AN ITERATIVE PROJECT BASED OPEN SOURCE ERP TRAINING MODEL

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MODEL LATIHAN ERP ITERATIF BERDASARKAN PROJEK

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DECLARATION

I hereby declare that the work in this thesis is my own except for quotations and summaries which have been duly acknowledged.

02 March 2018

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P67732

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ABSTRACT

Enterprise Resource Planning (ERP) is a system which can support complex business processes in an organization. ERP is not only software, but a solution which means that it needs to be implemented successfully through a systematic implementation procedure to reduce the risks of failure. Research about ERP reveals that many implementation projects around the world still fail. Among the most important success and failure factors of ERP implementation cited in the literature are concerned with training and consultation. ERP training models and methods mainly focused on proprietary ERP systems and not open source systems, where the main targeted audience are either students or end users. These methods and models usually disregard the role of power users in an organization. Power users are defined as self-starting leaders in the organization who play a key role as internal consultants among the users. In order to cater for these issues, the main aim of this study is to propose a new ERP training model for power users that supports open source ERP systems. Hence the objectives of this research are, firstly to identify the factors that hinders or promotes ERP training success. The second objective is to develop a model of open source ERP training and the third objective is to examine and validate the model based on expert feedback and also to examine and validate the model based on users' feedback. The proposed training model is developed based on three main concepts, namely, the training cycle model, iterative development model and the project based learning approach. The training cycle model is used as the base for the proposed model while the iterative development model is used to propose a post training support to develop the competency in an iterative and incremental steps. Finally, the project based learning approach is used as a method of learning during the training to make sure participants can develop a module thus giving them the confidence and skills for real implementation after the training in their respective organizations. A two-step process was conducted to validate the model. Firstly, by using an expert panel to validate the model and its components and secondly by applying the model as a case study to examine the effectiveness of the short course training at the United Nations University International Institute for Global Health. Findings from the research demonstrate that the model is effective and can be used not only in academia but also by industry practitioners to develop effective ERP training modules.

ABSTRAK

Enterprise Resource Planning (ERP) adalah sebuah sistem yang boleh menyokong proses bisnes yang kompleks dalam sesebuah organisasi. ERP bukan hanya sebuah perisian, malah is adalah satu penyelesaian. Ini bermakna ERP perlu diimplemen dengan jayanya melalui satu prosedur implementasi untuk mengurangkan risiko kegagalan. Penyelidikan dalam ERP menunjukkan kebanyakan projek implementasi ERP masih menemui kegagalan. Antara faktor kejayaan dan kegagalan implementasi ERP yang dibahas dalam kesusateraan adalah berkait dengan latihan dan perundingan. Model dan kaedah latihan ERP kebanyakannya hanya fokus kepada sistem ERP proprietari dan bukannya sistem sumber terbuka yang mensasarkan pelajar atau pengguna akhir. Model dan kaedah latihan sedia ada juga tidak mengambil kira peranan power users dalam sesebuah organisasi. Power users ditakrif sebagai pemimpin dalam organisasi yang mempunyai peranan utama sebagai perunding dalaman dalam kalangan pengguna ERP dalam organisasi. Untuk menangani isu yang diutarakan ini, maka, tujuan utama kajian ini adalah untuk mencadangkan sebuah model latihan ERP yang baharu bagi power users khusus untuk sistem ERP sumber terbuka. Objektif kajian ini adalah, pertama, untuk mengenalpasti faktor yang menghalang atau mempromosi kejayaan latihan ERP. Objektif kedua adalah untuk membangunkan sebuah model latihan ERP sumber terbuka dan objektif ketiga adalah untuk memeriksa dan mengesahkan model berdasarkan maklumbalas dari pakar dan untuk menentukan kebergunaan model berdasarkan maklumbalas pengguna. Model latihan yang dicadangkan ini dibangunkan berdasarkan tiga konsep utama iaitu, model kitaran latihan, model pembangunan berlelar dan pendekatan pembelajaran berasaskan projek. Model kitaran latihan mebentuk asas bagi model cadangan, sementara model pembangunan berlelar pula berperanan untuk mencadangkan sokongan pasca latihan demi untuk membina kompetensi secara berlelar dan berperingkat. Akhir sekali, pendekatan pembelajaran berasaskan projek diguna sebagai kaedah semasa latihan bagi memastikan peserta latihan boleh menghasilkan sebuah modul yang sekali gus memberi mereka keyakinan serta skil untuk mereka melaksana implementasi sebenar selepas latihan dalam organisasi masing-masing. Proses dua langkah telah diguna untuk mengesah model. Langkah pertama melibatkan panel pakar yang mengesahkan model serta semua kompnen yang ada dalam model dan langkah kedua melibatkan penggunaan model dalam sebuah kajian kes, untuk melihat keberkesan latihan ERP di United Nations University International Institute for Global Health. Hasil kajian ini menunjukkan bahawa model latihan ERP yang dicadangkan ini boleh diguna bukan hanya dalam persekitaran akademik malah oleh pengamal industri bagi menghasilkan modul latihan ERP yang berkesan.

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LIST OF ABBREVIATIONS

ACM	Association for Computing Machinery
B2B	Business to Business
BPR	Business Process Reengineering
CRM	Customer Relationship Management
CSE	Computer self-efficiency
CSF	Critical Success Factor
DIY	Do It Yourself
EA	Enterprise Architect
EIS	Enterprise Information Systems
EMR	Electronic Medical Record
EMS	Emergency and Ambulance Management
ERP	Enterprise Resource Planning
EUCCB	End User's Characterization and Competency Building
F-R	Functional-Requirement
FSF	Free Software Foundation
GL	General Ledger
GNU	GNU's Not Unix
GST	General System Theory
HIS	Hospital Information System
HR	Henning Field Rating
IP	Intellectual Property
IS	Information Systems
ISO	International Organization for Standardization
IT	Information Technology
ITS	Issue Tracking Software
JIT	Just in Time
LIS	Laboratory Information System

MBA	Master of Business Administration
MOH	Ministry of Health
MOU	Memorandum of Understanding
MP4	MPEG Layer-4 Audio
MRP	Material Requirement Planning
NCBI	National Center for Biotechnology Information
ORM	Object Relational Mapping
OS	Operating System
OSS	Open Source Software
OVA	Open Virtual Appliance
OVF	Open Virtualization Format
PBL	Project Based Learning
PC	Personal Computer
PI	Perinatal Information
PIS	Personal Information Systems
PSH	Patient Surgery History
RDD	Recreational Drug Database
SCM	Supply Chain Management
SEM	Structural Equation Modeling
SF	Success Factor
SME	Small and Medium Enterprises
UI	User Interface
UKM	Universiti Kebangsaan Malaysia
UN	United Nations
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNICEF	Children's Rights & Emergency Relief Organization
UNU	United Nations University
UNU-IIGH	United Nations University, International Institute for Global Health

VMM	Virtual Machine Monitor
WHO	World Health Organization
WiFi	Wireless Fidelity

CHAPTER I

INTRODUCTION

1.1 INTRODUCTION

ERP is an enterprise software system that can manage all business processes of an organisation in one single database allowing not only internal departments like sale, purchase and manufacturing to effectively communicate but also increase efficiency in customer relations as well as supply chain communication and management. It is a must for organisations in order to rapidly respond to market needs by increasing efficiency in their business processes in all departments so as to remain competitive in the market. ERP is designed from the ground up to address this need by storing all information in a single database allowing the information to flow from customer quotation and orders to production, purchasing and finally to track delivery of the goods and services to customers. ERP has been around for more than four decades. However, they have been complex to develop and therefore there were a small number of players in the market (For example, SAP®) and ERP systems have been expensive to buy as the cost could easily go up to millions of dollars therefore mostly only large companies could afford to buy it.

However, by the rapid growth of software engineering and availability of reusable open source components, doors of opportunities opened for many new vendors to develop cost effective ERP systems and make them affordable for small and midsized enterprise (SME). Nowadays there are a variety of ERP packages for SMEs to choose from, ranging from million-dollar SAP®R/3® to free and open source (FOSS) ERP systems like Odoo®. Although there is no license cost for the open source ERP systems, there are still cost involved in ERP implementation and training and consultation is one of the major costs to be paid to external consultants.

In addition to that, ERP implementation involves much collaboration which raises the concern of the success of the project. It is reported that effective consultation is one of the major success factors of ERP implementation.

ERP consultants are usually external experts to the organisation with domain knowledge of the same industry as an organisation and they have a good understanding of the ERP packages and modules and configurations of the system. So, they can assist in implementation of the ERP package in the organisation.

There is a group of users in the organisation called power users. They are key users with a solid understanding of organisations business process and the industry. It means that if they had knowledge of the ERP package, they would be the best candidate to drive the implementation within their organisation. Because they not only have a knowledge of the industry but they are familiar with the business process and business rules within their organisation. However, most ERP training courses are targeting end users on how to use the systems and implementation courses are mostly designed by universities and they are comprehensive courses include topics related to an industry which is something that power users are already familiar with.

