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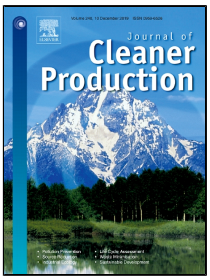

Development of guidelines for the implementation of sustainable enterprise resource planning systems

Abdoulmohammad Gholamzadeh Chofreh, Feybi Ariani Goni, Jiří Jaromír Klemeš, Muhammad Noman Malik, Huma Hayat Khan

PII:	S0959-6526(19)33525-5
DOI:	https://doi.org/10.1016/j.jclepro.2019.118655
Reference:	JCLP 118655
To appear in:	*Journal of Cleaner Production*
Received Date:	01 February 2019
Accepted Date:	29 September 2019

Please cite this article as: Abdoulmohammad Gholamzadeh Chofreh, Feybi Ariani Goni, Jiří Jaromír Klemeš, Muhammad Noman Malik, Huma Hayat Khan, Development of guidelines for the implementation of sustainable enterprise resource planning systems, *Journal of Cleaner Production* (2019), https://doi.org/10.1016/j.jclepro.2019.118655

Development of guidelines for the implementation of sustainable enterprise resource planning systems

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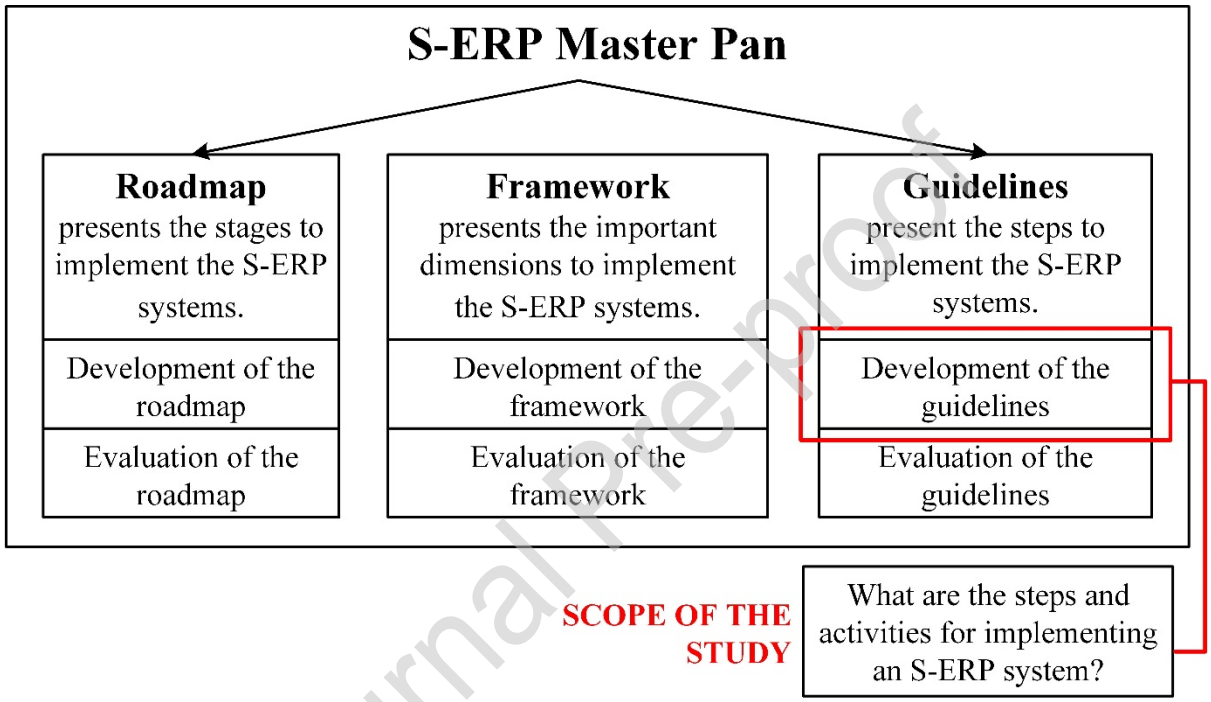
Abstract: Sustainable Enterprise Resource Planning is an enterprise system that incorporates essential entities of the corporate sustainable value chain into a centralised system. It is a massive information system, and its deployment requires a considerable investment of money and time. Unwell plan, limited resources, and weak commitment can lead to the failure of system implementation. Few studies have discussed the concept of Sustainable Enterprise Resource Planning systems. However, little research has focused on the implementation aspect of the system, especially on proposing a general plan that can guide practitioners to implement the Sustainable Enterprise Resource Planning systems. To address this gap, this study aimed to develop comprehensive guidelines that provide steps and activities for implementing the system. The guidelines are developed using a conceptual research method that relies on the examination of literature to find and integrate various concepts, including sustainability aspects, project management, organisational decision levels, and strategic management. The method envelopes three phases: (i) Collection of steps and activities from the existing sustainability and ERP guidelines, (ii) Classification and evaluation of the identified steps and activities, and (iii) Identification of steps and activities required for the guidelines. The proposed guidelines entail three main modules comprising implementation steps, levels, and

activities. The results would be useful for practitioners in giving a formal direction to efficiently implement Sustainable Enterprise Resource Planning systems in their corporate value chains.

Keywords: Sustainability; enterprise resource planning; industry 4.0; integrated information system; guidelines.

Graphical Abstract:



Research Highlights:

- S-ERP master plan incorporates three aspects of roadmap, guidelines, and framework.
- S-ERP guidelines assist practitioners for effective implementation of S-ERP systems.
- Conceptual research methods are applied for guidelines development.
- S-ERP guidelines integrate implementation steps, levels, and activities.
- New activities are considered in the developed guidelines.

1. Introduction

Sustainability is a concept and process of enforcing environmental, economic, and social transformation towards a better quality of life (Scheidel et al., 2018). The philosophical reason for the emergence of this concept is the occurrence of environmental and social problems in society. This notion directs people to think of renewable resources, protection of the natural environment, human development, and other related aspects, and act for present and future generations (Sauvé et al., 2016). The importance of sustainability has been firstly acknowledged in the Brundtland Commission, the Rio Earth Summit, and other international conferences. International and regional governments impose industries to change their corporate's vision, mission, goals, and strategies in the direction of sustainability. Organisations now prioritise sustainability in organisational and social policies and regulations (van Zanten et al., 2018).

Embracing sustainable business practices in an organisation's value chain can have a number of significant benefits such as increasing productivity and creativity (Bryson, 2017), evading fraud and mismanagement (Moosa and Ramiah, 2018), improving employees' loyalty (Law et al., 2017), and more reliable products (Küçüksayraç, 2015). Sustainability should be intertwined as an essential component of the corporate strategy, culture, and business processes. However, organisations often face data segregation problem while practising sustainability due to uncoordinated activities (George et al., 2016). Sustainability performance reports cannot be effectively executed, and the decision-making process remains silo. Organisations require a management system that can integrate all their core functions into a centralised database and platform that allows practitioners to connect all sustainable management functions and track business resources, operations, and status.

Chofreh et al. (2014) described S-ERP as an advanced information system that integrates all entities in the corporate value chain to streamline business processes towards sustainability outcomes. The S-ERP system allows organisations to assess and disclose the sustainability impacts of their extended value chains. It helps practitioners to manage, monitor, and report the enterprise resources, supply, production, and distribution by integrating the external and internal data (Odenwald and Berg, 2014). Tsai (2019) stated that the implementation of S-ERP systems would assist the organisations in achieving sustainability goals under Industry 4.0, where all business processes are connected through advanced digital technology.

Several S-ERP applications are available through different software vendors such as Microsoft Dynamics 365 (Microsoft, 2018) from Microsoft and Sustainability Performance Management 4.0 from SAP (SAP, 2018) to help companies manage their sustainable business. Microsoft Dynamics 365 intelligence software, which is an advanced version of Microsoft Dynamics AX, has an environmental sustainability dashboard that facilitates organisations evaluate, track, and report their sustainability performance. This advantage enables organisations to respond to sustainability initiatives that can decrease environmental issues (Microsoft, 2018). Similarly, Systems, Applications and Products in Data Processing (SAP) offers Sustainability Performance Management 4.0 system applications, which enable organisations to deal with the management, assessment, and disclosure of organisational performance towards sustainability outcomes. This intelligence business software helps organisations to centralise the data and information to manage corporate environmental, social, and economic performance (SAP, 2018).

