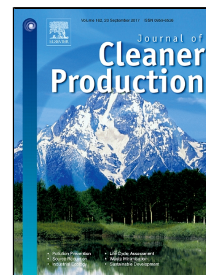


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Development of a Roadmap for Sustainable Enterprise Resource Planning Systems Implementation (Part II)

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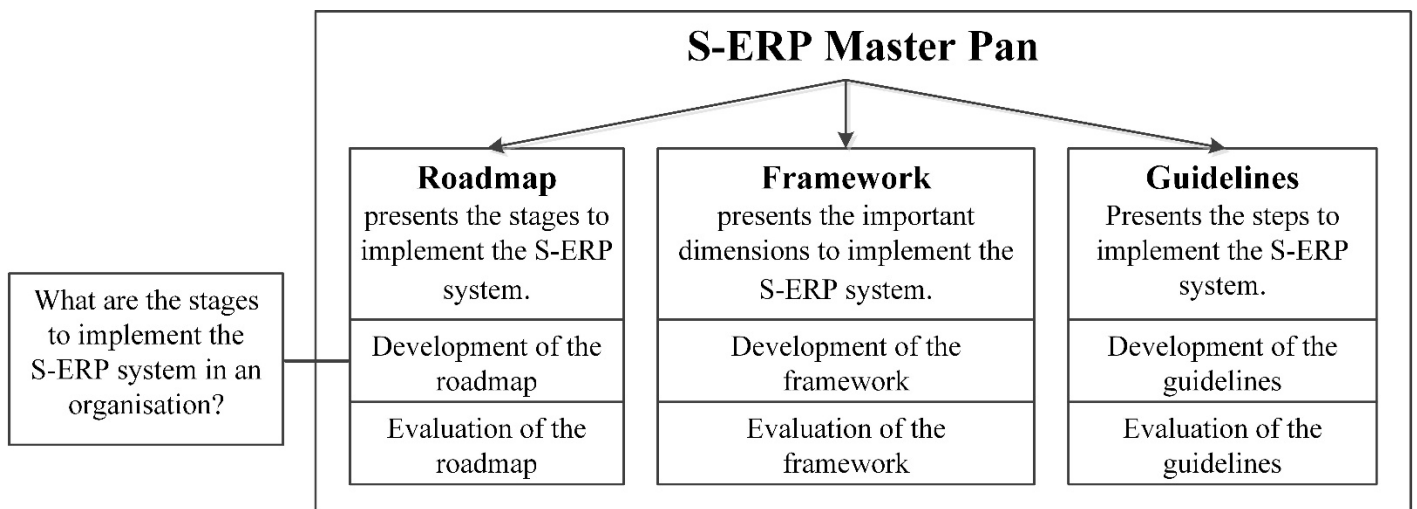
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Abstract. Organisations need to implement Sustainable Enterprise Resource Planning (S-ERP) systems to manage their sustainable business. This system enables an integration of sustainable processes, information and data on every level of the organisations' value chain. Leading information technology companies like Oracle, Microsoft, and Systemanalyse und Programmentwicklung (SAP) have developed such sustainable enterprise system. However, the problem faced by companies is in the implementation of the S-ERP systems. Due to the absence of a master plan, organisations are not always provided with a thorough plan on the implementation process of the system. This gap in the available knowledge has motivated researchers to engage in the development of a master plan to implement the S-ERP systems that consist of a roadmap, framework, and guidelines. The aim of this research is to concentrate on the development of the roadmap providing the implementation stages of the S-ERP systems. A conceptual research method is used in the study that is mainly dependent on the available literature. Numerous existing roadmaps are reviewed to expose the gaps and inconsistencies. Project management method is used as a basic concept for developing the roadmap. As a result, the roadmap includes three phases (pre-implementation, implementation, and post-implementation) and each of them includes numerous stages to implement the S-ERP systems.

This roadmap would be useful for practitioners in providing the stages to implement the S-ERP system in their organisations.

Keywords: Sustainable enterprise resource planning; Implementation; Master plan; Roadmap; Development.

Graphical Abstract:



Research Highlights:

- Sustainability, ERP, project management have been examined.
- A review of the methodology used in the existing studies is provided.
- Gaps and inconsistencies in the existing relevant literature have been exposed.
- Project management used as a basic concept to develop the S-ERP roadmap.
- Recommendation of future research on the S-ERP master plan is provided.

1. Introduction

Sustainability concept is broadly acknowledged as the topics relevant to environmental issues intensify and increase (Čuček et al., 2015). This concept has been incorporated into supply chain management (Silvestre, 2015), finance (Lagoarde-Segot, 2015), supplier relations (Leppelt et al., 2013), product design (Seay, 2015), strategy (Küçüksayraç, 2015), and the policy and operations (Lam and Lai, 2014) of various companies. Organisations from various sectors need to integrate sustainability strategy into their business practices (Lubin and Esty, 2010). According to Chofreh et al. (2014a), numerous organisations have embedded sustainability into their extended value chain. The approach that has a clear vision, mission, and strategies would be successful in transforming towards sustainability (Lubin and Esty, 2010).

In achieving sustainable future, organisations require having a holistic view of the entire extended value chain (Klemeš, 2015). They need advanced models, indicators, and methods for evaluating their sustainability performance (Jayalet al., 2010). Information systems (IS) play an important role in assisting organisations in completing these sustainability processes (Elliot, 2011). IS aids them to collect the sustainable data and information, perform data analysis and conversion, monitoring and controlling, and report (Scipioni et al., 2008). During the last decades, IS plays a significant role for global business (Malhotra et al., 2013). However, a research in Green IS field is still in infancy (VomBrocket al., 2013). Fewer academics and practitioners take IS into consideration while implementing sustainability initiatives.

Organisations face generally two problems during their transformation towards sustainability. They are segregation between sustainable business functions (Chofreh et al., 2014a) and lack of a comprehensive plan for implementing sustainability (Chofreh et al., 2016a). According to Capgemini (2013), the sustainability data and activities are commonly

managed by using a tool or single system that is isolated from an enterprise system. The practitioners managed the data and information by using spreadsheets that are varying and cannot be easily monitored. This phenomenon indicates a misalignment between sustainability and IS strategies (Goni et al., 2013b).

Numerous organisations apply manual tools and methods to collect and analyse the sustainability metrics (Chofreh, 2015). This way of managing would fail when they need to repeat this process frequently and especially when the third party needs to audit the sustainable data and processes. A new technology generation of IS is compulsory as a business solution to improve sustainable business performance. The sustainable data, processes, and activities across extended value chain now must be integrated into an enterprise system. In addition, the sustainability process integration becomes one of the important issues in our society (Nemet et al., 2016). For those reasons, the role of Sustainable Enterprise Resource Planning (S-ERP) system is imperative in solving this problem (Chofreh et al., 2016b).

S-ERP systems have been defined as “information systems driven by sustainability concerns, covering every level of the extended value-chain” by Chofreh et al. (2014a). S-ERP systems can be described as an integrated IS enabling a company to integrate sustainable business processes, units, and activities. Its design allows the capturing and managing the data from every dimension of sustainability. Chofreh et al. (2016c) declared that the S-ERP systems have been developed by various companies such as Microsoft, Oracle, and SAP to help companies in addressing issues related to segregation. However, companies face problems in the implementation of this system as a result of the lack of a master plan for the implementation of this complex system. In the academic perspective, sustainability is rooted in different research areas, particularly in the area of value-chain. However, there is less research that highlights the importance of S-ERP systems in integrating the business functions, processes, and data in the extended value chain.