This research, is in the field of Information Science in general and in the area of Information Systems and Enterprise Resource Planning (ERP) in specific. This research discusses the importance of having an in-depth training and development model of ERP systems, especially with focus on open source ERP systems to be implemented by an in-house team of consultants within organization (a group of knowledgeable users within organization called power users) enabling them to implement the ERP systems independently without relying on external consultants. This research aims to contribute to the knowledge by proposing a new ERP training model which can be implemented in the form of a short course that is effective in transferring knowledge of the ERP implementation. This research analyse training as one of the main critical success factors of implementing ERP that can impact the successful development and deployment of open source ERP systems.

The objective of this chapter is to provide a background of the topic and highlight the problems in the area and to define research questions and set the objectives of this research. This chapter begins by introducing ERP, then it continues with the importance of conducting effective ERP training. It demonstrates the key role of ERP training in the success or failure of ERP implementation and introduce open source ERP. The present chapter also provides and in-depth training for power users as a research gap in the ERP which deserve more attention from academia. Lastly, the research question is formulated and the objectives are defined and the research method to achieve the objectives will be explained.

1.2 RESEARCH BACKGROUND

ERP is an important contribution of computer science and particularly information systems for the business environment. It can support complex business processes of the organisation, including sale, purchase, warehouse and manufacturing into one single database that sometimes contains more than thousands of tables by utilising advanced software engineering technologies (i.e.: Design Patterns). Umble (2003) stated that ERP is not only software, but a solution which means that it needs to be implemented properly through a systematic implementation procedure to reduce the risk of failure.

For such complex system like ERP that is able to automate business processes within the organisation, implementation involves close collaboration which raises the concern of the success of the project. Many ERP implementations failed due to many reasons (Wong *et al.* 2005). For Malaysian industry, in a research project done by Noudoostbeni (2009), it was concluded that training is among the most important success factor of ERP implementation for SMEs from end user's viewpoints.

Among the most notable success and failure factors of ERP implementation cited in the literature are training which allows the organisation to gain knowledge of the ERP system and how it handles the business process (Jamali *et al.* 2011; Kim *et al.* 2015; Tarhini *et al.* 2015)

This information is needed especially because during implementation, there need to be a mapping and alignment of business process with features of ERP systems which needs proper understanding of ERP systems. Therefore training is among the most critical success factors identified by researchers and is a major phase in implementation procedure of ERP systems (Sumner 1999; Kale & Kale 2000).

There are large volumes of published articles studying ERP systems. However, ERP researchers are still reporting it as a diverse topic that is very broad and still continues to be more matured (Ranjan *et al*. 2016) and research in the ERP area is still lacking, and the gap in the ERP literature is immense (Grabski *et al*. 2011).Therefore, several studies have been made to address research agendas in the main areas by pointing out that teaching ERP is among the topics that require more attention from researchers and practitioners (Haddara & Zach 2011). Kuem (2016) described ERP training as a major challenge in ERP systems mainly because of the complexity of the ERP. Schlichter (2010) has written the most comprehensive literature review in the field of ERP. In his review of 885 peer-reviewed journal articles in the area of ERP systems from 2000 to 2010, only 3% of articles addressed topics related to education in ERP.

Moon (2007) reviewed 313 articles from 79 journals on the subject of ERP since 2000 to 2006. He pointed out that the number of articles on ERP education is relatively few. He claimed that there are limited studies attempted to go further by conducting experiments to investigate practical and hands-on ERP training. Hawking and Foster (2011) outlined their experience in Victoria University where they conducted a training using an ERP system. By focusing on Human Resource (HR) modules of SAP®, they concluded that using a real ERP system in their training allowed students to gain hands-on experience and feeling of the value of the course

Another attempt was made by Kirkham and Saymour (2006) at the University of Cape Town to use a live ERP system during their training. Authors with industrial experience in ERP believed that it is crucial to integrate hands-on ERP experience into the information systems (IS) curriculum.

By the growth of free and open source software engineering, open source alternatives to many proprietary software packages started to grow on the internet and draw attention from the industry as well as academic bodies. A considerable amount of research has investigated open source software, its growth, motivation behind it and its quality and development methodology and in the open source revolution. Open source ERP systems are not an exception and in mid-1990, a number of open source ERP systems started to increase. Because of the complexity of ERP systems, open source ERP systems did not gain much attention from the industry and academia. However, recent reports show that industries are showing much interest and attention to open source ERP systems to adopt in their organisations which can be due to its advantages. Some of these benefits include:

1. No vendor lock-in: There is no vendor lock-in and corporates can make sure that they own the software for planning new changes or integrations without depending on any specific vendor.

2. Free license: There is no license fee for open source software; Corporates can download the software and start using it for unlimited number of users (as long as it does not exceed the maximum amount of system resources)

3. Easy customisations: Unlike closed software, in open source software any changes can be made to the system through customisations. Customisation can be planned up to the lowest layers of the software. The reason is that open source software is developed by using other components that are open source and therefore underlying layers of the software are open for developer. Hence, customisation can be done even in low level layers.

4. Cost effective: Total cost of ownership is much lower compared to the proprietary software, especially this advantage is bold in the areas that proprietary software implementation can cost millions to implement.

In addition to above general advantage of using open source software, Serrano and Johansson (2006) argue that there are more advantages of adopting open source ERP systems :

1. Open source ERP is highly adaptable. Since most ERP projects require customisation to allow organization to take full advantage of the system, it becomes important to have access to the source code to adapt the software to the organization's needs.

2. Open source ERP has less dependency to supplier of the software. It can become a risk for the organization to heavily invest on an ERP system with a closed source code maintained by one or limited number of suppliers. In case of open source ERP systems, since the source code is maintained in the community of online users, there is less or no dependency to a particular supplier or vendor.

3. Open source ERP has less cost of implementation. It is reported by Johansson that the license cost can easily reach to 30% cost of implementation. One of the big differences in open source ERP systems is that they do not have license costs that can help organization to reduce the cost of implementation.

Since the source code of open source ERP systems are available for free and there is no license cost, the majority of the remaining cost for the implementation is for training and consultancy for the implementation which is still a concern. Despite the fact that many research articles in the ERP area are addressing a comprehensive and ongoing training cycle for ERP adoption, findings from a study conducted by Koh (2009) on a training model devised by an ERP vendor reveals that ERP systems can be implemented by end users by attending a very short course instead of the external consultants. This type of end users is commonly referred to as power users. Power users are users with a thorough understanding of operations and business process of the company supported by domain knowledge in their particular industries (Kumar *et al.* 2003).

The short training course provided by an ERP vendor in the case study conducted by Koh (2009) was only five days and consist of three days technical and two days' administration. SME-specific ERP vendor studied as a case in this research claimed that their ERP system could be implemented and run in production by users

with a very limited investment in the training course. As Koh (2009) mentioned in his conclusion, this area of research is novel and result of such research will be very useful for many organisation seeking to minimise investment in training and consultancy. Koh's work (2009) triggered a signal and opened a new door for research to investigate training models that are short-term yet effective and allows power users to do the implementation themselves with minimum investment in training and consultancy. The training model of the case company was not discussed in Koh's article (2009) and the main objective of Koh's work was to check the validity of the claim.

1.3 PROBLEM STATEMENT

ERP systems can support the complex business process of the organisation using different modules for automating sale, purchase, warehouse and manufacturing process in a centralised database. For such complex systems like ERP that automates complex business processes within the organisation, implementation involves much collaboration which raises the concern of the success of the project. There are many cases that ERP implementation projects failed and researchers make an effort to contribute to the knowledge by looking into the success and failure factors to understand how and why ERP projects fail (Wong *et al.* 2005).

ERP just like any other enterprise systems are costly and it is estimated that 50 - 75% of enterprise systems implementation failed to justify the huge investment in the project and literature reported that training related factors are the main contributors to the failure of the project. (Arasanmi *et al.* 2011).

It is obvious that one of the main factors that success of any IT project depends on is whether user can effectively interact with the software package or not. Therefore effective training of end users not only can result in effective usage of the system but it plays a key role in success of the IT project. In case of ERP, inadequate end user training is reported as a major ERP failure reasons that requires more attention from researchers (Tarhini *et al.* 2015).

Among one of the most remarkable success and failure factors of ERP Implementation cited in the literature is consultation (Noudoostbeni *et al*. 2009; Jamali *et al.* 2011; Kim *et al.* 2015; Tarhini *et al.* 2015). ERP Consultants are usually external to organization and their role is to collect requirements and help companies to install and configure and if necessary, customise their ERP systems during the implementation phase (Tsai *et al.* 2007).