S-ERP systems are generally implemented to manage and report on business activities linked to the environmental and social impact, and align the organisational processes, people, and products with the corporate sustainability goals and requirements. In the perspective of SAP (2018), the S-ERP system technically contains two main scenarios: data collection and

reporting. For data collection, the system can manually and automatically collect the sustainability key performance indicators data of the business for reporting based on GRI standards. For reporting, the required information can be reported through different interfaces, such as texts, diagrams, tables, and charts, for further analysis. Therefore, the system would facilitate the top managers in making short- and long-term decisions.

Microsoft (2018) stated that the implementation of S-ERP systems contributes to making an organisation more sustainable in a various way. First, the system generally uses cloud-enabled technology; therefore, it can free up space for the server location. Second, it can save energy and power due to its constant need to remain cool. Third, the implementation of S-ERP systems contributes to reducing the carbon footprint. Four, it can minimise waste through less printing because the system enables information sharing across the organisation with an accessible facility. Fifth, the application of S-ERP system can improve the quality of stakeholder engagement as the system can provide actual sustainability reporting and facilitate collaboration and communication through information sharing.

,The fundamental concept of the S-ERP system is based on the Enterprise Resource Planning (ERP) concept. However, the notion of an ERP system is based on profit without considering the sustainability aspects of social and environment. S-ERP implementation is also reflected in the ERP system. It needs significant changes in business processes and involves all managerial levels in an organisation. This process requires time, high budget, and a large internal commitment (Goni et al., 2013). Poor planning and understanding of process changes before implementation are the main reasons for project failure (Albliwi et al., 2014). After the inclusion of sustainability into ERP, the implementation of S-ERP is getting challengeable. Therefore, organisations need an effective plan to provide a holistic method for implementation of the system.

From an academic standpoint, there have been a limited number of studies concerning the development of plans that integrate important perspectives and actions to implement the S-ERP system. To address the knowledge gap and S-ERP implementation challenges, Chofreh et al. (2016) have proposed a master plan for the implementation of S-ERP systems that consists of roadmap, framework, and guidelines. The S-ERP master plan is similar to Accelerated SAP (ASAP) methodology that has been proposed by SAP in assisting the practitioners to implement ERP systems in organisations from every sector such as Energy and Natural Resources (Building Products, Chemicals, Mill Products, Mining, Oil and Gas, Utilities), Financial Services (Banking, Insurance), and Consumer Industries (Agribusiness, Consumer Products, Fashion, Life Sciences, Retail, Wholesale Distribution) (SAP, 2019).

The S-ERP roadmap shows the general stages to implement the system that mainly incorporates project management concept (Chofreh et al., 2017). The content and reliability of the roadmap were then evaluated in the previous study using expert reviews (Chofreh et al., 2018a). The final roadmap focuses on two folds, firstly towards sustainable organisations and secondly to sustainable integrated organisations. Roadmap to a sustainable organisation provides phases for transforming business towards a sustainable value chain. The roadmap to sustainable integrated organisations shows phases to integrate business functions in a sustainable value chain.

The S-ERP framework delivers various important aspects and components in implementing an S-ERP system. It has been proposed by Chofreh et al. (2018c) by integrating the concept of decision-making and sustainability. The framework was then evaluated in the work of Chofreh et al. (2018b) using expert reviews. The framework discussed on two levels of sustainable implementation and system implementation. The sustainability implementation framework provides aspects and components to transform the organisation towards sustainable

organisations. The system implementation framework shows aspects and components for implementing an S-ERP system.

To devise the S-ERP implementation action plan, the present study aims to develop S-ERP guidelines that specify steps and activities to be taken in actual practice for the implementation of S-ERP systems. The development process involves a conceptual research method to review existing studies in the areas of sustainability and ERP implementation. The novelty of this study laid on the S-ERP guidelines that integrate various steps of the implementation action plan, organisational decision levels (strategic, tactical, and operational), and implementation activities that are interrelated with implementation steps and organisational decision levels. This study is theoretically important to enrich research development in the subject of the S-ERP system. In a real-world perspective, the proposed guidelines will help practitioners for the implementation of S-ERP effectively in their organisations.

2. Literature Review

Research on the S-ERP system is not yet mature, rather at an early stage (Chofreh et al., 2014). To formulate the S-ERP guideline structure, a thorough analysis of previous efforts on sustainability and ERP implementation guidelines to find rigorous and important concepts for guideline development is needed. Deliberations from the identified concepts, including aspects of sustainability, strategic management, organisational decision levels, and project management are also presented in this section. Figure 1 illustrates the segmentation of the topics reviewed in the present study.

Figure 1. Structure of the literature review

2.1 Sustainability Implementation Guidelines

Guidelines need to address specific elements, including structure, activities, and indicators (Global Reporting Initiative, 2015). It can be a part of a framework or stand-alone. British Standard Institution - BSI (2003) stated that guidelines are an important part of a business transformation in providing direction for organisations towards sustainable practices and results. They should be flexible, practical, reliable, and comprehensive that can be applied across a broad range of industries. The formulation of guidelines needs to envision various key steps to ensure effective system implementation.

Since market forces have driven the embedment of sustainability concept into the business core processes, many organisations should move their business transformation from unsustainable practices toward rethinking, redesigning, and sustainably redeveloping business practices (Ajmal et al., 2018). One of the most critical challenges faced by organisations today is the embedment of sustainability aspects (environment, economy, and society) into their core business functions (Ritzén and Sandström, 2017). To holistically commit and implement sustainability, organisations require sustainability implementation guidelines that guide them towards effective implementation.

A number of guidelines for sustainability implementation were proposed in previous studies. Heemskerk et al. (2002) provided procedures to help practitioners understand the value

of reporting in sustainability practices and guide them on how to develop reports. They argued that economic, environmental, and social aspects need to be integrated into company actions and reports should be communicated to stakeholders and society. The main purpose of this idea is to uphold the liability and transparency of the organisation. This notion has also been applied by BSI (2003) in their guidelines. They introduced guidelines for embedding sustainability issues into organisational practices. The main principles of these guidelines are based on organisational capital, including human, finance, and accountability.

In a different context, Lambrechts et al. (2009) developed general guidelines for implementing sustainability in higher education institutions. It was formulated based on observations at a university in Belgium and consultation with all stakeholders. This guide provides a systematic action plan to integrate sustainability into education, research, and operations involving all managerial levels at the university. Similarly, Stephens and Graham (2010) presented guidelines for directing practitioners to turn universities towards sustainability practices. They adopted a transition management approach to facilitate and accelerate sustainability transformation concerning planning, implementation, and monitoring of changes at the university.

Several guidelines were also proposed for certain users. As an example can serve the Association of Professional Engineers and Geoscientists of British Columbia (APEGBC) (2013) launched guidelines for sustainability implementation in engineering and geoscience practices. This guide concentrates on five factors comprising advanced sustainability knowledge, sustainability impacts integration into the project life-cycle, stakeholder collaboration, discussion, sustainability performance assessment, and improvement. The target market of this guideline is engineering and geoscience professionals who need to apply sustainability elements to their work and responsibilities. In other fields, Welfering et al. (2014)

introduced sustainability guidelines for urban transport and mobility practitioners. They explained important steps and actions to plan urban mobility and reveal the benefits of the plan.

Similar to Heemskerk et al. (2002), GRI (2015) offered specific guidelines for preparing sustainability reporting. They argued that sustainability reports should provide advance information related to sustainability practices in the organisation for stakeholders to facilitate them in making strategic decisions. To produce comprehensive guidelines, they integrated two crucial factors, namely action plans and sustainability indicators. This guideline is widely adopted by governments and organisations worldwide as it helps practitioners to understand and communicate the impact of their business on sustainability issues.

