A MASTER PLAN FOR THE IMPLEMENTATION OF SUSTAINABLE ENTERPRISE RESOURCE PLANNING SYSTEM

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ABSTRACT

The world is faced with the problem of integration between sustainable business functions. Sustainability data are not sufficiently integrated and used for decision making. To solve this problem, organisations need information systems to facilitate their sustainability initiatives. A number of vendors such as SAP, Microsoft and Oracle have developed Sustainable Enterprise Resource Planning (S-ERP) systems as a holistic solution to support sustainability initiatives. However, organisations still face the problem of implementing this system. There is a lack of master plan, which shows the stages, dimensions and steps to assist the practitioners in implementing S-ERP systems. Therefore, this study attempts to develop an S-ERP implementation master plan that consists of roadmap, framework and guidelines, and to evaluate the usability of the master plan from academicians and practitioners perspective. In order to attain the research objectives, this study employs a conceptual research method which relies primarily on the literature for the development of a master plan. Various research fields including sustainability, Enterprise Resource Planning (ERP) system, and relevant literature were observed in order to discover how academicians and practitioners solved the problems of integration between sustainable business functions. Since an S-ERP system is a complex system that needs appropriate strategy and planning, various concepts including project management, strategic management, and sustainability were hugely employed in developing the master plan. In addition, the usability of the master plan was evaluated by 12 experts from the academia and industry via a peer review method. This evaluation consists of two main phases including data collection through semi-structured interview and data analysis using ATLAS.ti 6 software. As a result, the roadmap in the S-ERP system implementation master plan was divided into two concepts: general overview and specific features, followed by the purpose of each step. Moreover, the framework in the S-ERP system implementation master plan was divided into two frameworks: sustainability implementation portfolio and S-ERP implementation project. Following the concept employed in the frameworks, the guidelines were divided into two guidelines: sustainability implementation portfolio and S-ERP implementation project. From the evaluation results, the experts confirmed that the proposed S-ERP implementation master plan can generally be used for implementing S-ERP systems in all types of industry. The master plan for the implementation of S-ERP system could serve as a theoretical base for further research in S-ERP system, which can give more insights into the system implementation. In addition, this master plan could serve as a tool for practitioners in implementing S-ERP systems within organisations.

ABSTRAK

Dunia berhadapan dengan masalah integrasi di antara fungsi-fungsi perniagaan yang lestari. Data kelestarian tidak cukup bersepadu dan digunakan untuk membuat keputusan. Untuk menyelesaikan masalah ini, organisasi memerlukan sistem maklumat bagi memudahkan inisiatif kelestarian mereka. Beberapa vendor seperti SAP, Microsoft dan Oracle telah membangunkan sistem perancangan sumber perusahaan lestari (Sustainable Enterprise Resource Planning, S-ERP) sebagai satu penyelesaian yang menyeluruh untuk menyokong inisiatif kelestarian. Walau bagaimanapun, organisasi masih menghadapi masalah untuk melaksanakan sistem ini. Terdapat kekurangan pelan induk yang menunjukkan peringkat, dimensi dan langkah-langkah untuk membantu pengamal dalam melaksanakan sistem S-ERP. Oleh itu, kajian ini bertujuan untuk membangunkan satu pelan induk pelaksanaan S-ERP yang terdiri daripada pelan tindakan, rangka kerja dan garis panduan, dan untuk menilai kebolehgunaan pelan induk daripada perspektif ahli-ahli akademik dan pengamal. Untuk mencapai objektif kajian, kajian ini menggunakan kaedah penyelidikan konsep yang bergantung terutamanya kepada literatur bagi pembangunan pelan induk. Pelbagai bidang penyelidikan termasuk kelestarian, sistem perancangan sumber perusahaan (Enterprise Resource Planning, ERP), dan literatur yang berkaitan diamati untuk mengetahui bagaimana ahli-ahli akademik dan pengamal menyelesaikan masalah integrasi di antara fungsi-fungsi perniagaan yang lestari. Oleh kerana sistem S-ERP adalah sistem yang kompleks yang memerlukan strategi dan perancangan yang sesuai, pelbagai konsep termasuk pengurusan projek, pengurusan strategik, dan kelestarian telah digunakan dengan meluas dalam membangunkan pelan induk. Selain itu, kebolehgunaan pelan induk telah dinilai oleh 12 orang pakar yang terdiri daripada ahli akademik dan pengamal melalui kaedah semakan sejawat. Penilaian ini terdiri daripada dua fasa utama termasuk pengumpulan data melalui temubual separa berstruktur dan analisis data menggunakan perisian ATLAS.ti 6. Sebagai hasilnya, pelan tindakan dalam pelan induk pelaksanaan sistem S-ERP telah dibahagikan kepada dua konsep: gambaran umum dan ciri-ciri khusus, diikuti dengan tujuan setiap langkah. Selain itu, rangka kerja dalam pelan induk pelaksanaan sistem S-ERP telah dibahagikan kepada dua kerangka: portfolio pelaksanaan kelestarian dan projek pelaksanaan sistem S-ERP. Mengikuti konsep yang digunakan dalam rangka kerja, garis panduan telah dibahagikan kepada dua garis panduan: portfolio pelaksanaan kelestarian dan projek pelaksanaan sistem S-ERP. Hasil daripada penilaian, pakar-pakar mengesahkan bahawa pelan induk pelaksanaan S-ERP yang dicadangkan dapat digunakan umumnya bagi melaksanakan sistem S-ERP dalam semua jenis industri. Pelan induk bagi pelaksanaan sistem S-ERP boleh berfungsi sebagai asas teoritikal untuk penelitian lebih lanjut dalam kajian sistem S-ERP, yang dapat memberikan gambaran yang lebih jelas mengenai pelaksanaan sistem. Di samping itu, pelan induk ini boleh berfungsi sebagai alat untuk pengamal melaksanakan sistem S-ERP dalam organisasi.