The implementation of S-ERP systems can be seen from ERP systems that are multifaceted and challenging (Sykes et al., 2014). Numerous organisations face various problems in implementing the ERP systems and some of them experienced with failures (Nelson, 2007), such as lack of support from top managers, less budget, poor project management, problems related to users, and data inconsistency and inaccuracy (Sahran et al., 2010). The complexity of S-ERP systems is higher including new data types, new data sources, and new stakeholders (Melville and Whisnant, 2012). S-ERP is predicted more challenging to be implemented successfully than ERP system as it has to cover three sustainability dimensions including social, environmental, and economic. The implementation result of the S-ERP systems could be similar to the earlier wave of ERP systems or even worse. This would affect the achievement of sustainability goals and objectives.

Chofreh et al. (2014a) mentioned that there is a lack of study providing the necessary guidance; outlining the steps, viewpoints, and stages, to assist practitioners in implementing the S-ERP systems. The related study conducted by Melville and Whisnant (2012) showed how the S-ERP works via a case study without considering how to implement the system. In fact, organisations require a comprehensive master plan to assist them in the implementation of S-ERP systems. In an attempt to fill this gap in available knowledge and help companies in solving this issue in practice, a master plan on how to implement S-ERP systems has been developed by researchers (Chofreh et al., 2016a).

An introduction to the concept of the S-ERP master plan has been described in our previous paper (Chofreh et al., 2016a). The S-ERP master plan was defined as “*a detailed conception of the S-ERP systems that contains a comprehensive plan of action to guide practitioners in implementing S-ERP systems*” (Chofreh et al., 2016a). It consists of three main components including a roadmap, a framework, and guidelines. The roadmap refers to some stages that need to be considered in implementing the S-ERP systems. The framework refers to an

important structure underlying the perspective that needs to be considered for implementing S-ERP systems. The guidelines refer to steps that show actions needed to be taken in order to complete the implementation of S-ERP systems. Figure 1 shows an overview of the master plan components and their relationships.

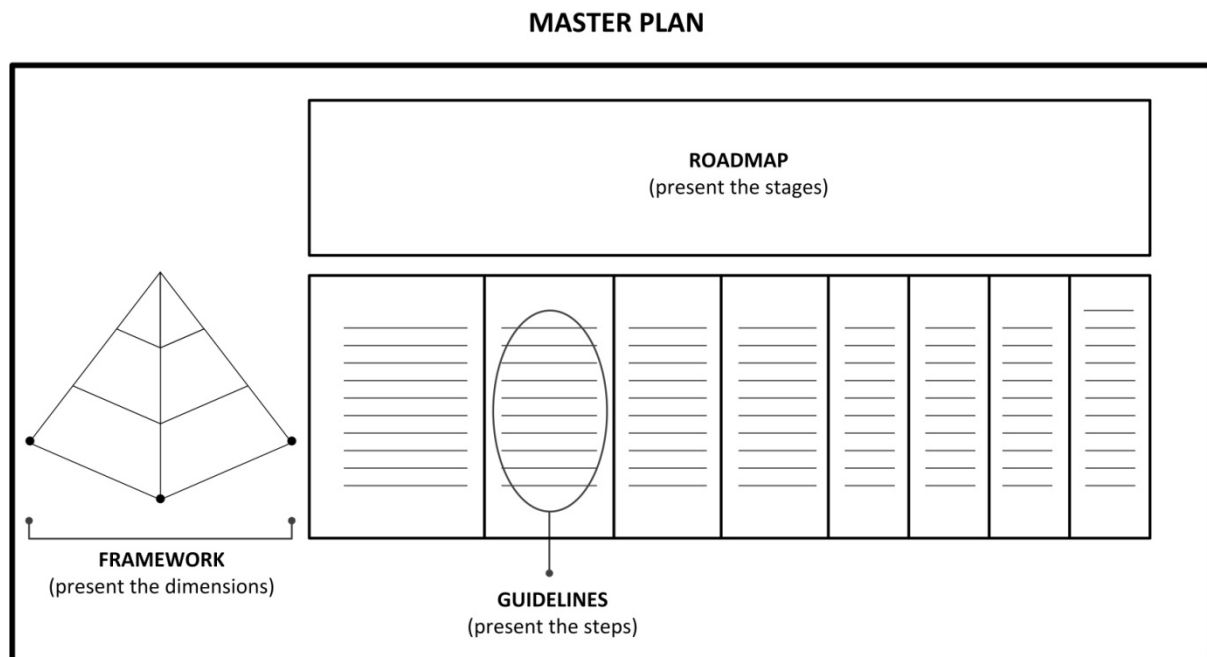


Figure 1. General idea of the S-ERP master plan (Chofreh et al., 2016a)

As shown in Figure 2, the development and evaluation of the master plan consist of six steps: 1) Development of the roadmap; 2) Evaluation of the roadmap; 3) Development of the framework; 4) Evaluation of the framework; 5) Development of the guidelines; and 6) Evaluation of the guidelines. The focus of this paper is on the development of the roadmap, which is further explained in the next sections.

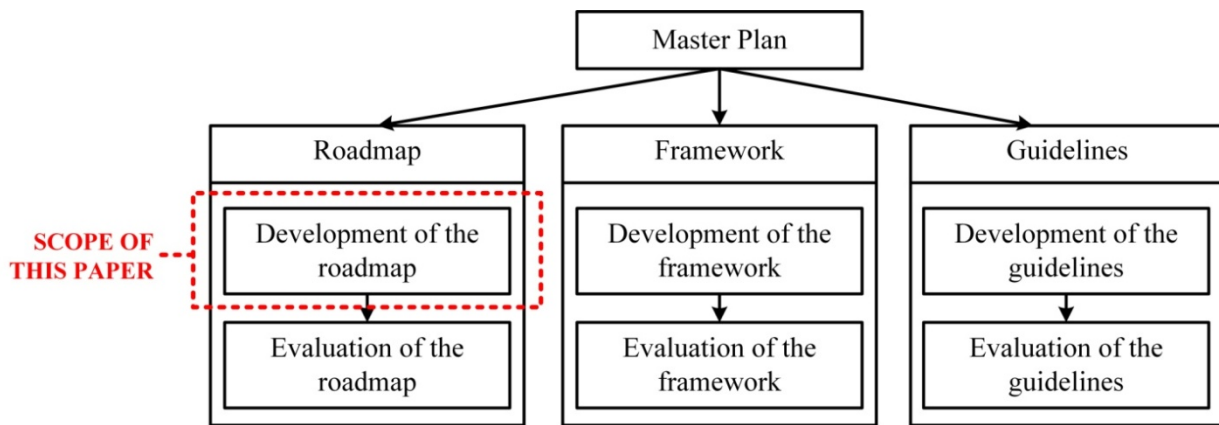


Figure 2. Scope of this study

Section 2 provides a review of the relevant literature that leads to the formulation of the roadmap. Section 3 presents a method used to develop the S-ERP roadmap. The process of the roadmap development is explained in Section 4. Section 5 concludes the study following an explanation of the results significant and recommendation of future studies.

2. Literature Review

Chofreh et al. (2014a) underlined the continuous growth of the number of studies on S-ERP systems. Multi-disciplinary skills and research that incorporate different disciplines are needed in implementing this system. In carrying out this research, the literature on different research fields such as sustainability, ERP system, and project management should be investigated in order to find the knowledge gap and inconsistencies in the literature. The literature review has been systematically divided into four categories, as given in Figure 3.