The European Margarine Association (IMACE) (2016) introduced guidelines for sustainability reporting in the area of food safety and quality. The guidelines were initially conceptualised based on important issues that emerged in margarine manufacturing companies and included several related sustainability performance indicators. The International Union for Conservation of Nature and Natural Resources (2018) developed guidelines for sustainability implementation in the field of tourism and visitor management. They provided basic principles from planning to managing sustainable tourism in several categories of a protected area such as a strict nature reserve, national park, and monument. The guideline incorporates impacts assessment, aligning management objectives with the impact of tourism, adaptive management, capacity building, income and cost management, and best practices. Table 1 summarises the literature analysis of existing sustainability implementation guidelines.

Table 1. Summary of existing sustainability guidelines

Reference	Research focus	Methodology
Heemskerk et al. (2002)	Sustainability reporting	Survey and case study
New Zealand Business Council for Sustainable Development (NZBCSD) (2003)	Sustainable supply chain implementation in the organisation	Theoretical research and case study
BSI (2003)	Sustainability implementation in the organisation	Conceptual research and case study
Lambrechts et al. (2009)	Implementation plan for sustainability in higher education	Case study
Stephens and Graham (2010)	Sustainability implementation for higher education institutions	Conceptual research
APEGBC (2013)	Sustainability implementation in engineering and geoscience practices	Conceptual research
SA8000:2014 (2014)	Standards for social accountability in the workplace	Not available
United Nations Global Compact	Principles on human rights, labour, environment, and anti-corruption	Not available
Welfering et al. (2014)	Guidelines for sustainable urban transportation and mobility	Conceptual research
AA1000SES (2015)	Stakeholder engagement standards	Not available
GRI (2015)	Sustainability reporting	Conceptual research and interview
IMACE (2016)	Sustainability reporting for food manufacturing companies	Conceptual research
ISO 26000:2010 (2017)	Standards for social responsibility	Not available
IUCN (2018)	Guidelines for sustainable tourism and visitor management in protected areas	Conceptual research and experts review

The present study accumulates sustainability implementation guidelines from various resources, including published works, reports, and standards to get the general idea of the guidelines from academic and practical perspectives. Table 1 shows that these guidelines are proposed for different purposes; however, they generally adopted similar concepts. Therefore, the analysis of the sustainability implementation guidelines helps the present study to capture the important concepts and aspects to consider in the development of S-ERP guidelines. The identification of the adopted concept is further explained in Section 4. The literature analysis also revealed several methods used for the development of the guidelines. These methods are conceptual research, case study, survey, experts review, and combination of them. Further analysis of the methods used is presented in Section 3.

2.2 ERP Implementation Guidelines

S-ERP systems are considered as an advanced version of ERP systems that includes environmental, social, and economical aspects in the business integration processes. Since research in S-ERP systems is limited, this study examines the existing studies in ERP system implementation to get the general idea in developing the S-ERP guidelines. ERP is generally considered a pillar of the organisation because of its application and benefits (Goni et al., 2011). This system allows practitioners to integrate and streamline business processes in all corporate functions within an organisation. The main feature of ERP is to integrate all departments and business units within the organisation, providing actual operations, advanced database, and a consistent user interface (Wailgum and Perkins, 2018).

Ijaz et al. (2014) mentioned that the application of an ERP system could be implemented with pre and post-implementation dynamics. Such implementation is complex and challenging as they have various features and competencies to be considered (Goni et al., 2012). However, effective ERP implementation can provide several benefits to the organisation including

efficiency in business processes, effective decision-making, improving business agility, and increasing data and information security (Sadrzadehrafiei et al., 2013). Therefore, many academics and practitioners, such as a software vendor, introduced a guideline for successful ERP implementation in organisations.

There have been a considerable number of guidelines to assist practitioners in overcoming challenges in implementing ERP systems. Wallace and Kremzar (2001) proposed guidelines of ERP systems implementation in organisations. The guidelines aim to estimate and balance demand and supply. They include planning, scheduling, and forecasting approaches that connect suppliers and customers, use decision-making processes, and manage all business functions. Similarly, Malik (2009) developed guidelines for effective ERP implementation in organisations. The believed that the ERP system strategy should be in line with business strategies and requirements. The guideline incorporates pre- and post-implementation of the system. Each implementation level includes several actions to transform the organisation towards an integrated enterprise.

Sahran et al. (2010) introduced guidelines for the implementation of an ERP system in small and medium enterprises (SME's). They integrated three main components consisting of critical success factors, implementation techniques, and processes. Shaul and Tauber (2012) similarly developed ERP guidelines for the context of small and medium enterprises. The guidelines also considered similar components, such as success factors and implementation strategies. However, the guidelines proposed by Shaul and Tauber (2012) focused more on the analysis of success factors at all managerial levels.

A further study conducted by Sun et al. (2015) who formulated guidelines to improve the performance of ERP system implementation. Similar to Shaul and Tauber (2012), Sun et al. (2015) identified critical success factors for ERP implementation. However, they further

evaluated the reliability of the identified factors in several companies as case studies to assess the performance of ERP applications. The summary of existing ERP guidelines is given in Table 2.

Table 2. Overview of ERP guidelines

Reference	Research focus	Methodology
Wallace and Kremzar (2001)	Effective ERP system implementation in an organisation	Conceptual research and case study
Ehie and Madsen (2005)	Implementation of the ERP system and its importance for higher education institutions	Conceptual research and survey
Malik (2009)	Effective ERP system implementation in an organisation	Theoretical research and case study
Deloitte (2010)	Guidelines for overcoming several challenges in implementing an ERP system	Conceptual research
Sahran et al. (2010)	Highlighted effective Implementation of ERP system for SME"s	Conceptual research and case study
Shaul and Tauber (2012)	Implementation of ERP system for SME"s	Survey
Sun et al. (2015)	Guidelines for improving ERP system performance	Conceptual research and survey

Table 2 summarises the existing ERP guidelines from different works to acquire commonly adopted concepts for the development of the S-ERP guidelines. Existing ERP guidelines were generally developed to achieve the effectiveness and efficiency of system implementation and reduce the possibility of implementation failures. In terms of the adopted methodology, the majority of the analysed works used a conceptual research method to develop the ERP

guidelines. This finding is also similar to research in the field of sustainability guidelines, which commonly adopts the conceptual research method. A description of the methods adopted by the present study is provided in Section 3.

2.3 Organisational Decision Levels

The level of decisions in an organisation generally includes strategic, tactical, and operational decisions. Strategic decisions refer to decisions that focus on initiatives and plans that have a long-term impact on the company. The scope of this decision is broad and is generally made by top-level managers. Tactical decisions involve short-term decisions that are narrow in scope. They are usually made by middle-level managers to implement strategic initiatives and plans. Operational decisions are decisions concerning daily business routines that are commonly taken by low-level managers.

Tiainen (2014) argued that decision-making is an important process in an organisation to keep the business on the right track. Business successes and failures depend on the accuracy of decision-making, especially those related to strategic decisions. Decision-making in the implementation of complex systems such as ERP and S-ERP is a challenge for the organisation. Managers at all levels of the organisation and the project team will face various choices regarding the transformation of business processes. At the strategic level, decision-makers need to analyse the advantages and disadvantages of system implementation as well as considering all potential problems and risks. Especially with the addition of sustainability aspects to the S-ERP system that affects the level of complexity in implementing this system as it requires involvement from internal and external stakeholders. Figure 2 illustrates the level of organisational decisions, actors, and their general role in system implementation.