There is another group of users in organization named power users. Power users are users with a thorough understanding of operations and business process of the company supported by domain knowledge in their particular industries (Kumar *et al.* 2003). In an important research project done by Koh (2009), She argued that power users can act like an internal consultants if they have gone through a proper training. Findings from Koh's research were in contrast with recommendations from most ERP vendors and highlighted a big gap in the literature and it opened a new door for researchers to investigate training models that are short-term yet effective to allows power users to do the implementation themselves with minimum investment in training and consultancy.

The investment in ERP implementation can even be less if the ERP package that is selected is open source. By the growth of open source software, open source ERP becomes popular due to it's major benefits like high adaptability, less dependency to vendor and no license costs (Johansson & Sudzina 2008). However most research articles have focus on properietry ERP packages like SAP and therefore open source ERP is also identified as the research gap in the literature (Haddara & Zach 2011; Haddara & Zach 2012). There is a need to explain training requiremnets in open source ERP systems as well as make up for lack of research towards adoption models of ERP systems by power users independently in organization, a concept that was initially introduced by Koh (2009).

The research gap is not only addressed by the literature but also supported by evidence of interviewing the industry leaders Redhuan D Oon, The founder of Adempiere, One of the top ERP projects reported by SourceForge (McKenna 2011) and Cédric Krier the founder of Tryton, A free and open enterprise resource planning

program that is used as a base ERP for popular projects like GNU Health (Karopka *et al.* 2014). The results of a preliminary study of interviewing two active leaders of open source ERP systems reveals that when it comes to open source, lack of knowledge is one of the factors hindering the adoption of ERP systems. This is also a common occurrence even in the large companies where they have more budgets to spend on training and consultancy (Haddara & Zach 2012).

According to the review of the literature, the past research does not address ERP training and development models that support open source ERP for end users (Jewer & Evermann 2015). In addition, past literature also did not consider factors that enhance the Open Source ERP in-depth training for participants to grasp the knowledge to be able to implement the ERP independently and there are limited training models or methods to support power users to implement the ERP (Koh *et al.* 2009).

It is expected that by the development of an ERP training models, trainers can utilise the model to conduct their training efficiently and to have a better understanding of the need of participants for open source ERP adoption. In addition, an organisation can utilise the model to plan and invest in ERP training to increase the success rate of implementing open source ERP to automate their business process. Policy makers, including the UN with the objective of building human capital, can implement a better strategic planning for open source ERP training programs in developing countries.

1.4 RESEARCH QUESTIONS

The goal of this research is to explore training needs for open source ERP development and implementation. In academic studies, research questions influence the overall direction of the study by narrowing down the purpose statement of the study to one or more specific questions to be answered. In the research question section, the general problem identified by the author is narrowed down to conclude an issue which can be used in the overall process of this research. The section is started by asking one main general research question that can address the problem.

What is the suitable training model for power users in an organisation to become competent ERP consultant in order to play the key role of training, implementation and development of open source ERPs in their respective organisations?

As a result of analyzing the above governing research questions, three research issues could be defined and concluded as the research questions in this research study as follows:

1. What are the main elements of the ERP training model?
2. How effective is the ERP training model from the view of ERP trainers?
3. How effective is the ERP training model from the view of power users as the participants of the training?

By analysing the research question, it can be concluded that researcher has to construct the model (i.e.: if existing models do not address the need), which can help the researcher to formulate the first sub-question that is derived from the initial question. As for any new model proposed, it has to be validated in a process named model validation. Beecham (2005) defined model validation as a process to ensure researcher about the accuracy of the model and to ensure that model meets its purpose.

The objective of the ERP training course is to train the participant to become a consultant so that in the process of implementation of open source ERP, instead of relying on external parties as a consultant, the internal team can handle the process of implementation.

Therefore, in the case of collaboration with external consultants, it is more for seeking implementation advices and not to be dependent to the participant. In order to achieve this goal, by having a comprehensive analysis of training needs to design the model is vital.

1.5 RESEARCH OBJECTIVES

By examining the research problem, this research attempts to solve the problem. In summary, the objectives of this research are to:

1. To identify the elements of ERP training.
2. To develop a model of open source ERP training
3. To validate the model by experts through expert validation
4. To evaluate the model's usefulness through case study

In terms of the scope of this research, Odoo® (formerly known as OpenERP®) and Tryton® are used as open source ERP tool in the case study. Also, through a case study, the new iterative project based training method is developed for conducting training for the development of health information systems using Odoo® as the application development framework it can be applied to other vertical information systems. (For example Student Information Systems).

1.6 RESEARCH METHODS

Qualitative methods are about understanding or exploring a central phenomenon in order to generate a theory or model. The main objective of this research study is to develop a model of open source ERP training to support training for power users and therefore qualitative methods can be adopted to develop and examine the ERP model and to address research questions and objectives.

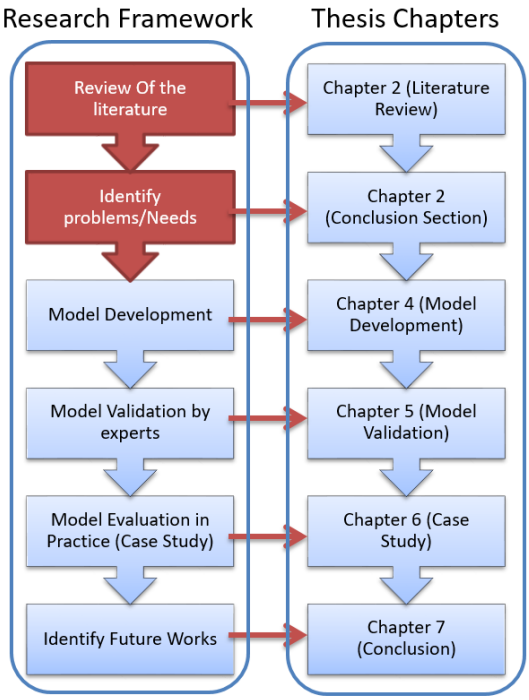

Figure 1.1 Six stage research approach

As shown in Figure 1.1, this research is divided into 6 phases. At baseline, this research starts by reviewing the literature to report the current literature and the gaps to build a conceptual framework around ERP training. Then, this research explores the theories that can address the gaps to form a new training model that can address the gaps found in the literature. The model will be further described in details and with specifications. Moreover, in the next stage of this research, expert's opinion process will be defined to validate the model by means of interview.

To further evaluate the model from the view of participants, the author then will deliver the course using the new model. The focus of the short course will be on functional and technical applications and development of OPTIMIST® GNU Health®, a hospital information system based on ERP framework.

CHAPTER II

LITERATURE REVIEW

2.1 INTRODUCTION

This chapter provides a review of the past research on the topic of study. It serves as a foundation for the next chapter to design the training model. This chapter organised as follows. First, literature will be referred to in order to define ERP. Then review continues to the ERP projects and how ERP packages are implemented (it is referred to as ERP implementation procedure). After that, the review continues by looking into the critical success factors of implementation and then discuss ERP training as the key success factor identified in the research will be discussed in both academic and industry. At the end the gaps are provided and two learning theories that can contribute to the topic to fill the gap are explained.

2.2 ERP SYSTEMS

Enterprise Resource Planning (ERP) is a system which can support complex business processes in the organisation. It can automate sale, purchase, warehouse and manufacturing process allowing departments of the organisation to communicate with each other effectively. Klaus (2000) defines ERP as terminology that is commonly used in the industry and it refers to a business software solution that integrates all functions of activity and activities across departments

It means that ERP systems automate sale, purchase, warehouse and manufacturing and the other business process with the aim of having only one single database to store all information. Despite the fact that ERP seeks to automate all business process within the organisation, It’s main objective is to automate key

functions within the organisation (Sammon & Adam 2007). ERP is also addressed as one of the most critical technologies for integration of best practices in business management utilising the power of information and communication technologies (Macris 2004).

ERP implementation can be defined as a sequence of stages aiming to explain how the outcomes develop over the period of project timeline (Markus & Robey 1983; Boudreau & Robey 1999; Rajagopal 2002; Somers & Nelson 2004). There are different models suggested for ERP implementation life cycle that can be used as a reference model for implementation procedure.

A three-stage model is suggested by Deloitte Consulting (1998). It includes stabilising (stage one) with the objective to secure the base and synthesise (Stage two) with the aim of building ERP for the future and synergize (Stage three) to achieve value and benefit the ERP system in use. Figure 2.1 shows the three-stages of Deloitte Consulting.