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LIST OF ABBREVIATIONS

BSI	-	British Standards Institution
ERP	-	Enterprise Resource Planning
GRI	-	Global Reporting Initiatives
IBM	-	The International Business Machines Corporation
IIRC	-	International Integrated Reporting Council
IS	-	Information Systems
IT	-	Information Technology
LCA	-	Life Cycle Assessment
NGO	-	Non-Governmental Organization
NZBCSD	-	New Zealand Business Council for Sustainable Development
PDCA	-	Plan Do Check Act
PDSA	-	Plan Do Study Act
S-ERP	-	Sustainable Enterprise Resource Planning
SAP	-	Systems, Applications, and Products
TBL	-	Triple Bottom Line

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CHAPTER 1

INTRODUCTION

1.1 Background of the Problem

Sustainability enables the creation of a new opportunity through innovation to achieve competitive advantage and drive cost reduction programs (Accenture, 2011). Beyond the obvious cost saving derived from using less energy, additional benefits include changing behaviours leading to increased productivity, improved morale, streamlined business processes, creative innovations and better use of technology (Chofreh *et al.*, 2014b). Organizations that acknowledge and embrace the key drivers for sustainability will obtain the ultimate benefits of market opportunities and efficient business operations (Hutchins, 2009). Hence, numerous organizations are involved in sustainability initiatives in their business strategy (Bonini *et al.*, 2010). They understand that they have a responsibility to contribute in solving critical environmental issues and their customers expect them to provide sustainable products and services (Boudreau *et al.*, 2008).

Significant contributions have been made in relation to environmental operations and policy (Linton *et al*., 2007), strategy (White, 2009), finance (Lazonick and Tulum, 2011), product design (Calcott and Walls, 2005), supplier relations (Gimenez *et al*., 2012), post-consumer product management (Saccani *et al*., 2007), and supply chain management (Linton *et al*., 2007). The sustainability strategy needs to be systematized and integrated into daily practices of organizations of all sizes in all sectors (Lubin and Esty, 2010). Sustainability will embed every business function, every business process, and every worker. On the way to this future, organizations with a clear vision and ability to navigate the wave of change will come out ahead (Lubin and Esty, 2010).

An organization needs a holistic vision across the entire supply chain for achieving sustainability, including the manufacturing systems across multiple product life-cycles (Chofreh *et al.*, 2014b). This requires improved models, indicators for sustainability performance evaluation, and optimization methods at the product, process, and system levels (Jayal *et al.*, 2010). To accomplish these processes, information systems represent a potential source of solutions (Elliot, 2011), such as data collection, data analysis and conversion, information evaluation, report and communication, monitoring, and controlling (Scipioni *et al.*, 2008). However, less research attention is given to sustainable information systems or green information systems (Melville, 2010). Consequently, academicians and practitioners do not take information systems into consideration for implementing sustainability initiatives.

