERP
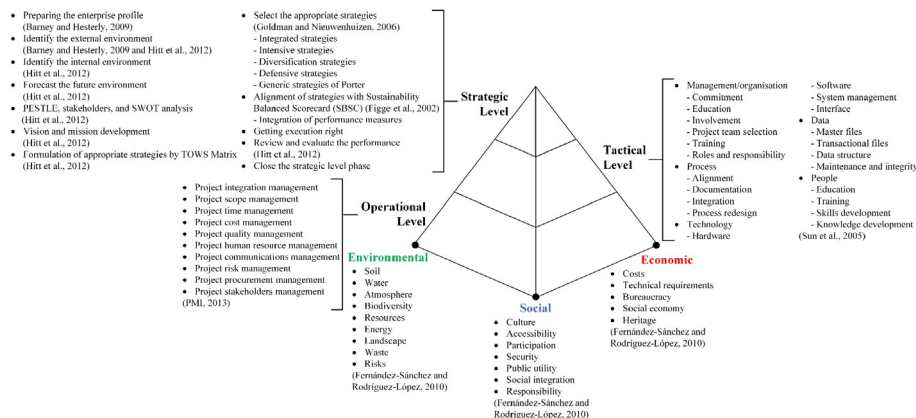

Fig. 5. S-ERP systems implementation framework (Figge et al., 2002, Goldman and Nieuwenhuizen, 2006).

system, is a complex process. The organisations first need to align the S-ERP strategy with their business strategy and then perform the system implementation activities. An effort to implement the S-ERP systems from the beginning is time-consuming and it cannot be covered by a single research. Another potential area is the development and assessment of the S-ERP guidelines. The outcomes of this work would be advantageous for practitioners as the guidelines show the detail activities to implement the S-ERP systems. The outcomes of this study would complete the structure of the S-ERP master plan and facilitate the practitioners to execute the implementation process in their organisations.

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