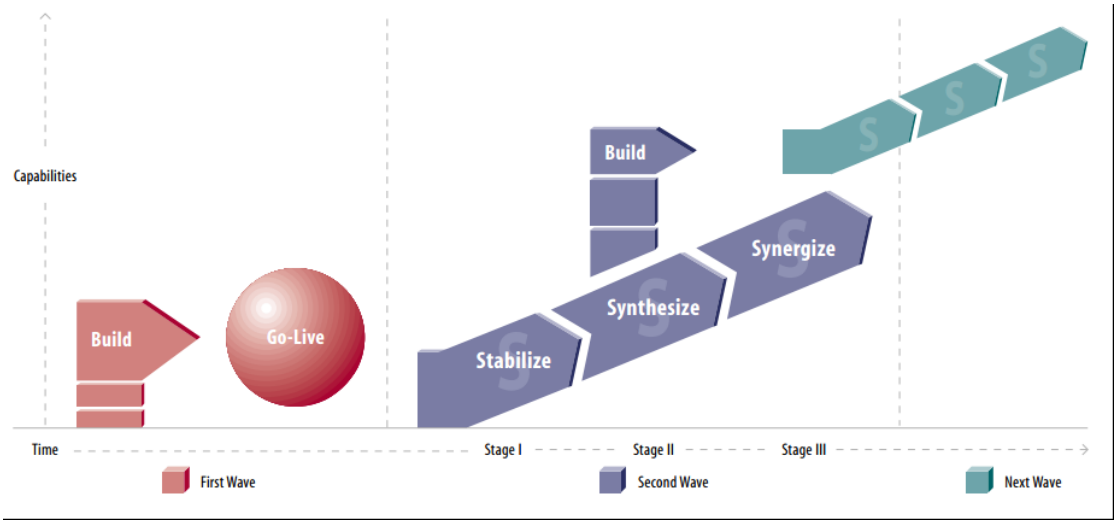

Figure 2.1 An ERP implementation life cycle suggested by Deloitte Consulting

Source: (Deloitte & Touche 1998)

Deloitte implementation procedure is focusing on the second wave of ERP implementation that is focusing on after go-live suggesting a long-term improvement and development of the package to maximise its benefit. A notable point of Deloitte's

research is to summarise their findings for the key issues or concerns from top Fortune 500 companies. As shown in Figure 2.2 by conducting in-depth interviews with 62 companies listed in Fortune 500 and by summing up the answers from 164 professionals. From the interview, it can be concluded that training is considered as the key issue and concern of the companies.

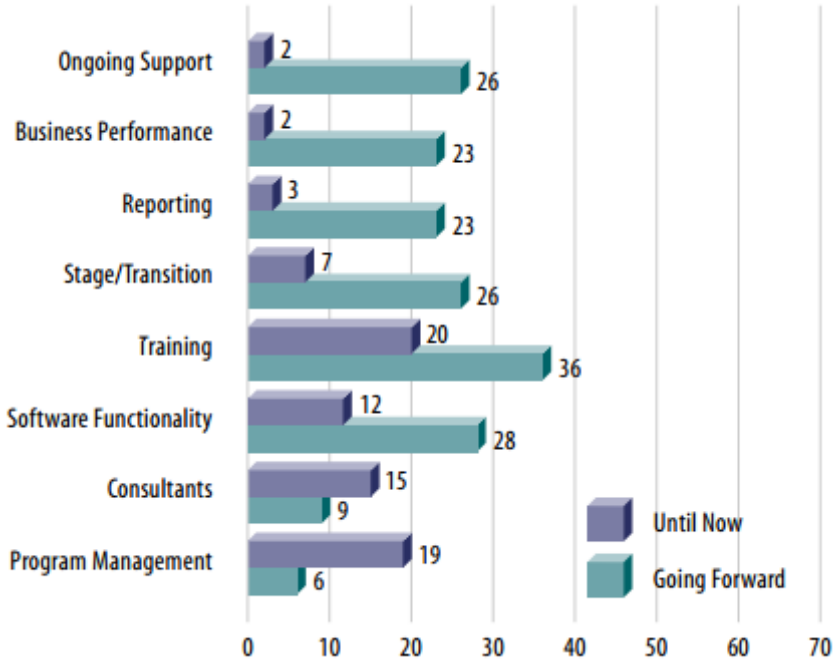

Figure 2.2 ERP training as a key concern of companies before and after go live

Source: Deloitte & Touche 1998

Another model that includes five stage is suggested by Ross and Vitale (2000). They include design stage, implementation stage, stabilisation stage, continuous improvement stage and finally the transformation stage. They argue that the implementation procedure has a temporary impact during the key stage (implementation stage) of the project and improvements would be visible during the stabilisation stage. Figure 2.3 shows the perceived organisational performance over the time.

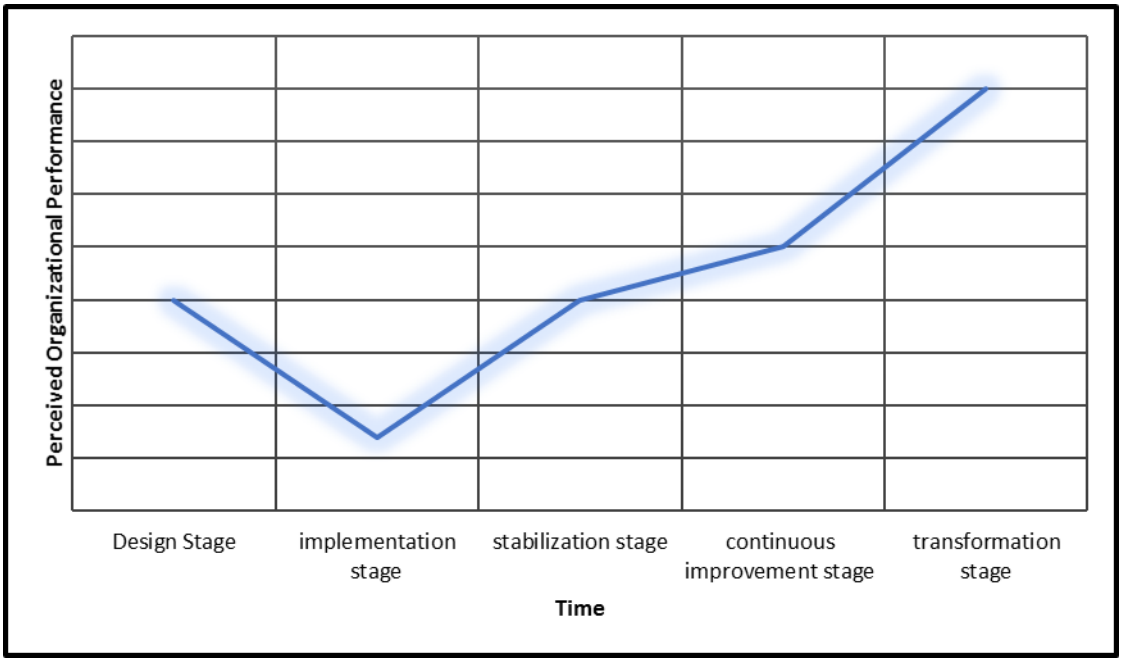

Figure 2.3 Perceived organisational performance over the time of ERP implementation

Source: Ross & Vitale 2000

As expected, implementation is the key stage of their model. In the interview questionnaire they asked a key question from participants about their opinion whether they do anything differently if they were to do ERP implementation project again, and analyzing the results revealed that most of the participants in the research answered the same way, that is to have more training on how the new information system can change the company's operation.

Rajagopal (2002) suggested a six stage implementation for ERP systems including initiation, adoption, adaptation, acceptance, routinization, and infusion. In another study, Esteves (1999) suggested an ERP life cycle framework. The framework provides project phases and they consist of adoption decision phase, acquisition phase, implementation phase, use and maintenance phase, evolution phase and finally the retirement phase together with a dimension that includes change management, people and process and product dimension. Figure 2.4 represents the ERP life cycle framework.

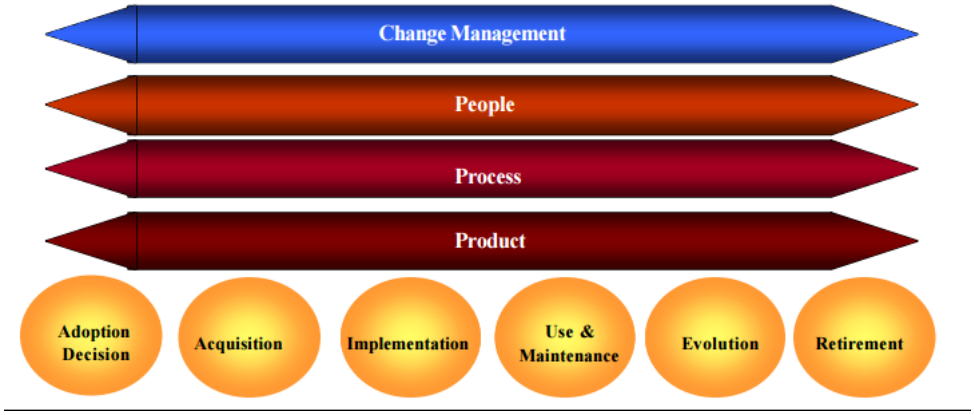

Figure 2.4 ERP life cycle framework

Source: Esteves & Pastor 1999

Esteves's ERP life cycle framework tends to represent a more generic approach that can allow researchers to use it as a reference model in their ERP related review research and (Haddara & Zach 2011) and (Esteves & Bohórquez 2007) are examples of that. Esteves also argues that consultants should be playing the key role during implementation phase by providing training for implementation following the methodologies.