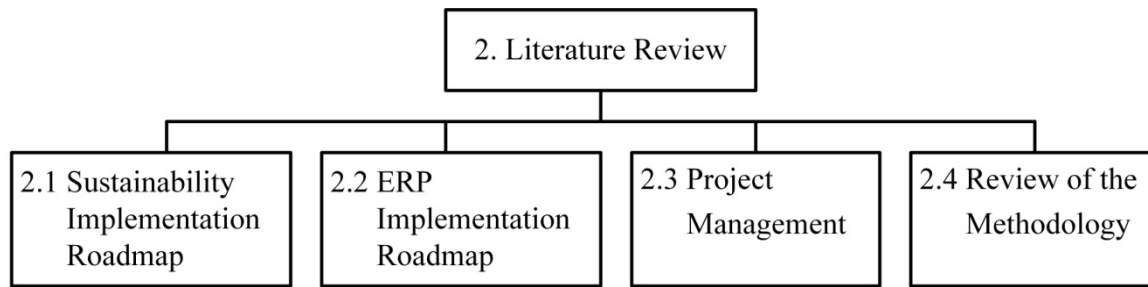


Figure 3. Framework of the literature review

2.1 Sustainability Implementation Roadmap

Road-mapping is a common method and technology, which has been used in developing policies at the company (de Laat and McKibbin, 2003). According to Phaal et al. (2004), road-mapping is a flexible method with extensive applications in business settings to support long-term and strategic planning. Companies need a roadmap in the transformation of their business leading it toward sustainability. Ahmed and Sundaram (2012) declared that an effective sustainability roadmap should provide an overview of the process of sustainable business management plan where various high-level phases are included to provide direction for decision-makers on how to manage a sustainable business lifecycle. Lubin and Esty (2010) stated that sustainability transformation has been initiated by various companies, but mostly lacking an execution plan and/or vision. This underlines the need of roadmaps for guiding companies in their sustainability journey.

Various sustainability implementation roadmaps proposed to facilitate sustainability practices in companies were investigated by Chofreh et al. (2015). For example, Nidumolu et al. (2009) and later Ahmed and Sundaram (2012) proposed a roadmap for sustainable business transformation. Table 1 summarises the studies that proposed sustainability transformation roadmaps followed by their research methodology.

Table 1

Review of research in roadmap for sustainability implementation

AUTHORS	RESEARCH FOCUS	STAGES		METHODOLOGY
(1) Vanegas (2003)	A roadmap along with the preliminary set of principles needed for the implementation of sustainability is provided in this study.	1. Planning 2. Design 3. Procurement and construction	4. Commissioning and start-up 5. Operations and maintenance 6. End-of-service-life	Conceptual research and empirical findings
(2) Could and Wallbank (2007)	Examination the way in which sustainability can be integrated into the real estate process to produce outcomes supporting the organisational sustainability strategy and providing a roadmap for occupiers to work toward successful sustainability results.	1. Establishing objectives 2. Inspecting buildings and gathering data 3. Establishing baseline performance and setting targets 4. Identifying opportunities and solutions 5. Secure space and agree terms 6. Establishing measurement and reviewing processes 7. Implementing initiatives – highest impact first	8. Managing cultural change 9. Ongoing performance management 10. Measuring and monitoring performance 11. Reviewing performance at 12 months 12. Reporting on results 13. Reviewing and feedback	Conceptual research, survey, and case study
(3) Waage (2007)	A development of a practical roadmap serving as guidance for product development managers and product designers to integrate sustainability issues into their decision-making processes.	1. Understand and establish sustainability context 2. Explore and define sustainability issues 3. Define, refine and assess 4. Implement and receive feedback		Conceptual research

(4) Duarte et al. (2008)	A report of the INOVE project, which aimed to find and help the sustainability implementation in small and medium enterprises.	<ol style="list-style-type: none"> 1. Planning and organisation 2. Environmental assessment 3. Brainstorming 4. CP options feasibility evaluation 	Conceptual research and case study		
(5) Nidumolu et al. (2009)	An offering of five stages on the path to becoming sustainable. The authors mentioned that sustainability recently is the key driver of innovation.	<table border="0" style="width: 100%;"> <tr> <td style="width: 50%; vertical-align: top;"> <ol style="list-style-type: none"> 1. Viewing compliance as opportunity 2. Making value chains sustainable 3. Designing sustainable products and services </td> <td style="width: 50%; vertical-align: top;"> <ol style="list-style-type: none"> 4. Developing new business models 5. Action plan development 6. Implementation 7. Results evaluation </td> </tr> </table>	<ol style="list-style-type: none"> 1. Viewing compliance as opportunity 2. Making value chains sustainable 3. Designing sustainable products and services 	<ol style="list-style-type: none"> 4. Developing new business models 5. Action plan development 6. Implementation 7. Results evaluation 	Conceptual research
<ol style="list-style-type: none"> 1. Viewing compliance as opportunity 2. Making value chains sustainable 3. Designing sustainable products and services 	<ol style="list-style-type: none"> 4. Developing new business models 5. Action plan development 6. Implementation 7. Results evaluation 				
(6) Lubin and Esty (2010)	The focus on sustainability transformation by designing a roadmap that concerns on the strategic issue.	<table border="0" style="width: 100%;"> <tr> <td style="width: 50%; vertical-align: top;"> <ol style="list-style-type: none"> 1. Performing old things in new ways 2. Performing new things in new ways </td> <td style="width: 50%; vertical-align: top;"> <ol style="list-style-type: none"> 3. Transforming core business 4. Creating a new business model and differentiation </td> </tr> </table>	<ol style="list-style-type: none"> 1. Performing old things in new ways 2. Performing new things in new ways 	<ol style="list-style-type: none"> 3. Transforming core business 4. Creating a new business model and differentiation 	Conceptual research
<ol style="list-style-type: none"> 1. Performing old things in new ways 2. Performing new things in new ways 	<ol style="list-style-type: none"> 3. Transforming core business 4. Creating a new business model and differentiation 				
(7) Ahmed and Sundaram (2012)	A proposition and implementation of a generic sustainability modelling and reporting roadmap, framework, and application.	<table border="0" style="width: 100%;"> <tr> <td style="width: 50%; vertical-align: top;"> <ol style="list-style-type: none"> 1. Discover and learn 2. Strategize 3. Design </td> <td style="width: 50%; vertical-align: top;"> <ol style="list-style-type: none"> 4. Transform 5. Monitor and control </td> </tr> </table>	<ol style="list-style-type: none"> 1. Discover and learn 2. Strategize 3. Design 	<ol style="list-style-type: none"> 4. Transform 5. Monitor and control 	Conceptual research and peer review
<ol style="list-style-type: none"> 1. Discover and learn 2. Strategize 3. Design 	<ol style="list-style-type: none"> 4. Transform 5. Monitor and control 				

(8) Arena and Chiaroni (2014)	<p>The sustainability roadmap of an Italian-based multinational corporation was analysed by the authors.</p> <p>The usage of the roadmap was also investigated in an attempt to gain a better understanding of the way in which it supports the process of change.</p>	<p>Products (know-why):</p> <ol style="list-style-type: none"> 1. Design for environment 2. Green procurement 3. Green logistic 4. Energy efficiency 5. Waste management <p>Processes (know-what):</p> <ol style="list-style-type: none"> 1. Green procurement 	<ol style="list-style-type: none"> 2. Green logistic 3. Green efficiency 4. Waste management <p>Organisation (know-how):</p> <ol style="list-style-type: none"> 1. Energy efficiency 2. Waste management 3. People engagement 	Case study
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Based on an examination of the literature references in Table 1, it can be concluded that there are various stages identified in the existing sustainability implementation roadmaps. However, the development of the roadmaps does not appear to be always underlined by a single general method since researchers used various concepts and viewpoints in forming the roadmaps, such as project management and organisational change concepts. For example, Vanegas (2003) proposed a roadmap for implementing built environment sustainability. The author offered a roadmap based on empirical findings and insights gained from the leadership in the education, research program, and numerous activities in sustainability. In another study, Could and Wallbank (2007) proposed a sustainability implementation roadmap in real estate industry. A leadership concept and based on the research results of the survey in formulating the roadmap was presented.