During the transformation of the organization from unsustainable into sustainable, two problems emerge: the segregation between business functions and lack of holistic plan during implementation (Chofreh *et al.*, 2014b). To the extent that environmental and social issues are reflected in marketplace and the growing importance of environmental and social issues, various organizations have implemented specific environmental or social management systems during the last decade (Figge *et al.*, 2002). These systems have, however, rarely been integrated with the general management system, core business processes, and the tools of an organization. As a result, environmental and social management is often not linked to the economic success of the organization and the sustainability contribution thus remains uncertain (Figge *et al.*, 2002). If organizations desire to attain concurrent improvement of the economic, environmental and social performance of the business towards sustainability, this lack of integration between business functions, units, and processes apparently becomes a major obstacle (Figge *et al.*, 2002, Schaltegger and Wagner, 2011). Therefore, the role of Sustainable Enterprise Resource Planning (S-ERP) system is vital to solve this problem.

1.2 Problem Statement

The recent research and growth of knowledge about sustainability have increased interest in the boundaries of industry and organizational levels (Sarkis, 2001). These researches are scattered into a variety of fields such as cleaner production (Luo *et al.*, 2014), pollution prevention (Abou-Elela *et al.*, 2008), minimization of resource usage (Almutlaq *et al.*, 2005), eco-design (Calcott and Walls, 2005), sustainability marketing (Rettie *et al.*, 2012), corporate social responsibility (Porter and Kramer, 2006), and sustainability in finance (Lazonick and Tulum, 2011). However, there has been scarce research which has looked into how they can integrate the sustainable business functions, units, and processes in organizations in a holistic manner (Chofreh *et al.*, 2014b).

Currently, sustainability processes and data have been managed as a niche practice within the organizations, using tools, processes, and procedures isolated from enterprise systems. They were only managed with a collection of spreadsheets of varying and uncontrolled quality and design. The majority of organizations leverage existing tools and manual methods to initially collect environmental, economic, and social metrics (Capgemini, 2013). This approach breaks down when the organizations need to repeat this process on a quarterly, monthly, or more frequent basis and when the data must be audited by a third party. As sustainability became a strategic issue, a new generation of technology solutions emerged delivering significantly improved functionality and reliability. But with sustainability now a material factor in the strategic and operational management of an organization, sustainability process and data management and reporting must be truly integrated into enterprise systems and processes.

Moreover, the organizations execute sustainability modelling within a specific environmental or social management systems without integrating them with the integrated management system, core business processes, and tools of a firm (Figge *et al.*, 2002). These stand-alone information systems are not designed to capture sustainability related data and are not designed to support the management of data of all the sustainability dimensions (Frost *et al.*, 2012). In addition, it is crucial for organizations to integrate their data and information with their stakeholders in

order to monitor the sustainability practices (QGCPO, 2009). If the organizations do not implement integrated information systems, they cannot take a proactive approach to ensure ongoing and early discussion at the early stages of business requirements analysis. As a consequence, environmental and social management are often not linked to the economic success of the organization and the economic contribution of environmental and social management therefore remains vague. This issue inhibits the achievement of sustainability goals, negatively impacting cost and thwarting value generation opportunities, since the right information is not available to the right people at the right time (Hoffman, 2007). Furthermore, it may turn out to be a major obstacle in achieving simultaneous improvements of the economic, environmental and social performance of businesses to sustainability and its competitive advantage (Figge ***et al.***, 2002). Thus, there is a need for organizations in implementing a centralized information system, such as S-ERP system, to aid them in managing sustainability processes, data, and information.

A new class of information system, namely S-ERP system, has emerged to address the integration issues in sustainability implementation. An S-ERP system is important as a holistic solution to support sustainability initiatives. It enables to integrate sustainable business functions, processes, and data into a single platform. According to Pike Research's report, an S-ERP system is being rapidly adopted by organizations and represents a growing market that is projected to reach $5.7 billion by 2017 (Pike, 2011). However, a research on S-ERP system is still in its infancy (Chofreh ***et al.***, 2014b).