Markus (2000) contributed to the topic by offering a four stage ERP project lifecycle comprising project charter as the first stage, ERP configuring and rollout as the second stage and shakedown as the third stage and finally the onward and upward as the final stage of ERP systems. Figure 2.5 shows the ERP implementation life cycle proposed by Markus and Tanis (2000).

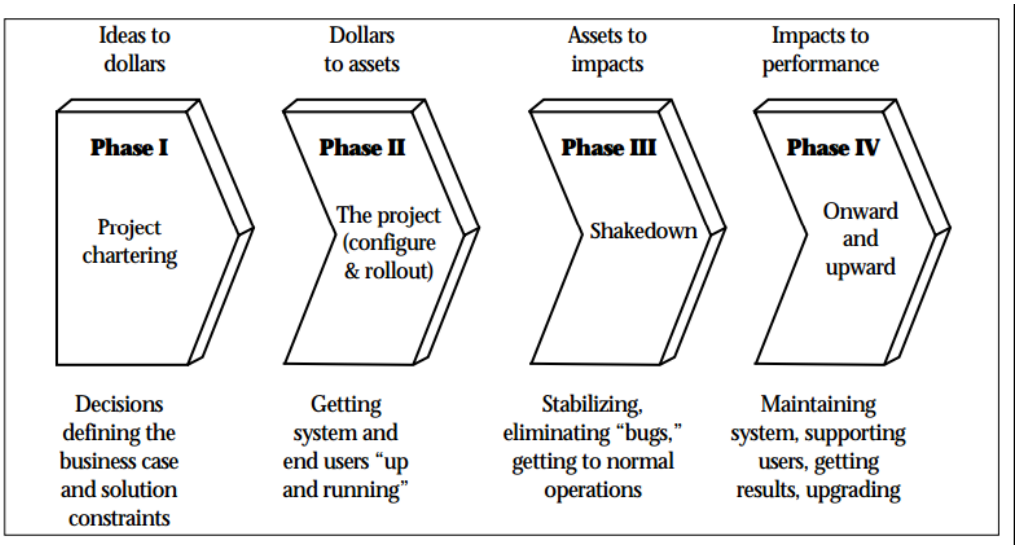

Figure 2.5 ERP implementation life cycle

Source: Markus & Tanis 2000

Markus provided an example of million-dollar SAP implementation that failed during the project phase. The company made a risky decision by advancing the ERP rollout by only ninety days. ERP team were very close to the end of the project, and they were forced to go live sooner and as a result of this decision training was skipped.

Markus explained the ERP implementation as a disaster. He reported that the company lost USD15 million. In addition to that, the company faced bankruptcy and ERP vendor, and the ERP consultant was sued each for USD 500 million.

When it comes to ERP Implementation projects, it is reported that the ERP implementation projects are often exceeding the budgets and delivered behind schedule (Garg & Garg 2013). ERP Implementation requires modification of the software packages (customisation), and for ERP implementation this is a key area of concern due to its impact on the implementation process and the total cost of the project (Davis 2005). Such significant investments for automating the business process in ERP packages has positive implications for the companies allowing them to be more competitive and can improve the overall performance of the enterprise (Wei *et al*. 2005).

As stated before, training plays a key role in the life cycle of ERP implementation. Therefore, in the next section, more findings from the literature will be discussed regarding ERP training to form the conceptual model for the rest of this research.

For such an important integrated information system and with the objective of identifying the reasons for failure, researchers contributed to the topic by identifying and addressing critical success factors in ERP implementation (Noudoostbeni *et al*. 2010) (Bullen 1995). In the next section, will be discussed in a great detail literature regarding critical success factors and their relation to the training.

2.3 ERP TRAINING

ERP researchers have not investigated ERP training in much detail (Grabski *et al.* 2011). The objective of this section is to analyse training as one of the main critical success factors of implementing ERP, highlighting the research methods and theories used by authors and to form a conceptual framework.

2.3.1 Conceptual Framework

There are large volumes of published articles studying ERP systems. However, it is reported that the gap in the ERP literature is immense (Grabski *et al*. 2011). Therefore, the investigation was done by researchers to provide new research agendas and they are pointing out that teaching and training in the area of ERP are still among the topics that require more attention from researchers and practitioners (Haddara & Zach 2011). Schlichter (2010) has written the most comprehensive literature review in the field of ERP. In his review of 885 peer-reviewed journals from 2000 to 2009 only 3% of articles addressed topics related to education in ERP.

Therefore, the past research was analysed to form a conceptual framework for ERP training. The articles were reviewed from the year 2000 afterwards with primary keywords of ERP Training and ERP Education, and their full text has been extracted from ISI Web of Knowledge®. There were few articles excluded from the discussion

like (Shea & Khalil, 2004) which was because the abstract was removed from publisher website. There was also an article that has been found to be in violation of IEEE's publication principles (Jing, Hua, & Ieee, 2008) and therefore the text is not analysed in their? review process. Appendix 1 and 2 provides a detailed analysis of the articles included in the process of the literature review. Figure 2.6 shows the conceptual framework derived from the table.

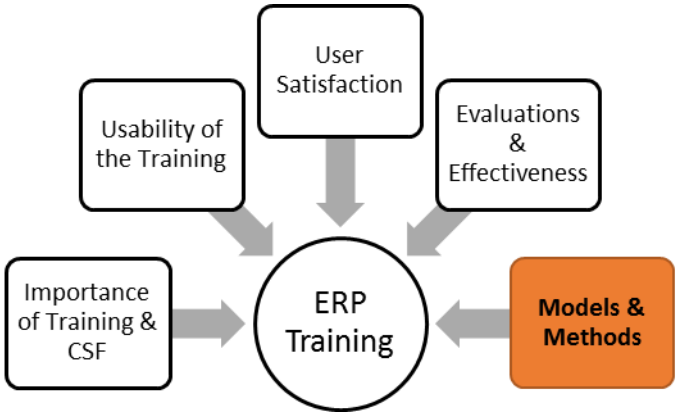

Figure 2.6 ERP training conceptual framework

In the next sections, each research themes will be briefly defined, and summary of the literature review supported by data table is explained (available in Appendix A and Appendix B). After that in the next sections, models and methods will be investigated further.

2.3.2 Critical Success Factors (CSF)

For such an important integrated information system like ERP and with the objective of identifying the reasons for failure, researchers contributed to the topic by identifying and addressing critical success factors in ERP implementation (Noudoostbeni *et al.* 2010) (Bullen 1995). The data table in Appendix A summarised the findings from the literature in regards to the critical role of ERP training in the success of ERP implementation also known as ERP Critical Success Factors (CSF). Among most remarkable success and failure factors of ERP implementation cited in the literature are training and consultation, which allows the organisation to gain knowledge of the ERP system and how it handles business process (Noudoostbeni *et al*. 2010).

Success Factor (SF) is a factor that is widely used in ERP field that allows the researcher to identify success rate of the ERP project implementation. Holland (1999) in his highly cited paper argues that it is a key question to ask from companies who successfully implemented ERP systems about their critical success factors. It is because managers of the organisations use success factors to determine the key elements that have to be done in view to achieve the implementation goals (Osman *et al*. 2006).

In one of the first study about success and failure factor in ERP projects conducted by Ang (1994), he concluded that lack of the ERP training could lead to failure in MRP implementation. In another study, Noudoostbeni (2009) distributed a questionnaire to 156 people working in Malaysian companies to identify the critical success factors and critical failure factors of ERP implementation. As a result, ERP training is considered as critical success factor and the critical failure factor.

2.3.3 Usability of the Training

Usability of the ERP training is another topic that was discussed in the literature. International Organization for Standardization (ISO) has a definition for the usability.

ISO 9421 (ISO 1998) is a guidance for usability and it defines usability as "The effectiveness, efficiency and satisfaction with which specified users achieve specified goals in particular environments. effectiveness: the accuracy and completeness with which specified users can achieve specified goals in particular environments."

Usability is further defined in the literature by Krug (2005) to have something (application or a process) to work well and to allow the end user to use the application or to go through the process to achieve the outcome expected from that application or process without frustration (Scott & Sugar 2004).

There are many research studies in the area of ERP reporting that enterprise resource planning systems lack an easy to use graphical user interfaces and it has an

adverse impact on the usability of the ERP systems (Singh & Wesson 2009). Therefore prior research has adopted empirical methods to assess ERP usability and use end users feedback and comments to validate the importance ERP graphical user interface usability (Calisir & Calisir 2004) (Parks 2012) (Oja & Lucas 2010) (Topi *et al*. 2005) and to explore the role of new E-training technology platforms to increase usability of the training manual (Chen & Zhou 2013).