In addition, it has been obvious that a conceptual research method was applied by the majority of studies to develop the roadmap. This method has been suitable for providing an answer to research questions that cannot be answered through empirical analysis (Xin et al., 2013). Moreover, peer review and case study methods were employed in numerous studies in the assessment of the roadmaps' applicability. The peer review technique has been used in the study carried out by Ahmed and Sundaram (2012). They proposed and assessed the sustainability implementation roadmap through the employment of FURPS (Functionality, Usability, Reliability, Performance, and Supportability) model.

2.2 ERP Implementation Roadmap

Enterprise Resource Planning (ERP) is a term initially introduced by Gartner Group in the early 1990s which was then adopted at a fast pace in 2000s (Jacobs and Weston Jr., 2007). ERP can be described as a system designed for integrating various business processes that allow the decision-makers to concurrently manage the resource accountability in every business activity

(Goni et al., 2011). Practitioners are facilitated by the capability in managing the relevant and surrounding issues including information security, global access, reducing data redundancy, and eliminating information conflicts (Goni et al., 2013a). To implement an ERP system, the company has to be totally committed as the process is expensive and the completion of the implementation process takes several years (Sahran et al, 2010). However, it has to be noted that successful integration of such system has various and strong benefits (Sadzadehrafiei et al., 2013).

Chofreh et al. (2014b) reviewed a number of roadmaps for the implementation of ERP in an attempt to help companies in their implementation of ERP systems. McGinnis and Huang (2007) introduced a four-stage ERP refinement model that incorporates a knowledge management concept. This model of continuous improvement is comprised of the support group, analysis, deployment, construction, and design. Another integrated roadmap was developed by Samaranayake and Abeysinghe (2011) to be used for ERP pre-implementation and during the lifecycle of the implementation process. Improving the ERP implementation outcome is the goal of this roadmap. The roadmap consists of various stages which are the initiation, planning, process analysis, realisation, transition, and operations. Asher (2009) presented a standard methodology from SAP for the ERP system implementation which is called Accelerated SAP is explained. This methodology is in line with the concept of project management and has been proven successful in different industries and settings.

In order to have an in-depth understanding of ERP system roadmaps, this study summarises and investigates the existing researches, which are presented in Table 2. This process assists in designing a coherent roadmap for decision-makers to manage the S-ERP systems implementation.

Table 2

Review of research in roadmap for ERP implementation

AUTHORS	RESEARCH FOCUS	STAGES		METHODOLOGY
(1) Strong and Volkoff (2004)	The introduction of a roadmap for the implementation of ERP system.	1. Plan the project 2. Follow proven strategies 3. Minimise customisation 4. Make time for details 5. Value your power users 6. Define new roles and processes - Train for the new ways - Be open to new control systems 7. Have a contingency plan	8. Recognise inevitable tensions - Delayed go-live ↔ on-time delivery - Business as usual ↔ preparation for change - Software functionality ↔ existing processes - Individual demands ↔ enterprise harmony - Standardisation ↔ flexibility - Accuracy ↔ timeliness 9. Leverage the new structure	Conceptual research
(2) Chuang and Shaw (2005)	A conceptual model of e-business, ERP, and supply chain management systems. This model relates these systems and provides different strategic objectives.	1. Planning 2. Developing 3. Implementing 4. Testing		Conceptual research, case study, and interview

(3) Motwani et al. (2005)	Exploration of success and failure factors of ERP projects via a case study in four companies that have implemented an ERP system. Based on the lessons learned from the case studies and literature, the authors proposed a roadmap for successful ERP implementation.	1. Pre-implementation 2. Implementation 3. Post-implementation	Conceptual research and case study
(4) McGinnis and Huang (2007)	An ERP refinement model integrating knowledge management in every major implementation phase is proposed in the study.	1. Analysis 2. Design 3. Construction 4. Deployment	Conceptual research and case study
(5) Verville et al. (2007)	The planning process to acquire ERP systems was explored in this study. The findings were based on an extensive study of four companies that had experienced the planning process.	1. Planning 2. Information search 3. Pre-selection ↔ acquisition, implementation, maintenance 4. Evaluation 5. Choice 6. Negotiation	Conceptual research, case study, and survey
(6) Chen et al. (2009)	Identification of various key factors of project management for the successful ERP implementation.	1. Initiation 2. Contagion 3. Control 4. Integration	Conceptual research, case study, and survey
(7) Asher (2009)	Explanation of Accelerated SAP methodology from SAP.	1. Project preparation 2. Business blueprint 3. Realization 4. Final preparation 5. Go live and support	Conceptual research

(8) Samaranyake and Abeysinghe (2011)	A conceptual framework for the implementation of ERP system employing pre-implementation roadmap to improve existing	1. Initiation 2. Planning 3. Process analysis	4. Realisation 5. Transition 6. Operations	Conceptual research and case study
(9) Pitic et al. (2014)	A proposition of a structured approach to ERP system evaluation and selection. In doing so, the authors combined a quality management approach to the authors' empirical findings.	1. Preliminary Phase - Decision to start - Appoint a project manager - Identify personnel - Evaluate internal personnel - Hire consultants - Appoint team - Team basic ERP training Output: - Project manager + team - Consultant 2. Analysis - Evaluate current process description fitness for generating ERP - Identify ERP related needs from the company processes considering company strategy	- Define minimum requirements criteria - Identify ERP suppliers and make preliminary selection 3. Evaluation - Request presentations, trials, and detailed offers - Define technical selection criteria - View and test ERP solutions - Technical evaluation - Prepare technical report 4. Negotiation - Analyse the technical report and identify negotiation elements - Define negotiation strategy - Negotiate - Decision	Conceptual research

Table 2 shows that the concept of project management was in general adopted by researchers in the development of ERP roadmaps. This has been evident in reviewing the proposed phases, which are in line with project management's process groups. However, they do not entirely realise the process groups. For example, Strong and Volkoff (2004) only considered planning stage in their roadmap, while Chen et al. (2009) in their later study only considered initiation and control stages in their roadmap. In addition, a conceptual research method was used by most of the researchers in developing the roadmaps. However, for the assessment of the roadmaps, a great number of researchers used varying methods like survey and case study.

2.3 Project Management

The relevant project management literature is investigated as a relevant research contributing to the development of S-ERP roadmap and S-ERP master plan (Chofreh et al., 2016a). Applying project management tools and methodology has significant importance in the improvement of organisational competitive advantage, efficiency, and performance (Golini et al., 2015). According to Shenhar et al. (2001), projects have to be evaluated on the basis of the period of project goals. The implementation of S-ERP systems reflects this approach. The organisations require identifying their strategic objectives prior to S-ERP implementation.

This project is complex and has to be undertaken at every level of management in a company. It requires teamwork, a company, and cross-organizational boundaries like partnering and joint venture. For the successful management of the complex project and fulfilment and implementation of the expectations and requirements of stakeholders, companies have to use project management as the application of techniques, tools, skills, and knowledge for S-ERP systems' implementation.

Project management can be described as a methodology to manage the process of project implementation (Chofreh et al., 2011). Project Management Institute (2013) states that the

process of implementing projects is conducted with the guidance of 10 knowledge areas and five process groups. The involved process groups include initiation, planning, execution, controlling or monitoring, and closing. These processes are continuous and iterative, mostly interdependent, and mainly follow the same sequence for completion on every project. However, project management involves typically ten main knowledge areas of stakeholder, procurement, risk, communication, human resource, quality, cost, time, scope and integration. The ten knowledge areas incorporate the processes that have to be fulfilled for gaining an effective and successful project management.