Numerous vendors such as SAP (Hopkins, 2010), Oracle (Weiss, 2011), and Microsoft (Microsoft, 2010), still undertake efforts to develop this system for solving the segregation problem in sustainability. S-ERP from SAP automates data collection and reporting. Moreover, Oracle Corp. offers its environmental accounting and reporting product, which adds sustainability reporting to its ERP software (Moore, 2013). Nevertheless, the organizations still face to the problem of implementing this system as it is a huge system requiring multidisciplinary skills and knowledge (Melville and Whisnant, 2012).

The emergence of S-ERP system mirrors that of ERP system. The earlier wave of ERP system rollouts turned out to be much more complex and challenging to implement than anticipated, leading to notorious failures and high overall failure rates (Nelson, 2007). For example, Nike spent $400 million for ERP system to upgrade its supply chain, only to see significant profit losses due to subsequent inventory problems (Nelson, 2007). Some of the reasons cited for high ERP failure rates include a lack of attention to business processes, insufficient executive sponsorship, poor project management, user issues, excessive customisation, lack of business input, and poor attention to data reliability and accuracy (ERPAsia, 2012). In addition to these challenges, S-ERP system adds new dimensions of complexity, including new data types, new sources of data, and new stakeholders (Melville and Whisnant, 2012). Thus, S-ERP is more challenging to be implemented successfully than ERP system. The result could be similar failure rates, which would hinder the achievement of greenhouse gas reductions, create financial losses, and hamper attempts to address climate change.

As shown in Table 2.1, the literature indicates no evidence of any work that outlines a comprehensive plan to direct practitioners in implementing an S-ERP system. The closest work done by Melville and Whisnant (2012) only showed part of the whole process. They conducted a case study of S-ERP systems implementation at SunGard Data Systems, a leading Fortune 500 software and technology services company. They found that S-ERP system needs to be driven by corporate sustainability strategy and it is required a strategy to be implemented. In addition, the implementation of an S-ERP system is challenging in terms of data collection, data processing, and data visibility. The data with different formats need to be gathered from different suppliers, customers, and business functions into a central database, calculated by using algorithms, and then displayed into usable information for key decision makers. However, their study only focused on phenomena shape successful implementation of S-ERP system and the attainment of corporate sustainability objectives without looking into detail on how to implement this integrated system. This lack of comprehensive plan and direction to guide practitioners in implementing S-ERP system has resulted in increased sustainability implementation cost and time and the decline in the quality of products and services (Nidumolu *et al.*, 2009). Hence, this problem motivates the researcher to perform

this study. An effort should be devoted to provide significant decision support tools for solving the sustainability issues, and also to provide a comprehensive master plan for implementing an S-ERP system. In order to do so, a variety research fields, such as sustainability, ERP system, S-ERP system, and other relevant literature, were studied in order to discover how the roadmap, framework, and guidelines were developed in each research field. This comprehensive review is provided in Chapter 2.

1.3 Research Questions

Considering the problem of S-ERP implementation in organizations, the questions that merit special attention are:

(i) What are the stages to implement S-ERP system in an organization?

(ii) What are the dimensions that need to be considered in order to implement S-ERP system?

(iii) What are the steps to implement S-ERP system in an organization?

(iv) What are the responses of academicians and practitioners when reviewing such a master plan?

1.4 Objectives of the Research

The main objective of this study is given as follows:

(i) To develop a roadmap for the implementation of S-ERP system.

(ii) To propose a framework for the implementation of S-ERP system.

(iii) To establish guidelines for the implementation of S-ERP system.

(iv) To evaluate the usability of the master plan from academicians and practitioners perspective.

1.5 Scope of the Research

The study is limited by the following constraints:

(i) The focus of this study is to develop a generic S-ERP implementation that is suitable for any organization.

(ii) The components of a master plan for the implementation of S-ERP system consists of roadmap, framework, and guidelines.

   a. The roadmap included pre-implementation, implementation, and post-implementation phases.

   b. The framework dealing with the decision-making paradigm (strategic, tactical, operational) and with the sustainability paradigm (environment, economy, society).

   c. The guidelines of the sustainability implementation portfolio focused on pre-implementation and implementation phases of strategic and tactical levels. Furthermore, the guidelines of the S-ERP implementation project focused on pre-implementation and implementation phases of strategic and implementation levels.