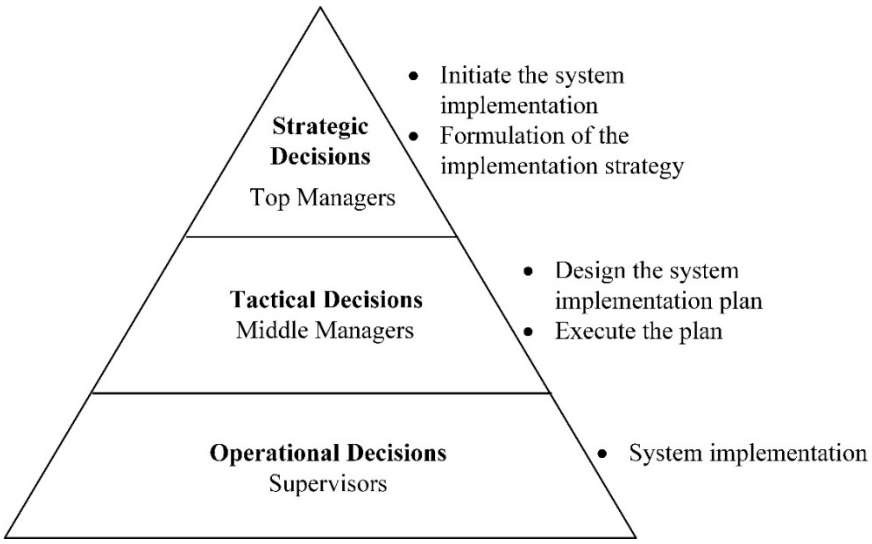


Figure 2. Level of organisational decisions within a firm

The concept of organisational decision levels has been adopted in sustainability and ERP guidelines. However, most studies only concerned on one or two decisional levels without considering the complete level of decision-making. For instance, APEGBC (2013) only deliberated the level of strategic decisions in the proposed sustainability guidelines. Deloitte (2010) similarly considered only the level of strategic decisions in ERP guidelines. Adoption of the concept depends on the scope and objective of the study.

The present study includes the concept of organisational decision levels in the development of the S-ERP guidelines. This concept is essential to be considered in system implementation to show the levels of activities and actors. The relationship between decision-making levels and activities shows a cohesive implementation process. The involvement of all managerial levels is vital to achieving effective system implementation.

2.4 Strategic Management

Strategic management in the project implementation is the process of determining project goals and objectives (Hillson, 2017). In this case, managers and experts need to analyse the internal and external environment of an organisation, determine vision and mission of the

project, formulate strategies, and implement strategies (Hitt et al., 2007). The development of effective strategies for managing project implementation is imperative for the creation and maintenance of stakeholder values and achieving project success (Hornstein, 2015). The concept of strategic management allows organisations to determine project investments that best meet business goals and objectives (Chang, 2016). The strategic management process overview is shown in Figure 3.

The approach of strategic management is profound vastly in the implementation of sustainability and ERP systems. Carcano (2013) mentioned that the application of strategic management in sustainability implementation enables organisations to deal with their stakeholders and the external environment. This process has a major contribution to achieving effective sustainability implementation. In term of implementing ERP systems, organisations need to align ERP strategies with business strategies to maximise system performance potential. They should have an ERP strategy and continue to adapt it to see the benefits of the system. Therefore, strategic management is vital for the system implementation, and this approach should also be applied as the implementation plan for S-ERP system.

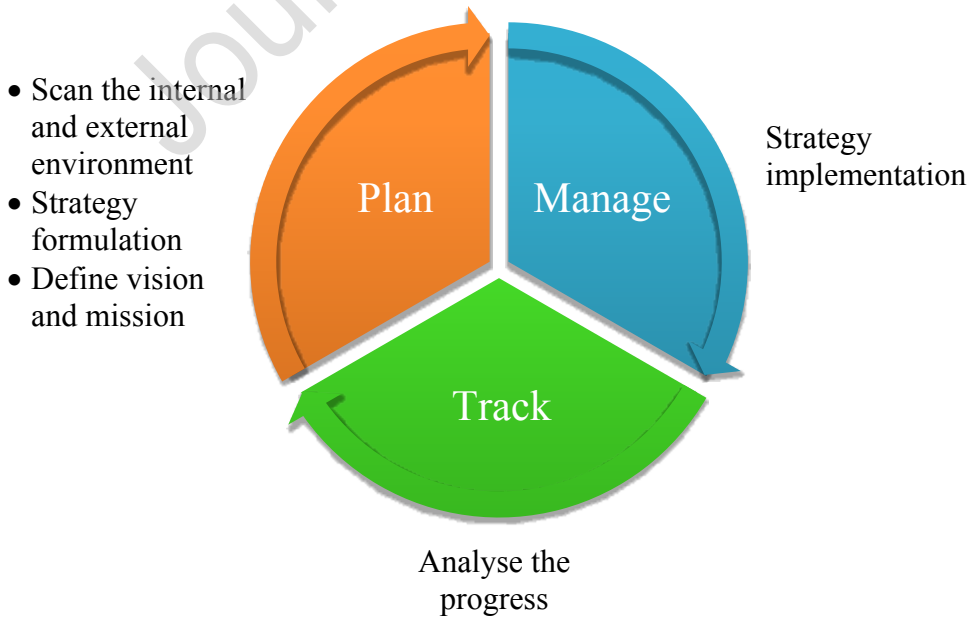


Figure 3. Strategic management process (adapted from Hitt et al. (2007))

Strategic management approaches have been widely considered in sustainability and ERP guidelines. Heemskerk et al. (2002) included activities of identifying objectives in sustainability guidelines. GRI (2015) incorporated strategy analysis and development, identification of the organisational profile, and identification of material aspects. In the ERP field, Malik (2009) incorporated the concept of strategic management in the pre-implementation phase. He considered several processes, including requirements analysis, project identification, and identification of project scope. Another study conducted by Sahran et al. (2010) only considered the business requirement analysis in ERP guidelines.

2.5 Project Management

A concise process, based on knowledge, and method of managing a project to achieve its objectives (Nicholas and Steyn, 2017). This concept is generally used in project implementation to complete projects within the identified time, budget, scope, and quality. PMI (2017) identified the project management formal structure that includes process groups and knowledge areas. Detail of the process groups and knowledge areas of the project management approach is shown in Figure 4.

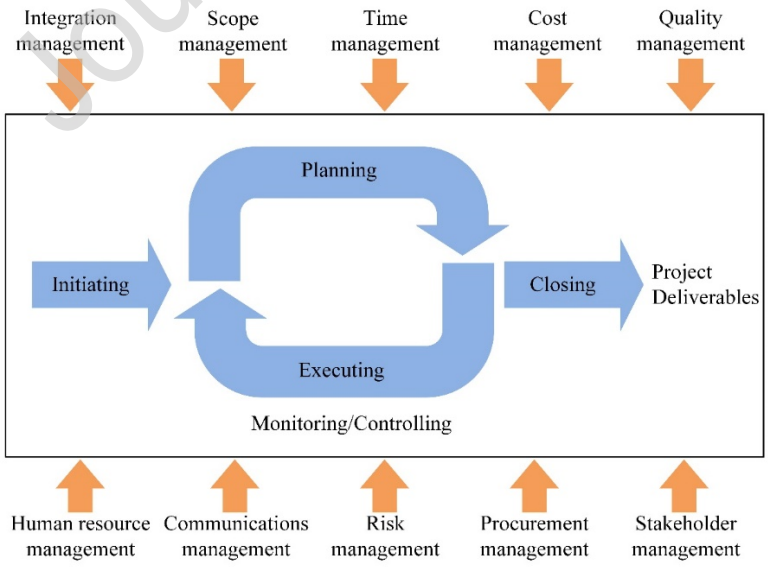


Figure 4. An overview of project management (adapted from PMI (2017))

Sustainability and ERP implementation are usually managed as projects and handled by the project manager. They need the knowledge and competence of project management to successfully implement the initiative (Sabini, 2016). This concept is important to keep the projects efficiently and effectively delivered, increase stakeholder satisfaction, and increase the flexibility and quality of implementation (Ara and Al-Mudimigh, 2011).

The prominent role of project management applications in the context of sustainability and the implementation of ERP is more understandable from the proposed guidelines. IUCN (2018) adopted several project management process groups in the sustainability guidelines. Similarly, Sahran et al. (2010) combined the project management process groups with their guidelines by arguing that ERP implementation can be successful based on effective project management consideration. Therefore, the adoption of this concept cannot be ignored. This can also be applied to the S-ERP given that the implementation of the system requires proper planning to achieve its goals and objectives. The present study adopts a complete process in project management concept as an activity at the operational level.

3. Research Methodology

This section provides the development process of the S-ERP implementation guidelines. The present study reviews the methodology used is sustainability and ERP studies to see an overall systematic process in developing the sustainability and ERP guidelines. The existing sustainability and ERP studies used various methods, including conceptual research, surveys, case studies, or mixed methods, as presented in Tables 1 and 2. The choice of methodology should be based on the identified research questions. For example, process-related questions are generally answered through conceptual research methods (Morse and Richards, 2012). Ridder (2016) mentioned that the case study method is used for exploratory studies that intend to answer “How” and “Why” research questions. This

method generally uses direct interviews and observations in certain organisations. Survey methods can be used to answer various basic and applied research questions, where data is systematically collected from a sample of individuals (Wolf et al., 2016).