According to the results of the literature review, it found that the project management concept has been widely used to develop the sustainability and ERP implementation roadmaps. However, the existing roadmaps did not consider the complete process groups in the project management concept. Therefore, this study incorporates this concept and envisage the process groups in the project management.

Chofreh et al. (2014b) state that using the concept of project management is becoming one of the greatest practices in ERP systems implementation and sustainability. The ERP system is extended to the S-ERP system (Chofreh et al., 2014a), it is possible to use the concept of project management in implementing the S-ERP system. Table 3 provides a summary of review in sustainability and ERP system implementation areas that highlight the utilisation of project management concept.

Table 3

Review in sustainability and ERP system implementation areas linked to project management

AUTHORS	AREA	PURPOSE OF THE PROJECT MANAGEMENT APPLICATION
Ngai et al. (2008)	ERP system	The authors empirically evaluated and proposed that project management is one of the critical success factors for implementing an ERP system.
Fernández-Sánchez et al. (2010)	Sustainability	A methodology for the identification, classification, and prioritisation of sustainability indicators on the basis of project management standards was developed by authors.
Chofreh et al. (2011)	ERP system	Proposed an ERP implementation framework based on project management perspective. The authors integrated the implementation process into five project management process groups and nine project management knowledge areas.
Goni et al. (2012)	ERP system	Developed a conceptual context for ERP system adoption. In this model, project management is included as one of the managerial capabilities that organisations should have for successful ERP system implementation.
Silvius (2012)	Sustainability	Exploration of the significance of projects and project management in sustainability development.
Brones et al. (2014)	Sustainability – eco-design	The results of this study indicated that environmental requirements interfere with project management. The use of project management concept could improve the eco-design's effectiveness in the process of product development.
Brook and Pagnanelli (2014)	Sustainability	It has been highlighted that the automotive industries require effective project management to drive their sustainability innovation strategies.

Table 3 demonstrates numerous studies integrated the project management concept into sustainability and ERP system implementation research areas. The core motivation to integrate this concept is to enhance the effectiveness and efficiency of the sustainability and ERP system implementation. This experience can be used in S-ERP system area by applying the project management concept as a methodology to implement the system. The presented work widely used this concept as a basis to develop a master plan for the implementation of S-ERP systems.

2.4 Review of the Methodology

Based on the review of the methodology aspect available the literature, there are numerous methodologies employed in sustainability and ERP systems research to develop the roadmaps including conceptual research, survey, case study, peer review, or combinations of above. The method selection depends on the types of questions that the research sought to answer. None of the methods can be considered superior to the other and each has its own rationale and limitation. For instance, a case study methodology answers certain questions that cannot be answered through an empirical survey. It was carried out to assess the degree of some phenomenon or to collect empirical evidence of that particular phenomenon (Mukhtar, 2006).

Conceptual research, peer review, and case studies are classified as qualitative methodologies. Survey methods basically engaged quantitative aspect (Fowler Jr., 2013). Qualitative and quantitative research approaches can be considered as the sides of the same coin (Benz and Newman, 1998). Mixed methods used in research are the ones that combine both qualitative as well as quantitative methods. Qualitative research approach uses the association of individual's or a group's opinion or experience regarding an aspect in solving a research problem or addressing an issue. From the narratives of respondents, a researcher can arrive at common themes and plots them for explaining the meaning of the data (Creswell, 2007).

In quantitative research approach, objective theories are verified via evaluating the association between the variables in the study. These variables are measurable and the data interpretation is done via statistical methods (Creswell, 2008). Mixed research methods are used when both qualitative and quantitative aspects are involved in the subject matter of study. In mixed methods, theoretical assumptions using qualitative as well as quantitative approaches are done. In mixed methods, where qualitative and quantitative approaches go parallel, the strength

of the study, reliability, and validity of findings are more emphasised (Creswell and Plano Clark, 2007).

Mukhtar (2006) stated that “*a conceptual research method is a basis of grounded theory*”. In such studies, answering research questions, which are not amenable to empirical analysis is possible (Xin et al., 2013). This can aid in the imagination, creativity, and innovation, which fosters the research's life (Gray, 2007). Meredith (1993) classified the conceptual research methods into three components including conceptual models, conceptual frameworks, and theories. The conceptual models are concerned with a conceptual description, taxonomies and typologies, and philosophical conceptualisation. The conceptual frameworks are concerned with conceptual induction, conceptual deduction, and conceptual systems. The theories concern meta-frameworks, which are a compilation and integration of these conceptual frameworks. The employment of this method can be seen in the work of Glavič and Lukman (2007) that developed a conceptual framework of sustainability terms. The purpose of their research is to clarify the ambiguity and classify terms used in the sustainability field.

A conceptual research is commonly combined with a case study, survey, or peer review method to provide a complete picture of analysis, encompassing both the theory building and theory testing aspects of the research that was undertaken. E.g. Loorbach et al. (2009) proposed a transition management framework to analyse the strategic role of transition management process towards sustainability. As a proof of concept, they presented the case of two companies working in the transition management context dealing with their sustainability problems. They conceptualised a general approach to redefining and reframe the sustainability business strategies. This illustration shows that research which combines several methodologies is useful in providing both the theoretical foundations and the practical usefulness of the results obtained from the research.

Fowler Jr. (2013) concluded that survey research method is a type of methodology that employs the collection of data and information from a sample of individuals in a population through the use of a questionnaire. There are two primary limitations of survey research:

- (i) Surveys are more expensive and time-consuming than most methodologies. However, many cost-saving approaches can be implemented.
- (ii) They involve a social interaction with participants. However, many experimental procedures and manipulations can be incorporated in surveys. The use of a survey research method is in the study of Heemskerk et al. (2002) that developed a roadmap for sustainability reporting. They highlighted several reporting practices from a number of companies in order to assist the sustainability reporting endeavours within the organisations. To support their research, they performed surveys on a number of companies from several countries, which were currently tackling their sustainability reports. They provided graphic examples that shown the utilisation of sustainability reports based on geographical origin and breakdown of reporting types.

Yin (2013) stated that case studies include detailed analysis and observation of similar circumstances in other companies in which the description and nature of the occurring issues are similar to the experience in the current condition. Their method can be usually useful for evaluating the theoretical models by using them in real world situations. Among the benefits of the case study research is that it can answer the 'why', 'what', and 'how' research questions. It also allows a researcher to learn the experience in its natural setting. This gives greater and deeper understanding to the researchers so it will be easier for them to generate the relevant theory. However, problems of accessibility and time seemed to be the main disadvantages of this methodology.

The case studies and conceptual research methods are valuable as they lend themselves to initial exploratory examinations in which the variables are yet not known and the phenomenon not yet understood (Mukhtar, 2006). It is also useful in answering basic questions pertaining to definitions, concepts, and explanation or description of a certain phenomenon. The use of case studies can be seen in the works of Duarte et al. (2008). They utilised conceptual research and case study methods to perform their study.

Tavakoli (2012) stated that a peer review, also called expert review, is a methodology used to advance the research process and research results by involving experienced and qualified experts. These experts will give important and consultative evaluation related to the quality of the research project and research results. The experts are helpful in providing direction and support, challenging the assumptions of the study and its findings, and helping the researcher to improve the trustworthiness and rigour of the study. The peer review process can be provided via formal, written reports or through informal conversations and email. The experts can also advance data analysis and interpretation credibility by seeking the support of peer briefers and using the feedback to reach consensus on the findings' coherence and agreement. The peer review method has been used by Ahmed and Sundaram (2012). They validated their artefacts through peer review sessions by academicians and practitioners.