However, studies in the area of usability in the ERP systems extends beyond the user interface. Training manual and documentation are part of the ERP training process, and there are research studies with a focus on the ERP training user manual and documentation to examine the usability of training manuals (Scott & Sugar 2004) (Scott 2005) (Scott 2008). There is a clear reason for ERP researchers in the area of ERP training to consider this research theme. Scott (2008) as one of the main contributors of this topic argues that the usability of ERP training documentation can have an impact on the effectiveness of training and as a result, it brings the faster return of investment for the ERP project.

2.3.4 Training Evaluations and Effectiveness

Training effectiveness can be defined as the study of the characteristics of the training that has impact on the training process during the entire training process whereas the term training evaluation is referring to the process to measure training programs to evaluate whether they are successful or not. Evaluation is usually measured against training content, however other aspects like how training can change the trainee. In addition evaluation is measuring the success of the training in regards to organizational payoffs (Alvarez *et al.* 2004).

In his high cited article for investigation of an integrated model of training evaluation and effectiveness, Alvarez (2004) argues that it is a common practice that professional trainers measure the training effectiveness through the evaluation process training study training effectiveness variables through the targets of training evaluation and it was decided based on the results from the literature to consider evaluation and effectiveness as one research theme. Regarding training evaluation

models, The Kirkpatrick evaluation model is one of the most popular models for designing training evaluations especially for-profit organisations for more than three decades (Bates 2004). This model measures the reaction of trainees, learning, behaviour and finally the results of the training.

Albadri (2009) was among the authors who adopt the Kirkpatrick evaluation model. Albadri adopted Kirkpatrick evaluation model as the theoretical basis to form his training approach which was adopted in major ERP implementations in United Arab Emirate (UAE). The model has been served as a base model for developing evaluation models in the area of ERP training. Training evaluation in the area of ERP was the topic of interest for ERP researchers.

2.4 ERP TRAINING MODELS

ERP training models are used by many universities as well as training vendors together with a practical case study so that learners can learn to analyse complex business process and different scenarios to handle it (Yingjie 2005). Therefore, past research was analysed to refine the conceptual framework for ERP training. Figure 2.7 shows the refined conceptual framework that extends the models and methods. In the next section, since the main focus of this research is to address power users as a new audience, models and methods will be explained in details.

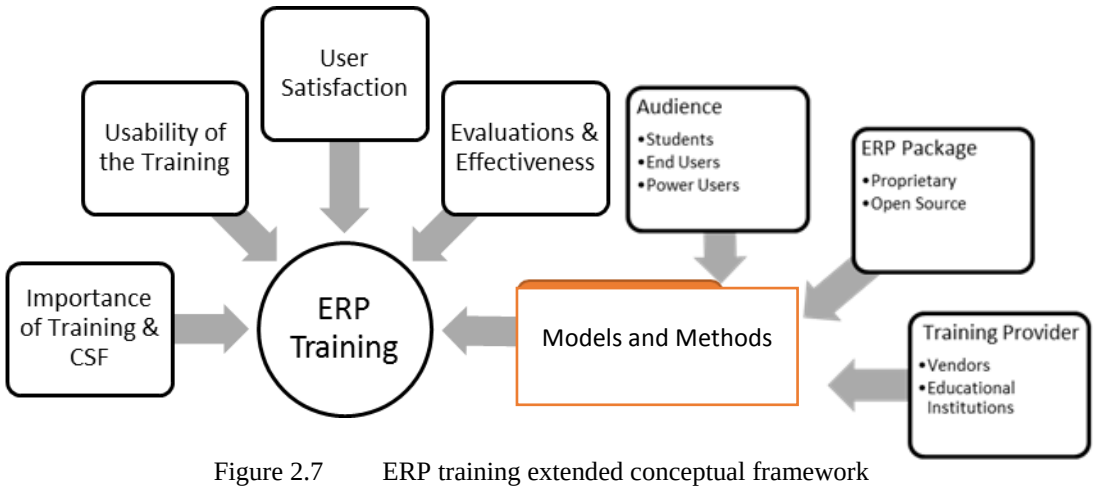

Figure 2.7 ERP training extended conceptual framework

2.4.1 Training Audience

Training audience refers to the group of participants for ERP training. According to the review of the literature, there are three major groups of ERP training addressed in the literature, they are:

1. End Users
2. Power Users
3. Students

Referring to the definition of the End-User from a dictionary of computer and Internet terms (2003), the End-User can be defined as the person who receives the goods or services or technologies and also uses it practically.

Regarding ERP systems implementation, all employees who need to use ERP systems are ERP End-Users who should participate training programs to understand how they work with the new system for automation of the business process (Nelson & Somers 2001). Traditionally many companies use external consultant for ERP implementation, and therefore, their objective is to maximise the process of transferring the knowledge of ERP system from external consultant to internal end users (Davenport 1998) (Nelson & Somers 2001).

The term Powers Users are also addressed in the literature as key users and super users (Mahdavian & Mostajeran 2013). Power users are users with a thorough understanding of company's operations and business process supported by domain knowledge in their particular industry (Kumar *et al.* 2003).

Wang (2007) argues that key users act like a developer for operational requirements for the ERP system. They are responsible for training the end users as well as play the pivotal role in advising and educating them and often are the first contact person for to address internal issues or change requests in the organisation.

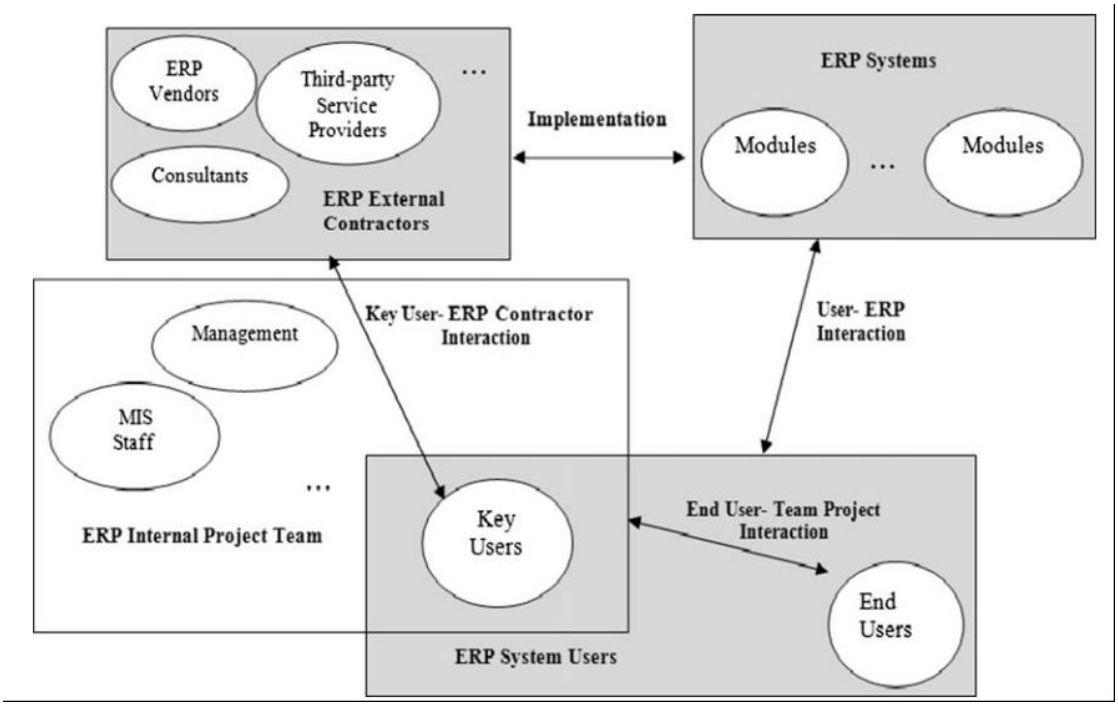

Figure 2.8 The key role of power user in ERP implementations

Source: Mahdavian & Mostajeran 2013

Mahdavian (2013) has demonstrated the role of key users in the diagram shown in Figure 2.8. As indicated in the diagram, key users communicate with internal users to assist them to use the system. Also, power user interacts with external contractors and consultants to collaborate on the ERP implementation, and power user is a key member of the ERP internal project team that requires interaction with management.

Based on the role of key users in the organisation, some organisations decided to go for a different approach. This new approach is to nominate a power user to participate training sessions provided by vendor and Kumar (2003) described it as the train the trainer model in ERP training. Then power users become responsible for further development of in-house learning materials to support the organisation end users. They also will act as a helpdesk and support resource for internal requests.

Due to a thorough understanding of the business process for power users especially in their respective organisation, if the knowledge is effectively transferred

from ERP vendors and consultants, power users can become an ERP consultant as clearly stated in one of the respondents to Kumar's survey. Participant answered that some of his staff had become ERP consultants and that was expected because their knowledge and skills and the amount of training they received were increased.