(iii) This study evaluates the usability of the master plan.

1.6 Significance of the Research

This study is significant both from the theoretical and practical standpoints. The rational and motivation for this research can be summarised as follows:

(i) From the theoretical standpoint, a study on S-ERP system as a solution for solving the segregation issues is imperative for academicians (Chofreh ***et al.***, 2014b). In particular, a study concerning the development of a master plan for the implementation of S-ERP system has a significant impact on research because it provides a big picture of the system. Moreover, every component of the roadmap, framework, and guidelines in the master plan potentially may provide future research directions for academicians.

(ii) From the practical standpoint, having a master plan that shows the stages, dimensions, and steps to implement a system can prevent increasing time,

costs, resources, and risks of project implementation. Moreover, it can improve quality of project implementation (PMI, 2013). Therefore, the development of a master plan, which consists of roadmap, framework, and guidelines, for the implementation of S-ERP system is significant for practitioners in order to give them a holistic perspective and direction to manage the implementation of this system.

1.7 Overall Research Methodology

This section briefly introduces the research methodology. The details, however, are presented in Chapter 3. The master plan was developed via development of roadmap, framework, and guidelines. The methodology applied is illustrated in Figure 1.1.

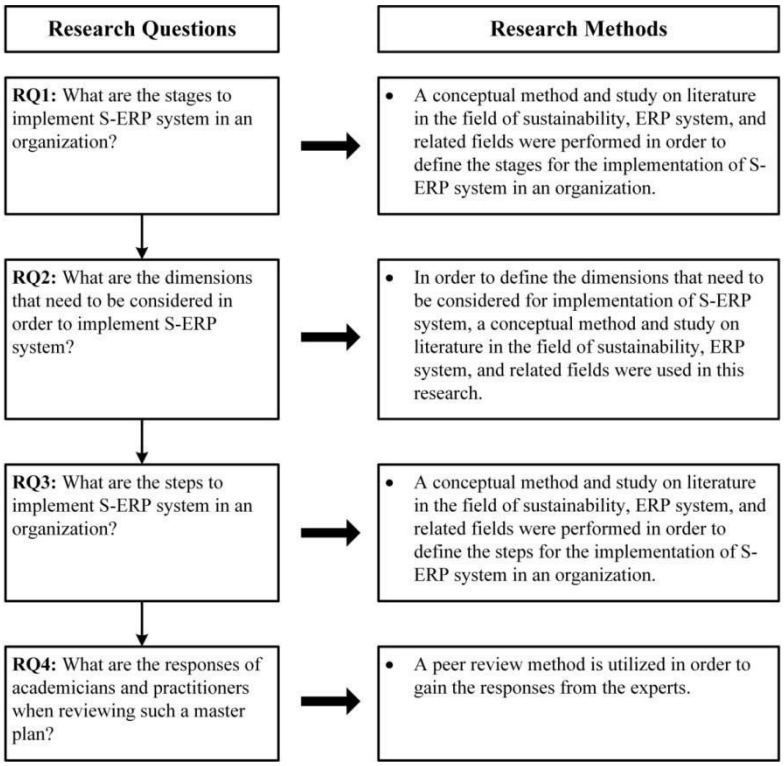

Figure 1.1 Summary of research methodology

This study is largely theoretical in nature. It thus follows the theory building concepts found in the sustainability, ERP, and related literatures. In order to answer the first research question, a critical review of the sustainability and ERP system

implementation roadmaps is done. A roadmap that shows the stages to implement S-ERP system is developed by using a conceptual method.

The second research question is answered with developing a framework that shows the dimensions of S-ERP system implementation. The framework is developed by using a conceptual method and critical review of the sustainability and ERP system implementation framework.

The third research question is concerned with the development of guidelines that show the steps for implementing S-ERP system. Similar with the roadmap and framework, the development of guidelines is handled via conceptual method and critical review of the sustainability and ERP system guidelines.

The fourth research question is the evaluation of the research findings. It demonstrates the usability of the master plan based on experts' point of view. This process is accomplished by utilizing a peer review method.