Based on previous explanation, it has been clear that there was a variety of methodological options to choose from in sustainability and ERP research results. The choice of methodology depends on a number of factors such as accessibility, time, the familiarity of techniques, and certainly the type of research question to be answered. Figure 4 indicates the types of methodologies used by researchers in both areas of sustainability implementation roadmap and ERP implementation roadmap.

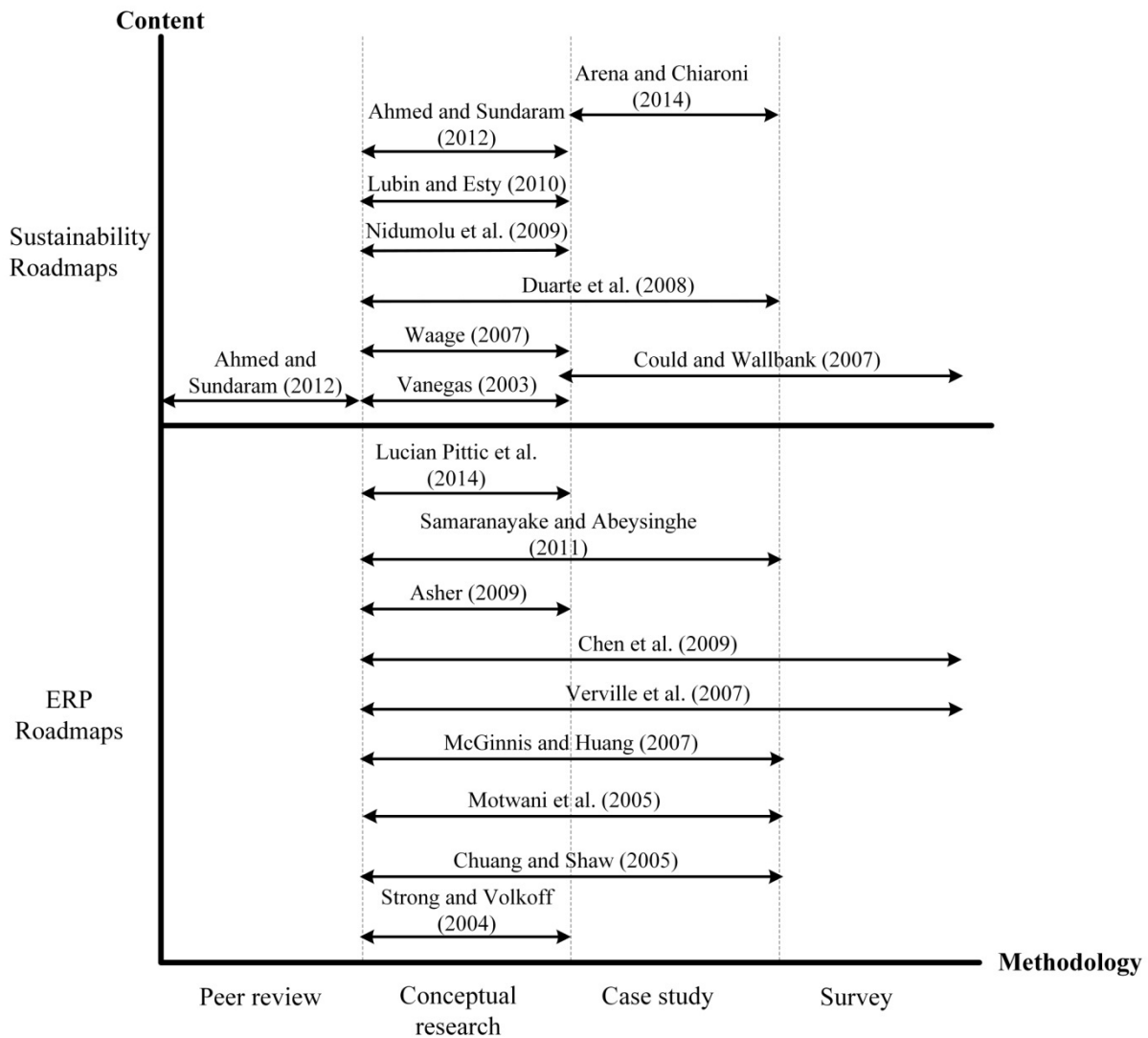


Figure 4. Review on content and methodology

3. Research Methodology

According to a review of the methodology in the previous section, the appropriate qualitative method for this study is a conceptual research method as it tries to engage in the development of a process-oriented description. This method mainly lays on the existing literature and it is commonly used in sustainability and ERP systems research results. Several steps of the conceptual research method undertaken to develop the roadmap are depicted in Figure 5.

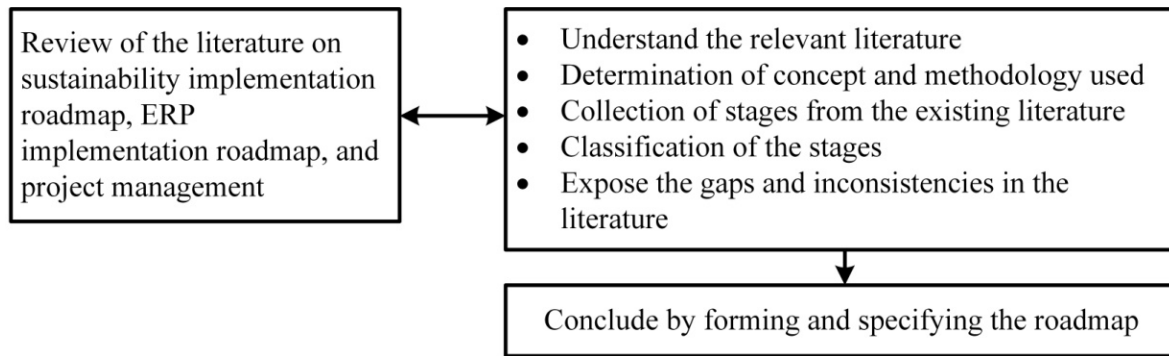


Figure 5. Process of the roadmap development

Studies on S-ERP systems are still in the initial phases and the available literature on the topic is limited (Chofreh et al., 2014a). The development of the roadmap started with a detailed review of the relevant and recent literature on the area of ERP system and sustainability since these areas are the origin of S-ERP system. This analysis has two main goals. The first goal of the analysis was the observation of the way ERP and sustainability implementation roadmaps were developed by practitioners and academics. A detailed understanding of the relevant literature is helpful in developing the roadmap. The phases in the roadmap from the relevant literature were examined and categorised. This process is one of the stages of conceptual research method which Mukhtar (2006) used to identify and gather variables from available past studies to develop a framework for the analysis of supply chain management performance. The second goal was to show the literature inconsistencies and gaps. The components missing in the available roadmaps were underlined in this research and the crucial and essential components among the proposed roadmaps were identified and adopted. After reviewing the literature, the way in which the development of the roadmap is carried out is explained in the following section of this study.

4. Development of the Roadmap

This section describes the role of the literature sources and the deliberations that were conducted in order to come up with the stages to implement S-ERP. The stages were classified into a suitable formation that culminates in the initial S-ERP implementation roadmap. Figure 6 illustrates an overview of the S-ERP system implementation roadmap development.