2.4.2 ERP Training in Industry

In this section, a detailed description of the articles collected is provided. The objective is to provide a summary of the findings of the articles in regards to ERP training and their contribution towards the topic. The discussion starts by reviewing the work done by Lin (2013) among SMEs.

In his recent study conducted in Taiwan, Lin studied the effects of innovation management and vocational training on the corporate operating performance of SMEs in Taiwan after implementing ERP systems. The findings show the fulfilment of operation performance during ERP implementation stages and employees addressed the importance of implementation.

Another attempt was made by Wang (2012) in China. With the objective of strengthening the training course for ERP talents and by viewing the system from a staff perspective, An ERP simulation system has been designed. The simulation system that has been designed by Wang (2012) has two parts, operational part for students and administration part for managers. The objective is to separate the business modules from related management modules. So that students can run simulated operations using sub-modules within the operational part, and managers can use the sub-modules of the administration part to run management operations. The system has been designed using advanced Java technologies, including Structs2 and Spring and Hibernate for data access layer which allows the system to be scalable.

Despite the fact that many research articles in the ERP area are addressing a comprehensive and ongoing training cycle for ERP adoption, finding from a study conducted by Koh (2009) on a training model devised by an ERP vendor reveals that end users can implement ERP systems for SMEs by attending a very short course.

This short training course provided by an ERP vendor in this study was only five days and consist of three days for technical and two days for administration. SME-specific ERP vendor studied as a case in this research claimed that their ERP system could be implemented and run in production by users with a very limited investment in the training course.

As Koh (2009) mentioned in his conclusion, this area of research is novel, and many SMEs look for reducing the investment of ERP implementation and since training and consultation is one of the major costs, result of his study can be useful for them. Koh's article would have been much more useful if he included the main elements of the model itself. Koh (2009) did not disclose the ERP training model that was used in the company in his study (it may be due to the confidentiality requested by the vendor), and the main focus of Koh's work was to check the validity of the claim. Another objective of Koh's work (2009) was to identify key factors that influence the success of the model. He conducted in-depth interview and analyze feedbacks and experience of the clients of the case company to form a theoretical framework. Koh's finding (2009) suggests that simplified system design is one of the key factors that brings ease of use and allows adoption of the system with minimum effort of Business Process Engineering (BPR).

Users who have prior experience of working with ERP systems is another key factor that could help end users to understand the process better and work with the system. However, highly experienced users who are responsible for implementing the software in the customer environment are the major key element that influenced the success of the model.

It seems that the support environment was another contributor to the success of the training model. Koh (2009) identified three major tools that were used by the vendor to support clients including a test database and a training CD supplied, an extensive release notes document as well as support via telephone.

Koh's work (2009) triggering a signal and opened a new door for research to investigate training models that are short-term yet effective and allows power users to

do the implementation themselves with minimum investment in training and consultancy.

In Malaysia, a research study was done to investigate the different training methods of ERP in SME sectors in Malaysian companies (Noudoostbeni *et al*. 2009) and Table 2.1 shows the summary of training methods that can be used for ERP training.

By studying Malaysian SMEs, he concluded that training is referred to as the most important critical success factor in ERP implementation. The study then investigates further by evaluating the effectiveness of different training methods from the end user perspective. Findings from this work show that lecturer and computer based training and on the job training are among the most used training methods in Malaysian SMEs.

Table 2.1 Research methods used in ERP training models

<table>
<tr><th>Computer-Based Training</th><th>CD-ROM</th><th>Lecture</th><th>Self-Directed Learning</th><th>On the-Job-Training</th><th>Simulation</th></tr>
<tr><td>Computer provides the learning stimulus</td><td>Interaction with training material through using joystick</td><td>Communication through speaking</td><td>Employees are responsible</td><td>Learning through observing peers</td><td>Represent a real life situation</td></tr>
<tr><td>Computer analyzes the responses</td><td rowspan="4">Interaction with training material through using touch-screen monitor</td><td>Cheap</td><td>Learning without an instructor</td><td>Learning through observing managers performing</td><td>Developing managerial skills</td></tr>
<tr><td rowspan="3">Computer provide feedback to the trainee</td><td>Less time</td><td>Learning process controlled by the trainee</td><td>Useful for training new hired employee</td><td>Fidelity to the equipment that trainee will encounter on the job</td></tr>
<tr><td>For large group of trainees</td><td>Encourage new employees to learn actively</td><td rowspan="3">Less investment in time and money for material</td><td>Fidelity to the situation that trainee will encounter on the job</td></tr>
<tr><td rowspan="2">Supporting other training methods</td><td>Gaining better understanding of working place</td><td rowspan="2">Expensive</td></tr>
<tr><td>Reducing the costs associated with traveling</td></tr>
</table>

Source: Noudoostbeni et al. 2009

In another study done by Mozaffar (2009), she refers to the findings from Gartner and other sources that indicate the importance of the training in ERP implementation. Then, by introducing the impact of business process and its role in new techniques like 6sigma, lean manufacturing, Just in time (JIT), she argues that

new enterprise systems (for example ERP, CRM and SCM) be evolving to respond to this change yet user training needs to be changed from a task-oriented approach to a process-oriented approach to allow end user to make use of the system in a more effective way.

In 2010, research on the adoption of a new training model called EUCCB (Albadri & Abdallah 2009) was published. EUCCB stands for the End User's Characterization and Competency Building approach. EUCCB was designed based on the existing theories of training management cycle and iceberg competency model. The objective of the model was improving the healthy level of ERP implementation, and the model was designed to be pluggable to the ERP implementation life cycle. The focus of the training model was to solve the ERP end-users' system acceptance in the post implementation phase of the ERP project to make sure the effective use of the ERP during the life cycle of the system which was reported by the author to be around 10-50 years. Albadri described the model as a series of relevant guidelines and procedures organised around four main components. They are shown in Figure 2.9.

Figure 2.9 Main elements of the EUCCB model

Source: Albadri & Abdallah 2009

Using the case study research method, the method was adopted by the ERP implementation project in one of the major companies in the field of oil and gas in the UAE.

The survey results reveal that there is an increased end-user acceptance rate. It was reported that 60% of end users participated in the survey are happy and found the training useful. Also, during the knowledge test conducted by researchers, a group of end users who attended the training programs conducted as part of the (EUCCB) could achieve a higher result.

Macris (2009) reported the first study of adopting the semantic web concept into the development of ERP training material. In his article he proposed a model to develop training materials for the ERP systems. Using the case study method to illustrate the usefulness of the new prototype model, a training scenario was chosen to develop an ERP training material for end users. The training scenario is focused on the meaning of the general ledger in the Microsoft Dynamics ERP package. In the case study of the scenario two main components are created:

1. Transaction Scenario for GL account
2. User Interface of the scenario GL Account

Macris (2009) argues that the method which is based on the semantic web be focusing on capturing the existing knowledge and representing it as ontology-based knowledge network which can provide additional benefits such as:

1. Semantic Search
2. Knowledge Navigation
3. Knowledge dissemination

Macris (2009) claims that the model is designed to be used within existing methodologies to enhance the user satisfaction. He claims that the method is not only applicable in the ERP area, but in a wider range of training. He claims that the model can be applied as a generic model for further development of learning materials for other systems and users can get same benefits in other areas of knowledge. Figure

2.10 shows a sample GL transactions scenario training aid based on semantic web principles.

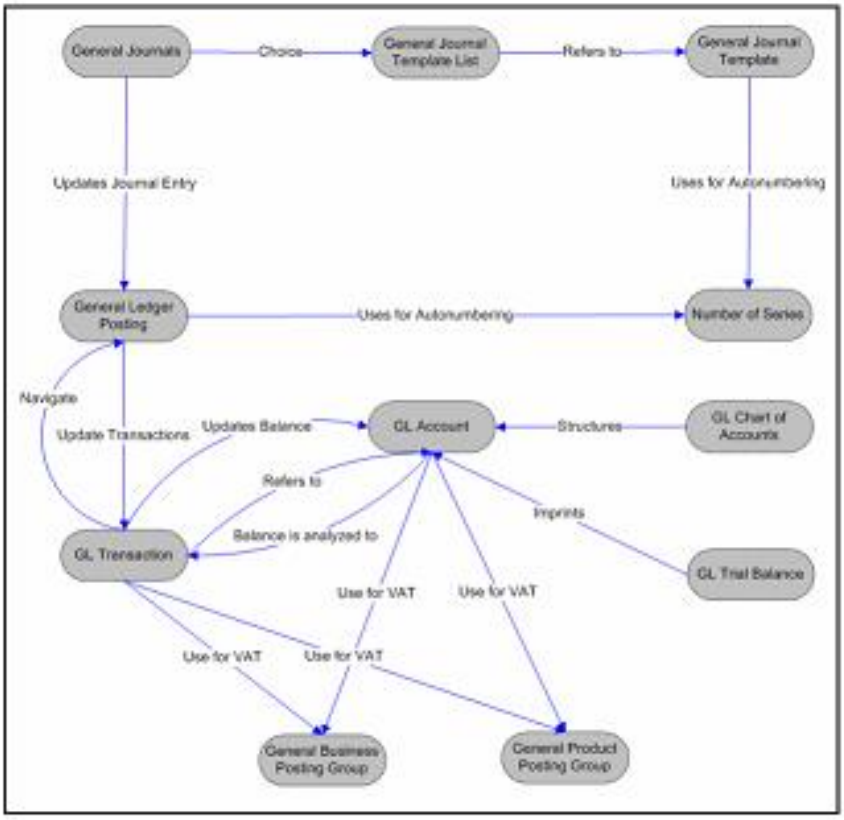

Figure 2.10 GL transactions scenario training aid based on semantic web principles,

Source: Macris 2009

Due to the novelty of the method, it may require further research to validate with more ERP process scenarios which include more advanced workflows and different ERP implementation packages.