The present study attempts to address the following research question: what steps and activities are required for the implementation of S-ERP systems? This question can be formulated by developing the S-ERP guidelines, and conceptual research method is considered well-suited for responding to the question as it requires logical clarification of concepts and analysis of the use of concepts, as stated by Xin et al. (2015). This methodology generally uses literature analysis to build new concepts. This study adapted three main phases of conceptual research method, which have been applied by (Chofreh et al., 2018a), for developing the S-ERP guidelines. Figure 5 illustrates the three phases in the conceptual research method, which include i) Collection of steps and activities from previous sustainability and ERP guidelines, ii) Classification and evaluation of the collected steps and activities based on the adopted concepts, and iii) Identification of steps and activities required for S-ERP guidelines.

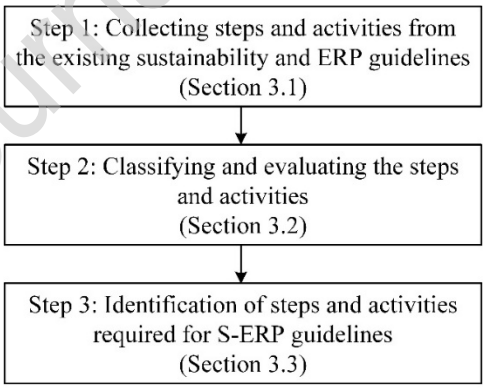


Figure 5. Methodology to develop S-ERP guidelines

3.1. Collection of steps and activities from the existing sustainability and ERP guidelines

This study analyses a number of guidelines in two research fields, including sustainability and ERP implementation. The literature search in these fields is conducted in several academic

databases including Google Scholar, Science Direct, and Scopus using the following terms for key words, such as sustainability implementation, sustainability guidelines, sustainability action plan, ERP implementation, ERP guidelines, and ERP action plan. The guidelines from international and regional institutions are also collected to find more practicable guidelines. This process is repeated until data saturation was reached. The literature search found that most of the sustainability and ERP guidelines are proposed by the institutions and consultants as a formal standard and procedure for organisations to implement sustainability and ERP as a system. All steps and activities that have been collected are then analysed to get the adopted ideas and concepts for developing the structure of S-ERP guidelines. Tables 3 and 4 present the steps and activities identified in the existing sustainability and ERP guidelines.

Various steps and activities have been considered in the sustainability and ERP guidelines. From these steps and activities, it can be seen that they were adapted from different concepts including sustainability aspects, organisational decision levels, project management, and strategic management, as shown in the column "adopted concept" in Tables 3 and 4. This adopted concept is then later analysed and used for the development of the S-ERP guidelines. The mapping process of the existing sustainability and ERP guidelines with the specific aspects of the adopted concepts is provided in Table 5. The conclusion that can be obtained from the formation of existing guidelines is that the guidelines should convey the following characteristics:

i) Streamlining the system implementation process,

ii) Integrate and link implementation steps, levels, and activities, and

iii) Focus on the key issues of system implementation.

Table 3. Steps and activities of previous sustainability guidelines

Reference	Research focus	Steps and activities	Adopted concept
Heemskerk et al. (2002)	Sustainability reporting	Managerial procedure: 1. Goals 2. Preparation 3. Actions 4. Follow-up/appraisal 5. Evaluation and learning Reporting procedure: 1. Goals 2. Preparation 3. Report development 4. Report dissemination 5. Provide feedback	Sustainability aspects, organisational decision levels, project management, and strategic management.
NZBCSD (2003)	Sustainable supply chain implementation in the organisation	1. Analyse internal processes and identify the risks 2. Identify supply chain activities 3. Embed sustainability into the corporate strategy	Sustainability aspects, organisational decision levels, and strategic management.

		4. Use assessment tools 5. Identify initiatives	
BSI (2003)	Sustainability implementation in the organisation	1. Governance and corporate vision 2. Preparation 3. Delivery 4. Evaluation and report	Sustainability aspects, organisational decision levels, project management, and strategic management.
Lambrechts et al. (2009)	Implementation plan for sustainability in higher education	1. Vision 2. Mission 3. Steering committee 4. Integration strategies 5. Evaluation 6. Report dissemination 7. Accreditation	Sustainability aspects, organisational decision levels, and strategic management.
Stephens and Graham (2010)	Sustainability implementation for higher education institutions	Multi-level perspective: 1. Landscape 2. Government 3. Function Procedures: 1. Strategy	Sustainability aspects, organisational decision levels, and strategic management.

		2. Tactic 3. Operation 4. Reflexive Transformation phases: 1. Pre-implementation 2. Execution 3. Breakthrough 4. Maintenance	
APEGBC (2013)	Sustainability implementation in engineering and geoscience practices	1. Uphold sustainability knowledge 2. Embed sustainability into business practice 3. Cooperate with experts 4. Plan and implement sustainability 5. Evaluate the sustainability performance 6. Identify opportunities for enlargement	Sustainability aspects and organisational decision levels.
SA8000:2014 (2014)	Standards for social accountability in the workplace	1. Policies, procedures, and records 2. Social performance team 3. Identification and assessment of risks 4. Monitoring 5. Internal involvement and communication	Sustainability aspects, organisational decision levels, project management, and strategic management.

		6. Complaint management and resolution 7. External verification and stakeholder engagement 8. Corrective and preventative actions 9. Training and capacity building 10. Management of suppliers and contractors	
United Nations Global Compact (2014)	Principles on human rights, labour, environment, and anti-corruption	Human rights: 1. Business should support and respect the protection of internationally proclaimed human rights 2. Make sure that they are not complicit in human rights abuses Labour: 3. Businesses should uphold the freedom of association and the effective recognition of the right to collective bargaining 4. The elimination of all forms of forced and compulsory labour 5. The effective abolition of child labour 6. The elimination of discrimination in respect of employment and occupation	Sustainability aspects, organisational decision levels, project management, and strategic management.

		Environment: 7. Businesses should support a precautionary approach to environmental challenges 8. Undertake initiatives to promote greater environmental responsibility 9. Encourage the development and diffusion of environmentally friendly technologies Anti-corruption: 10. Businesses should work against corruption in all its forms	
Welfering et al. (2014)	Guidelines for sustainable urban transportation and mobility	1. Define opportunities for effective sustainable planning 2. Identify process and scope development 3. Analyse current problems and develop solutions 4. Develop a vision, mission, and strategies 5. Identify priorities and targets 6. Set effective measures 7. Agreement and budget allocation 8. Develop a motoring and assessment plan	Sustainability aspects, organisational decision levels, and strategic management.

		9. Implement the plan 10. Communication 11. Lessons learned	
AA1000SES (2015)	Stakeholder engagement standards	1. Purpose and scope of the AA1000SES 2. Commitment and integration - Commit to the AA1000 accountability principles - Integrate into organisational governance - Integrate into organisational strategy - Integrate into operational management 3. Purpose, scope, and stakeholders - Establish the purpose of the engagement - Establish the scope of the engagement associated with the purpose - Determine the mandate, ownership, and stakeholders of the engagement 4. Stakeholder engagement process - Plan - Prepare - Implement the engagement plan	Sustainability aspects, organisational decision levels, project management, and strategic management.

		- Review and improve	
GRI (2015)	Sustainability reporting	General standard disclosures: 1. Develop and analyse the strategy 2. Identify the organisational profile 3. Identify material aspects 4. Stakeholder involvement 5. Develop the report 6. Governance 7. Morals and integrity Specific standard disclosures: 1. Management approach 2. Performance indicators	Sustainability aspects, organisational decision levels, and strategic management.
IMACE (2016)	Sustainability reporting for food manufacturing companies	1. Identify purpose and scope 2. Develop a sustainability framework and identify sustainability performance indicators 3. Reporting	Sustainability aspects and project management.
ISO 26000:2010 (2017)	Standards for social responsibility	1. Understanding social responsibility 2. Principles of social responsibility	Sustainability aspects, organisational decision levels, project management, and strategic management.