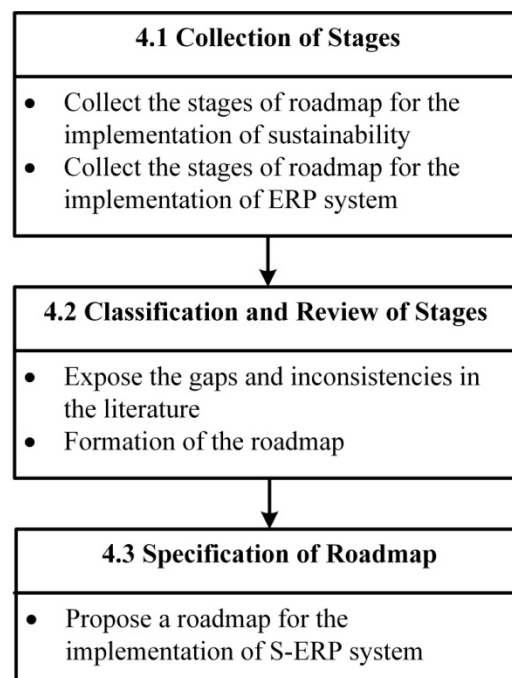


Figure 6. Development of a roadmap for the implementation of S-ERP Systems

4.1 Collection of Stages

This process begins with the collection of stages from the existing literature in sustainability and ERP system implementation. Table 4 and Table 5 show the stages in sustainability and ERP system implementation roadmaps.

Table 4

Stages of roadmap for sustainability implementation

AUTHORS	STAGES	
(1) Vanegas (2003)	1. Planning 2. Design 3. Procurement and construction	4. Commissioning and start-up 5. Operations and maintenance 6. End-of-service-life
(2) Could and Wallbank (2007)	1. Establish objectives 2. Inspect buildings and gather data 3. Establish baseline performance and set targets 4. Identify opportunities and solutions 5. Secure space and agree terms 6. Establish measurement and review	7. Implement initiatives-highest impact first 8. Manage cultural change 9. Ongoing performance management 10. Measure and monitor performance 11. Review performance at 12 months 12. Report on results 13. Review and feedback
(3) Waage (2007)	1. Understand and establish sustainability context 2. Explore and define sustainability	3. Define, refine and assess 4. Implement and receive feedback
(4) Duarte et al. (2008)	1. Planning and organisation 2. Environmental assessment 3. Brainstorming 4. CP options feasibility evaluation	5. Action plan development 6. Implementation 7. Results evaluation
(5) Nidumolu et al. (2009)	1. Viewing compliance as opportunity 2. Making value chains sustainable	3. Designing sustainable products and services 4. Developing new business models
(6) Lubin and Esty (2010)	1. Do old things in new ways 2. Do new things in new ways 3. Transform core business 4. New business model creation and differentiation	
(7) Ahmed and Sundaram (2012)	1. Discover and learn 2. Strategies 3. Design	4. Transform 5. Monitor and control

(8) Arena and Chiaroni (2014)	Products (know-why):	2. Green logistic
	1. Design for environment	3. Green efficiency
	2. Green procurement	4. Waste management
	3. Green logistic	Organisation (know-how):
	4. Energy efficiency	1. Energy efficiency
	5. Waste management	2. Waste management
Processes (know-what):	3. People engagement	
	1. Green procurement	

Table 5

Stages of roadmap for ERP system implementation

AUTHORS	STAGES	
(1) Strong and Volkoff (2004)	1. Plan the project	- Business as usual ↔ preparation for changes
	2. Follow proven strategies	
	3. Minimise customisation	- Software functionality ↔ existing processes
	4. Make time for details	
	5. Value your power users	- Individual demands ↔ enterprise harmony
	6. Define new roles and processes	
	- Train for the new ways	- Standardisation ↔ flexibility
	- Be open to new control systems	- Accuracy ↔ timeliness
	7. Have a contingency plan	9. Leverage the new structure
	8. Recognise inevitable tensions	
	- Delayed go-live ↔ on-time delivery	
(2) Chuang and Shaw (2005)	1. Planning	3. Implementing
	2. Developing	4. Testing
(3) Motwani et al. (2005)	1. Pre-implementation	3. Post-implementation
	2. Implementation	
(4) McGinnis and Huang (2007)	1. Analysis	3. Construction
	2. Design	4. Deployment

(5) Verville et al. (2007)	<ol style="list-style-type: none"> 1. Planning 2. Information search 3. Pre-selection ↔ acquisition, implementation, maintenance 4. Evaluation 5. Choice 6. Negotiation 																																
(6) Chen et al. (2009)	<table style="width: 100%; border: none;"> <tr> <td style="width: 50%;">1. Initiation</td> <td style="width: 50%;">3. Control</td> </tr> <tr> <td>2. Contagion</td> <td>4. Integration</td> </tr> </table>	1. Initiation	3. Control	2. Contagion	4. Integration																												
1. Initiation	3. Control																																
2. Contagion	4. Integration																																
(7) Asher (2009)	<table style="width: 100%; border: none;"> <tr> <td style="width: 50%;">1. Project preparation</td> <td style="width: 50%;">4. Final preparation</td> </tr> <tr> <td>2. Business blueprint</td> <td>5. Go live and support</td> </tr> <tr> <td>3. Realization</td> <td></td> </tr> </table>	1. Project preparation	4. Final preparation	2. Business blueprint	5. Go live and support	3. Realization																											
1. Project preparation	4. Final preparation																																
2. Business blueprint	5. Go live and support																																
3. Realization																																	
(8) Samaranayake and Abeysinghe (2011)	<table style="width: 100%; border: none;"> <tr> <td style="width: 50%;">1. Initiation</td> <td style="width: 50%;">4. Realisation</td> </tr> <tr> <td>2. Planning</td> <td>5. Transition</td> </tr> <tr> <td>3. Process analysis</td> <td>6. Operations</td> </tr> </table>	1. Initiation	4. Realisation	2. Planning	5. Transition	3. Process analysis	6. Operations																										
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3. Process analysis	6. Operations																																
(9) Pitic et al. (2014)	<table style="width: 100%; border: none;"> <tr> <td style="width: 50%;">1. Preliminary Phase</td> <td style="width: 50%;">- Define minimum requirements criteria</td> </tr> <tr> <td>- Decision to start</td> <td></td> </tr> <tr> <td>- Appoint a project manager</td> <td>- Identify ERP suppliers and make preliminary selection</td> </tr> <tr> <td>- Identify personnel</td> <td></td> </tr> <tr> <td>- Evaluate internal personnel</td> <td>3. Evaluation</td> </tr> <tr> <td>- Hire consultants</td> <td>- Request presentations, trials, and detailed offers</td> </tr> <tr> <td>- Appoint team</td> <td></td> </tr> <tr> <td>- Team basic ERP training</td> <td>- Define technical selection criteria</td> </tr> <tr> <td>Output:</td> <td>- View and test ERP solutions</td> </tr> <tr> <td>- Project manager + team</td> <td>- Technical evaluation</td> </tr> <tr> <td>- Consultant</td> <td>- Prepare technical report</td> </tr> <tr> <td>2. Analysis</td> <td>4. Negotiation</td> </tr> <tr> <td>- Evaluate current process description fitness for generating ERP</td> <td>- Analyse the technical report and identify negotiation elements</td> </tr> <tr> <td>- Identify ERP related needs from the company processes considering company strategy</td> <td>- Define negotiation strategy</td> </tr> <tr> <td></td> <td>- Negotiate</td> </tr> <tr> <td></td> <td>- Decision</td> </tr> </table>	1. Preliminary Phase	- Define minimum requirements criteria	- Decision to start		- Appoint a project manager	- Identify ERP suppliers and make preliminary selection	- Identify personnel		- Evaluate internal personnel	3. Evaluation	- Hire consultants	- Request presentations, trials, and detailed offers	- Appoint team		- Team basic ERP training	- Define technical selection criteria	Output:	- View and test ERP solutions	- Project manager + team	- Technical evaluation	- Consultant	- Prepare technical report	2. Analysis	4. Negotiation	- Evaluate current process description fitness for generating ERP	- Analyse the technical report and identify negotiation elements	- Identify ERP related needs from the company processes considering company strategy	- Define negotiation strategy		- Negotiate		- Decision
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	- Decision																																

From the collection of stages in Table 4 and Table 5, it can conclude that there does not seem to be a common agreement or phase in the design of ERP and sustainability implementation roadmaps. Numerous researchers are observing varying viewpoints in the development of roadmaps for sustainability and ERP implementation. This study proposed a new approach that incorporates the related stages in order to develop a roadmap for the implementation of S-ERP. The new approach should entail new phases involving effective processes that have to be accomplished during the project's life-cycle. The next section describes what are the stages based on the new approach and their logical reasons.