1.8 Organization of the Thesis

This thesis consists of seven chapters. Chapter 1 serves as the essential introduction to the study. Chapter 2 presents a review of the pertinent literature and methodologies that lead to the formulation of this thesis. Chapter 3 describes the chosen methodology and the rationale behind its choice. Chapter 4 provides the main contribution of this study that is development of a master plan, which consists of roadmap, framework, and guidelines. Chapter 5 describes the evaluation and analysis of the master plan. Chapter 6 provides the general discussion of the research findings. Chapter 7 concludes the thesis with the lists of conclusions, contributions, and recommendations for further study. The layout of the chapters is shown in Figure 1.2.

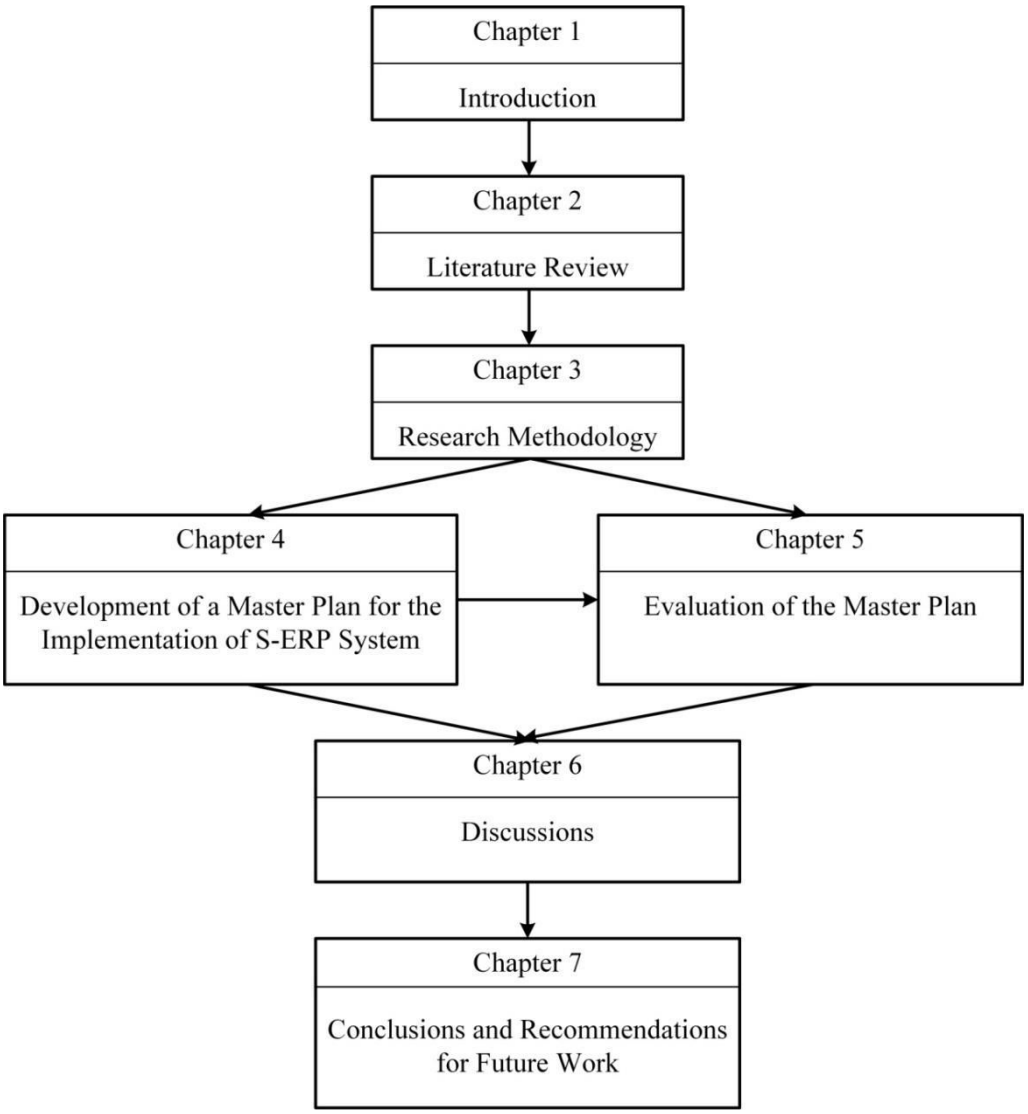

Figure 1.2 An overview of the chapters in the thesis

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