		3. Recognising social responsibility and engaging stakeholders 4. Guidance on social responsibility core subjects 5. Guidance on integrating social responsibility throughout an organisation	
IUCN (2018)	Guidelines focusing on sustainability aspects for outer space activities	1. Define objectives and values 2. Develop a plan 3. Transformation 4. Impact assessment 5. Influence human behaviour and change 6. Monitoring and controlling 7. Decision-making process 8. Stakeholder engagement 9. Communication and accreditation	Sustainability aspects, organisational decision levels, project management, and strategic management.

Table 4. Steps and activities of previous ERP guidelines

Reference	Research focus	Steps and activities	Adopted concept
Wallace and Kremzar (2001)	Effective ERP system implementation in an organisation	1. Initial education and training 2. Sales and operations planning 3. Demand management, planning, and scheduling processes 4. Process definition 5. Pilot and cutover 6. Data integrity 7. Finance and accounting processes 8. Process definition and implementation 9. Software selection 10. Software configuration and installation	Sustainability aspects, organisational decision levels, and project management.
Ehie and Madsen (2005)	Implementation of the ERP system and its importance for higher education institutions	1. Project initiation 2. Business plan 3. Realisation 4. Finalise the project 5. Go-live and maintenance	Sustainability aspects, organisational decision levels, and project management.

Malik (2009)	Effective ERP system implementation in an organisation	1. Pre-implementation - An ERP solution required or not? - Scope of work - Steering committee - Implementation team - Software development centre - Employees buy-in - Interfaces for the third party integration - Declare implementation as a project - Business process management 2. Implementation - Data collection - Preparedness - Pre-evaluation - Project planning - Process refinement - Support team - Quality team - Documentation with configuration	Sustainability aspects, organisational decision levels, project management, and strategic management.

		3. Post-implementation - Change management - Support - Human resource retention - Competency centre	
Deloitte (2010)	Guidelines for overcoming several challenges in implementing an ERP system	1. Get everyone on board to understand and articulate the need for change 2. Adequate sponsorship and leadership 3. Understand established business culture and historical response to change 4. Appropriately structure the project and clearly establish roles 5. Get back on track quickly by addressing people impacts and behavioural changes 6. Create change networks and develop internal support 7. Assess learning requirements and develop a tailored training program 8. Thoroughly plan and deliver post go-live support	Sustainability aspects, organisational decision levels, project management, and strategic management.

		9. Embedding change means anticipating and mitigating resistance 10. Identify, deal with, and defuse unanticipated impacts	
Sahran et al. (2010)	Highlighted effective Implementation of ERP system for SME's	1. Management direction 2. Stakeholder involvement 3. Analyse business requirements 4. Project initiation and planning 5. Consultant selection 6. Business and operational analysis 7. ERP software selection 8. Business process re-engineering 9. Pre-implementation training 10. ERP installation 11. Mapping the business requirements 12. System integration and testing 13. User acceptance and testing 14. Data migration and testing	Sustainability aspects, organisational decision levels, project management, and strategic management.

		15. Documentation 16. Post-implementation training 17. Communication and go-live 18. Post-implementation support 19. System maintenance and upgrade	
Shaul and Tauber (2012)	Implementation of ERP system for SME's	1. Major upgrade 2. New module 3. Backlog 4. Stabilisation 5. Implementation 6. Planning	Sustainability aspects and project management.
Sun et al. (2015)	Guidelines for improving ERP system performance	1. Assess organisational readiness 2. ERP software selection 3. Implementation 4. Final preparation 5. System running	Sustainability aspects and project management.

3.2. Classification and evaluation of the collected steps and activities

This section provides a classification of steps and activities identified in the existing sustainability and ERP guidelines, as given in Table 5. This table gives a literature analysis by mapping the steps and activities to the specific aspects of the adopted concepts. The aspect of sustainability refers to social, economic, and environmental. Organisational decisions levels include strategic to focus long term decisions, tactical to move forward smartly, and operational. Project management consists of several phases in the project life-cycle encompassing initiation, plan, execution, controlling/monitoring, and closure. Strategic management refers to activities related to the formulation and implementation of the organisation's main strategies.

As shown in Tables 3 and 4, the sustainability and ERP guidelines generally adapted several concepts including sustainability aspects, organisational decision levels, project management, and strategic management. However, these guidelines only considered several aspects of the concepts, as seen in Table 5. For instance, Welfering et al. (2014) considered all aspects of sustainability; however, they only included strategic aspect in their guidelines without considering tactical and operational activities and project management. This approach is similar to the sustainable reporting standards introduced by GRI (2015).

The concepts applied in ERP implementation guidelines can generally be adopted in the S-ERP guidelines as the general idea of these two concepts is similar, namely to integrate business processes and activities. Table 5 shows that the existing ERP guidelines only considered economical aspect as the fundamental of this system is based on profit. However, the sustainability aspects (environment, society, and economy) must be fully added to the S-ERP implementation guidelines because this system specifically manages and integrates sustainable business processes and functions.

Table 5. Classification of the steps and activities

Reference	Research field		Concepts used in the literature								
	Sustainability	ERP	Sustainability aspects			Organisational decision levels			Project management		Strategic management
			Environment	Society	Economy	Strategy	Tactics	Operations	Process groups	Knowledge areas	
Wallace and Kremzar (2001)		X			X		X	X	X		
Heemskerk et al. (2002)	X		X	X	X	X			X		X
NZBCSD (2003)	X		X	X	X	X					X
BSI (2003)	X		X	X	X	X			X		X
Ehie and Madsen (2005)		X			X			X	X		
Lambrechts et al. (2009)	X		X	X	X	X					X
Malik (2009)		X			X	X	X	X	X		X
Deloitte (2010)		X			X	X			X		X
Sahran et al. (2010)		X			X	X	X	X	X		X
Stephens and Graham (2010)	X		X	X	X	X	X	X			X
Shaul and Tauber (2012)		X			X				X		

APEGBC (2013)	X		X	X	X	X					
SA8000:2014 (2014)	X			X		X	X			X	X
United Nations Global Compact (2014)	X		X	X	X	X	X				X
Welfering et al. (2014)	X		X	X	X	X					X
AA1000SES (2015)	X		X	X	X	X	X	X		X	X
Sun et al. (2015)		X			X				X		
GRI (2015)	X		X	X	X	X					X
IMACE (2016)	X		X	X	X					X	
ISO 26000:2010 (2017)	X		X	X	X	X	X			X	X
IUCN (2018)	X		X	X	X	X	X	X	X	X	

The sustainability and ERP guidelines generally adopted the strategic level of an organisational decision. Strategic activities in this level are crucial in the system implementation as it influences on the success and failure of the system. For example, in the case of sustainability implementation, the top managers need to embed sustainability concept into their corporate vision, mission, and strategy, and this activity is considered at the strategic level. However, tactical and operational activities are identified based on strategic activities. This study considers all levels in organisational decision (strategic, tactical, and operational) to give a holistic perspective of the S-ERP implementation.

In term of project management concept, the project management process groups, which have been introduced by PMI (2017), are commonly adopted in the existing guidelines. For example, Shaul and Tauber (2012) considered executing and planning the process of the ERP project. Deloitte (2010) incorporated more complete process groups of project management. The inclusion of the project management aspects depends on the scope of the guidelines. In this study, the S-ERP guidelines incorporate complete process groups and knowledge areas in project management as they are necessary for tracking the progress of the project implementation.

3.3. Identification of steps and activities required for S-ERP guidelines

S-ERP guidelines are a vital component of the S-ERP master plan. They consist of detailed steps and activities that guide practitioners to effectively implement S-ERP systems in the organisation. S-ERP guidelines are developed based on the characteristics identified in the previous subsection and use input from the existing guidelines. Figure 6 shows the general structure of the guidelines.