4.2 Classification and Review of Stages

In forming the classification of the stages from the sustainability and ERP system roadmaps once again the literature is examined. As discussed in the previous section, project management approach is considered to be an appropriate methodology to design a master plan for the implementation of S-ERP system. The project management based approach to the development of the roadmap can facilitate the practitioners in managing the S-ERP project. This study adapted the five process groups in project management as stages in the roadmap including initiating, planning, executing, monitoring and controlling, and closing (PMI, 2013).

Motwani et al. (2005) categorised the ERP system implementation into three main phases including pre-implementation, implementation, and post-implementation. The pre-implementation phase refers to all necessary preparatory activities. The implementation phase refers to all activities for implementing the new system in its target environment. Furthermore, the post-implementation phase refers to activities for maintaining and enhancing the new system to meet the ongoing needs of the user community. Following this idea, this study mapped the five stages in the roadmap into those phases for better implementation management. The overview of adapted stages is given in Table 6. In addition, Table 7 and Table 8 are given

in order to classify the stages of the sustainability and S-ERP implementation roadmaps. These stages are classified based on appropriate process groups in project management.

Table 6

Stages in roadmap for the implementation of S-ERP systems

PROJECT IMPLEMENTATION LIFE CYCLE	PROCESS GROUPS
Pre-implementation	<ul style="list-style-type: none">• Initiating
Implementation	<ul style="list-style-type: none">• Monitoring/controlling• Planning• Executing• Monitoring/controlling• Closing
Post-implementation	<ul style="list-style-type: none">• Initiating• Planning• Executing

As given in Tables 7 and 8, the stages of sustainability and ERP system implementation roadmap did not consider complete process groups in project management. For instance, in sustainability implementation roadmap, Ahmed and Sundaram (2012) did not consider closing stage in their roadmap. Meanwhile, in ERP system implementation roadmap, Samaranayake and Abeysinghe (2011) did not consider monitoring/controlling and closing stages in their roadmap. Project management plan needs overlapping activities during the process of implementing the project. The outputs of a phase become the inputs of another phase. For instance, the planning stage's output can become the executing stage's input. As a result, it is crucial for the S-ERP system implementation roadmap to encompass complete process groups to ensure continues S-ERP system implementation project.

4.3 Specification of Roadmap and Discussion

The next deductive step is to specifically identify a roadmap for the implementation of an S-ERP system that fulfils the further mentioned goals which were derived from PMI (2013).

- (i) The relevant stages must be combined and related in a single cohesive form;
- (ii) The overlapping functions occurring during the implementation of S-ERP should be shown;
- (iii) In general, a stage's output should be another stage's input; and
- (iv) It has to operate as a thorough and systematic map helping the user in implementing S-ERP.

With the above objectives in mind and using the input from project management concept, it is proposed that the roadmap for implementing the S-ERP system includes three phases of pre-implementation, implementation, and post-implementation. Initiation along with controlling/monitoring stages must be included in the pre-implementation phase. Planning, execution, monitoring/controlling, along with closing stages must be included in the

implementation phase. Initiation, planning, execution, monitoring/controlling, along with closing stages must be included in the post-implementation phase. The structure of these stages and phases are essential as they show the thorough and effective project flow during its life-cycle. This is similar to the concept of project management. The specifications of the roadmap are illustrated in Figure 7.

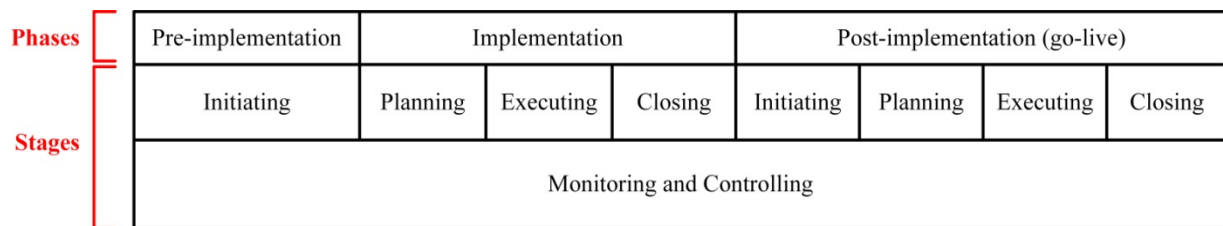


Figure 7. Roadmap for the implementation of S-ERP system (adapted from PMI, 2008)

Initiating stage is incorporated in the pre-implementation stage. This stage consists of processes carried out for obtaining an authorisation to begin the S-ERP implementation project. The main goal of the stage is the aligning of the expectations of stakeholders with the objectives of implementing the S-ERP system, providing them clarity about the business case and scope, and demonstrating the way in which they make a contribution to the project.

Three stages of planning, executing, and closing are incorporated in the implementation stage. The planning stage can be described as the process carried out for determining the overall scope of the attempts, defining and refining the goals, and developing the courses of action needed to fulfil the goals. The most important goal of this stage is identifying and describing path, tactics, and strategy for successful completion of the S-ERP system implementation project. The executing stage is concerned with processes needed for the completing of functions described in the planning stage on the basis of the specifications of the project. The closing stage consists of processes carried out for the completion of the entire functions in every stage.

The objective of this stage is to complete the S-ERP system implementation project and fulfil contractual obligations.

Four stages of initiating, planning, executing, and closing are incorporated in the post-implementation stage. The initiating stage includes processes carried out to describe activity and strategy for go-live. The planning stage incorporates processes concerned with developing a plan for the S-ERP system to go-live. The executing stage is concerned with processes needed for the completing of functions described in the planning stage. The closing stage consists of processes carried out for the completion of the entire functions in the post-implementation phase.

The concluding monitoring and controlling stage incorporate processes for following, assessing and coordinating the performance and progress of every stage in the three phases of pre-implementation, implementation, and post-implementation.

5. Conclusion

In order to move toward sustainability, companies should simultaneously improve the social, environmental, and economic performance of their business. The implementation of an S-ERP system is needed for the integration of every sustainability process, information and data across the extended value chain. However, studies outlining a master plan that shows steps, viewpoints and stages that can provide direction for practitioners in the implementation of the S-ERP systems are limited. Companies need a thorough master plan that consists of a roadmap, framework, and guidelines to help them in the S-ERP system implementation.

The goal of this study has been the development of a roadmap for the S-ERP system implementation. Different researchers approached the issue of developing the roadmap in various ways. A literature review has been required in using the conceptual research method and consequently, a project management concept for developing the roadmap was found.

The S-ERP roadmap is a part of the S-ERP master plan that is advantageous for practitioners to show them the stages of implementing the S-ERP system. The research has to venture further to assess the degree to which the roadmap is usable. The guidelines and framework must be developed and assessed for the completion of the master plan and to implement the S-ERP system.

Acknowledgement

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