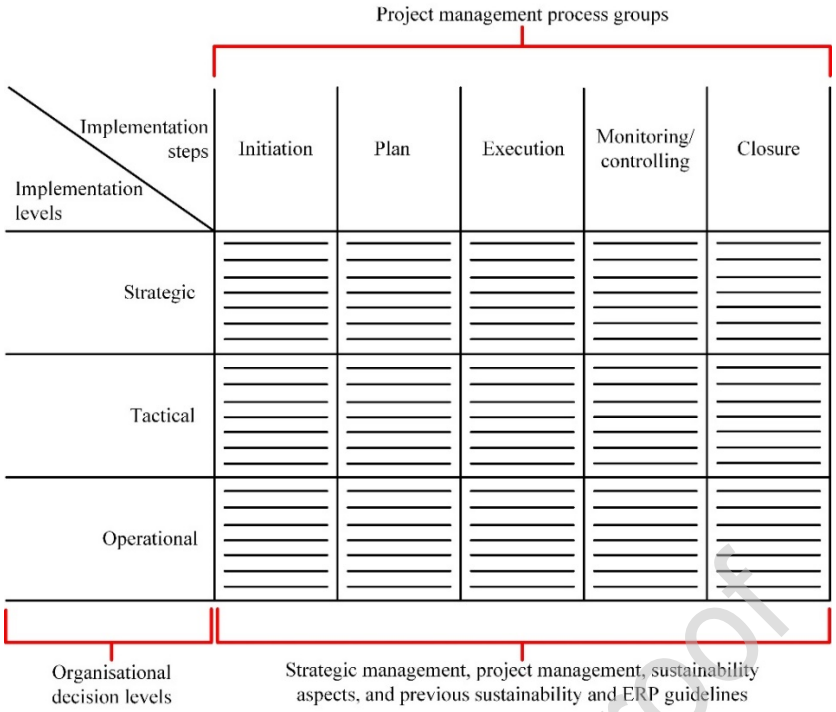


Figure 6. Mapping process for the development of S-ERP guidelines

The structure of S-ERP guidelines is developed into three main modules consisting of implementation steps, levels, and activities, adapting from the project management concept introduced by Project Management Institute (2017), which integrated project management activities into process groups and knowledge areas. Implementation steps are adopted from the project management process groups (PMI, 2017), which include initiating, planning, executing, monitoring/controlling, and closing. Based on the Project Management Body of Knowledge (PMBOK), a standard of project management, the organisations should start the initiating activities at the beginning of the project implementation; however, they also can start the next stages (planning, executing, and controlling) before the previous stage is completed. This approach is also applied in the S-ERP guidelines.

The levels of implementation are adopted from the organisational decision levels concept (Chofreh et al., 2018b). These levels include strategic, tactical, and operational, and they describe the segmentation of activities based on the level of decisions and actors.

Implementation activities at the strategic level should be carried out by top managers. Middle managers are responsible for executing activities identified at the tactical level, while activities at the operational level should be completed by junior managers.

The implementation activities are adapted from various concepts, including strategic management, project management knowledge areas, sustainability aspects, and several activities from existing sustainability and ERP guidelines. These activities are mapped to the S-ERP implementation steps and levels. They convey general activities for implementing the S-ERP system. The implementation activities are conducted using a top-down approach, which starts with the big picture. However, the activities in the tactical level can be started before the activities in the strategic levels are completed. This is also applied for the activities at the operational level. It depends on the project leader and the condition of the company. In addition, the activities at each level have a different range of period to be completed. For example, the activities at the strategic level are for long-term decision (about 10 to 20 y). The activities in tactical level can be done every 3 to 5 y. The activities in the operational level are routine activities that should be completed within a year or daily basis.

4. Results and Discussion

This section presents the S-ERP implementation guidelines developed in this study. Table 6 shows the concise S-ERP guidelines. Complete elements of the S-ERP guidelines are provided in Table 7. The novelty of this study resides in the developed S-ERP guidelines that integrate important steps, levels, activities, and their interrelationships for the system implementation. These guidelines are a part of the S-ERP master plan components that convey general procedures for implementing the system. The steps in the guidelines show sequential pace for the beginning to end that should be followed by the project team. These steps categorise implementation activities to facilitate experts in tracking the progress of system implementation. The levels in the guidelines deliver segmentation of activities based on the

level of decisions and actors. Implementation activities at the strategic level should be carried out by top managers. Middle managers are responsible for executing activities identified at the tactical level, while activities at the operational level should be completed by junior managers. Effective adoption of S-ERP guidelines with a strong commitment from stakeholders will result in effective implementation of the S-ERP system in the organisation.

Table 6. Concise S-ERP implementation guidelines

STEPS / LEVELS	INITIATION	PLAN	EXECUTION	MONITORING AND CONTROLLING	CLOSURE
STRATEGIC	• Strategic inputs	• Formulate strategies • Select appropriate strategies	• Involve in the strategic alignment process	• Review and evaluate performance	• Close the strategic management phase
TACTICAL	• Identify business needs and requirements • Identify stakeholders • Analyse required resources • Software and hardware selection • Vendors selection • System integration preparation • Analyse requirements of project documentation	• Design requirements change management process plan • Design a plan for stakeholder involvement • Resources acquisition plan • Design a plan to get the required software and hardware • Design system integration plan	• Implement change management • Manage stakeholder involvement • Acquire resources • Vendors selection • Select required software and hardware • Execute system integration process • Provide documentation for project design/planning	• Review and evaluate system implementation	• Close the tactical management phase
OPERATIONAL	• Design project charter	• Design system implementation activities	• Implement the system	• Monitor and control system implementation	• Close the system implementation

Table 7. Detailed S-ERP implementation guidelines

STEPS / LEVELS	INITIATION	PLAN	EXECUTION	MONITORING AND CONTROLLING	CLOSURE
STRATEGIC	• Strategic inputs[2] - Preparation of the sustainable enterprise profile[1] - Identify external environment[2] • Identify and scan general environment including economic, socio-cultural, global, technological, political/legal, demographic, environmental factors • Identify and scan industry environment including new entrants, the power of suppliers, the power of customers, substitute products, rivalry among existing competitors • Identify and evaluate competitors' environment - Identify internal environment[2] • Identify and scan resources (tangible or intangible resources), capabilities, core competencies, competitive advantage - Forecast future environment[2] - Analyse political, economic, social, technological, legal,	• Formulate strategies[2] • Select appropriate strategies	• Alignment between sustainable corporate strategy with S-ERP strategy - Integration of performance measures - Consider environmental aspects - Consider social aspects - Consider economic aspects - Consider consumer aspects - Consider internal process aspects - Consider learning and development aspects • Getting execution right - Use corporate governance, organisational structure, strategic leadership, and strategic entrepreneurship to implement initiating and planning phases. - Execute necessary and corrective action	• Review and evaluate performance[6] - Review the situation and initiating corrective action in initiating, planning, executing and closing phases[6] - Evaluate the performance in initiating, planning, executing and closing phases[6] - Process parameters - Monitoring output - Feedback of processes to strategic setting	• Close strategic management phase[4] - Provide feedback[11] - Create documentation for next improvement[5]

	environmental factors (PESTLE analysis)[2] - Identify stakeholder[3] - Analyse the needs of the stakeholder[3] - Analyse strengths, weaknesses, opportunities, and threats (SWOT) of the system implementation[2] • Identify strength • Identify weaknesses • Consider opportunities • Consider threats • Identify reasons for each strength, weakness, opportunity, and threat • Eliminate repetitive, irrelevant, and contradictory factors • Modifications, alterations, elimination, refinements, amendments to SWOT • Interpretation of SWOT highlighting weaknesses and threats • Matching of SW with OT • Integration of SWOT - Vision and mission development[2] • Define vision of the implementation of the S-ERP system • Define mission of the implementation of the S-ERP system • Setting objectives (convert the mission into specific performance targets)				

TACTICAL	• Identify business requirements[5] - Identify current business processes of the organisation[7] - Predict process changes of the organisation to be matched with the system - Predict system changes to be matched with the business process of organisation • Identify stakeholders[3] - Define stakeholder commitment in the project[3] - Obtain commitment and participation from the affected stakeholders[3] - Define new roles and responsibilities[8] - Determine scope of stakeholder involvement[3] • Analyse and identify required resources - Analyse required human resources - Analyse staffs' education background - Analyse and determine required skills, knowledge, and competencies for project team selection - Identify training requirements and materials for top managers, decision makers, project team members, key users, and end users[9]	• Design requirements change management process plan • Design a plan for stakeholder involvement[3] - Design stakeholder commitment plans[3] - Design a plan for stakeholder involvement[3] • Resources acquisition plan - Design a plan for project team selection - Design a plan for project team improvement programmes, such as trainings and workshops[9] • Design a plan to get the required software and hardware - Design a plan for hardware infrastructure - Design a plan for software selection[10] - Design a plan for software installation[12] • Design system integration plan[5] - Design a blueprint of integration processes - Design a plan for network and security configuration - Design for customising the system changes - Design a migration plan for master files - Design a migration plan for transactional files	• Implement change management • Manage stakeholder involvement[3] - Invite the stakeholder to various activities related to the system implementation • Acquire resources - Recruit the required staffs and experts - Execute skills and knowledge development programmes • Vendors selection[5] - Negotiate with vendors - Make a contract • Select the required software and hardware - Software and hardware selection - Software and hardware procurement - Hardware installation - Hardware configuration • Execute the system integration process - Software customisation - Migrate master files - Migrate transactional files - Update and modify data structure - Execute data maintenance and integrity • Provide documentation[5]	• Evaluate and review system implementation[4] - Monitor system integration process - Review system integration and initiate corrective action in all system implementation phases - Evaluate performance	• Close tactical management phase[4] - Provide feedback[11] - Create documentation for next improvement[5]

	• Software and hardware selection[10] - Identify software application and hardware based on the business needs - Ensure alignment of software ability with sustainable business strategies - Estimate software and hardware price - Identify software and hardware requirements • Vendors selection[5] - Check vendor's vision and strategic position - Check quality of vendors' proposal - Select appropriate vendors[5] - Ensure the availability of vendors' customer support and their ability to meet future needs • System integration preparation[5] - Analyse integration processes[5] - Initiate system integration process[5] - Determine network requirements and capacity - Determine server availability - Determine requirement for software installation - Identify security requirements	- Design a plan for updating and modifying the data structure - Design a plan for data maintenance and integrity • Design project documentation plan[5]			

	- Determine standards of hardware and software interfaces - Prepare and maximise potential of master files - Prepare and maximise potential transactional files - Identify data structure - Prepare data and system maintenance and integrity[5] • Analyse requirements of project documentation[5]				
OPERATIONAL	• Design project charter[4]	• Design system implementation activities[4] - Accumulate requirements[4] - Identify scope[4] - Build work breakdown structure of the system implementation[4] - Identify activities[4] - Organise activities[4] - Evaluate resources[4] - Evaluate activity periods[4] - Design timetable[4] - Define financial plan[4] - Develop quality plan[4] - Develop human resource plan[4] - Design communication[4] - Design risk management[4] - Ascertain risks[4] - Execute qualitative risk analysis[4] - Execute quantitative risk analysis[4] - Design risk responses[4]	• Implement the system - Direct and administer project implementation - Execute quality assurance - Establish project team - Manage project team - Disseminate information - Manage stakeholder expectancy[3] - Document stakeholder engagement and the outcomes[3] - Communicate stakeholder engagement outputs[3]	• Monitor and control system implementation[4] - Monitor and evaluate stakeholder engagement[3] - Learn and improve stakeholder engagement process[3] - Execute integrated change control - Validate scope and control scope- Control timetable[4] - Control budget[4] - Execute quality control[4] - Report performance[1] - Monitor risks[4]	• Close system implementation[4] - Provide feedback[11] - Create documentation for next improvement[5]

		- Design procurements[4]			

[1]GRI (2015)
[2]Hitt et al. (2007)
[3]AA1000SES (2015)
[4]PMI (2017)
[5]Sahran et al. (2010)
[6]APEGBC (2013)
[7]Malik (2009)
[8]Deloitte (2010)
[9]SA8000:2014 (2014)
[10]Sun et al. (2015)
[11]Heemskerk et al. (2002)
[12]Wallace and Kremzar (2001)

The S-ERP guidelines can be used by practitioners in any type of industry for assisting their business transformation towards sustainable integrated organisations. A successful S-ERP system implementation enables organisations to integrate all sustainable business functions to provide real-time information for decision-making, especially under the new manufacturing environment of Industry 4.0.

The proposed S-ERP guidelines identified new activities that are not considered in the previous sustainability and ERP guidelines, including strategic analysis, strategic alignment, resource analysis, and change management analysis. The strategic analysis allows practitioners to evaluate and develop internal and external environment of the company and reveals possible opportunities and threats that need to be considered in the system implementation. Strategic alignment is an important process in the system implementation that links the organisational strategy and process to the system strategy. This process enables organisations to be more agile and responsive to changing business conditions. Strategic alignment is a key process in the system implementation to integrate the business and system vision, mission, and strategy for optimising the system performance. Resource analysis activity is a way organisations understand their competencies and the value of resources. The developed S-ERP guidelines incorporate tangible and intangible resources for the analysis. Tangible resources include financial, organisational, physical, and technological resources, whereas intangible resources include human, innovation, and reputational resources. Another new activity is change management analysis that outlining the system implementation with process improvement analysis and business case analysis.

5. Conclusions

The present study attempted to address the existing knowledge gap of limited studies concerning the development of plans that integrate important steps and actions to implement

the S-ERP system. This limitation was addressed through the development of S-ERP guidelines. The formulation of the guidelines involves a conceptual research method that relies on literature analysis. This study examined the existing guidelines in two related areas, including sustainability and ERP implementation. The results revealed that there is no general technique underlying the development of the existing guidelines. The feature of the S-ERP guidelines was identified based on four adopted concepts, including sustainability aspects, organisational decision levels, strategic management, and project management.

The developed guidelines provide a unified approach to implementation steps, levels, and activities. These components are detailed as follows:

i) Implementation steps: initiation, plan, execution, monitoring/controlling, and closure.
ii) Implementation levels: strategic, tactical, and operational levels.
iii) Implementation activities: all identified activities that are mapped to the implementation steps and levels of the guidelines.

The present study provides significant contributions to theory and practice. The novelty of this study lies in the developed S-ERP guidelines that yield sequential steps and activities to implement the S-ERP systems. The guidelines provide a new finding of several activities comprising strategic analysis, strategic alignment, resource analysis, and change management analysis, which are not considered in the previous sustainability and ERP guidelines. In a theoretical viewpoint, the S-ERP guidelines would increase the growth of research in the field of S-ERP systems as research in this area is still in its infancy. In addition, the development of S-ERP guidelines complements the structure of the S-ERP master plan that can assist practitioners to understand the overall implementation process and reduce failures. The

identified activities indicate procedures for achieving the effectiveness of the S-ERP implementation in the organisation.

In the area of cleaner production, implementing an S-ERP system would help organisations to streamline sustainable business processes and improve the effectiveness of the cleaner production process. The S-ERP system enables practitioners to quickly evaluate sustainability performance and provide accurate decisions. This capability would increase production effectiveness, minimise energy consumption and carbon emissions by up to 40 % (Chofreh et al., 2018b), and contribute to the implementation of Industry 4.0 manufacturing technologies (Tsai, 2019).

The literature resources in the field of S-ERP systems are still limited because the research in this subject is still at the initial stage. Therefore, this study examined two related areas: sustainability and ERP implementation to get general ideas and concepts for the formulation of S-ERP guidelines. Several S-ERP applications are available through different software vendors to help companies manage their sustainable business. However, there are a few companies that are implementing the systems. Besides, research on S-ERP systems is still in the initial phase. There is a limited study that contributes to the implementation of the system within an organisation. Therefore, the present study is limited to the development of the S-ERP guidelines, without evaluating the applicability of the S-ERP guidelines through a case study method.

Further studies need to be conducted to evaluate the contents of the guidelines. Expert reviews can be used as a methodology involving several experts from related fields of study. The reliability and usefulness of the developed guidelines can be evaluated using an action research method. This study would be useful to provide a deeper analysis of the implementation of an S-ERP system in an organisation.

Acknowledgement

This research has been supported by the EU project "Sustainable Process Integration Laboratory – SPIL", project No. CZ.02.1.01/0.0/0.0/15_003/0000456 funded by EU "CZ Operational Programme Research, Development and Education", Priority 1: Strengthening capacity for quality research.

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