Another study was done to investigate the application of general system theory (GST) (Mahadevan *et al*. 2006). In this extensive research, a new strategic framework has been suggested, and authors highlighted the role of general system theory (GST) in ERP training. A logistics process which is among the challenging operational areas in any ERP implementation has been used, and the three different usability aspects of the ERP systems have been demonstrated in developing process of business logistics

management. The authors conclude that by using AHP method there can be an opportunity for a TC business system.

The process is demonstrated in Figure 2.11.

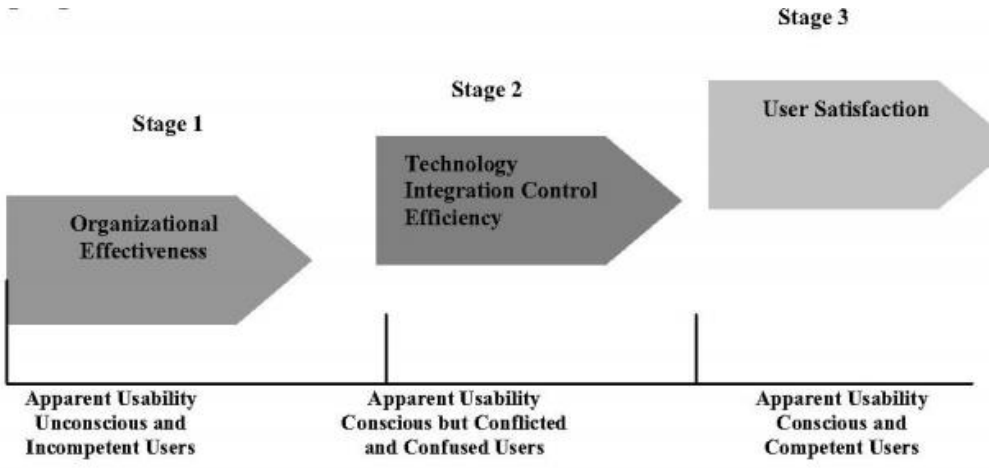

Figure 2.11 Three different aspects of ERP usability

Source: Mahadevan et al. 2006

Another study was done by Lee and Bradley (2004) to investigate the impact of training satisfaction on the perceptions of ease of use in ERP implementation. In the current study, qualitative data collection was done in the implementation of ERP in a higher education context. Among audiences, researchers identified the fact that there is a relationship between the job type and gender of trainees with the satisfaction of the training.

With the objective to overcome the lack of ERP training in ERP implementations, Ip (2004) has applied the system dynamic theory in the training process of ERP systems. In the case study conducted by him, an ERP training model has been proposed to simplify the training process in the manufacturing context and its main components of the model are demonstrated in Figure 2.12

Figure 2.12 ERP training model

Source: Lee & Bradley 2004

The model consists of three main elements that were incorporated into a website. Generic education provides a basic understanding of ERP and application training is focusing on ERP system itself and how the system can allow performing functions. In the constructive problem-solving part of the training is a series of problems that are in fact a day to day problems in the operations.

The model has been integrated with the web-based training system, and the result has been used as a framework for training in the case company, a lamp manufacturer. The main objective of the system dynamic is to help scientists to understand objects in a system interacting with each other and not as an isolated object. The theory has been applied to solve many problems in different context ranging from a steam engine to a bank account or even a basketball team (Forrester 1995) (Nelson & Somers 2001). Results from the study reveal usefulness of the model in the ERP context that can contribute to the success of ERP implementation.

The impact of computer self-efficacy and training on ERP end users intention to use the system has been investigated by Fan (2004). The study is based on the technology acceptance model, and it examines the driving factors for end users to work with the ERP system. Using a survey instrument, a total of 202 responses were received from end users working with ten different companies. The result then analysed and it was concluded that conducting an effective ERP training has a positive

impact on perceived ease of use of ERP system for the end user. In addition to that effective ERP, training has an indirect positive impact on perceived usefulness, attitude, and intention to use ERP system for the end user.

Shtub (2001) has investigated about a model that can be used in teaching and training of ERP systems. He highlighted the issue of understanding the ERP systems for the managers and inefficiency of training courses because training courses are focused on subjects (For example, marketing and finance). However, ERP vendors have designed the system to support business process within an organisation that is not only limited to a module (i.e.: a sale process may trigger the warehouse delivery process before it is done).

Therefore, Shtub developed a framework of training which contains a tool that has built-in ERP like a version of a management information system which is interactive and dynamic. A methodology was also present which includes three main teaching process:

1. The traditional operations management
2. The integrated, dynamic approach to operations
3. Using enterprise information systems to support the management of operations

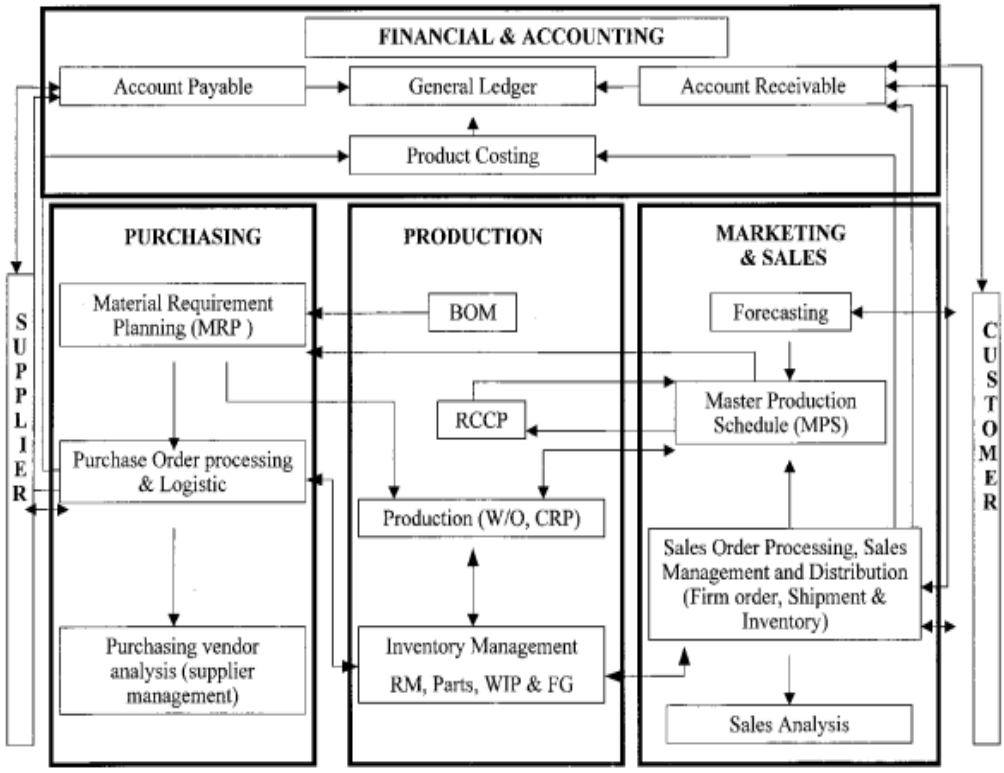

Figure 2.13 An integration of case study and modeling in OT training model

Source: Shtub 2001

The Operation Trainer (OT) methodology is used in industry as well as academic context. In the context of industry, the OT methodology was utilised for training courses for the management to deliver the concept of information system and information sharing. The teaching framework has been applied in both the industry and academic context. In the context of industry, the framework has been applied to teach managers of the company with ERP implementation. In the context of the university, courses designed for MBA students in business schools as well as engineering students for engineering school. Results and experiences from the case studies show the effectiveness of the training and show the potential of expanding the framework, and its tool to support the more complex business process (Shtub 2001).

Reviewing of the academic models reveals that research on the power user as a new targeted audience of ERP training is emerging. Power users act like internal consultants in the organisation. They are neither students who lack the knowledge of business process, nor end users who work on a day to day basis with ERP package.

Power users are key users in the organisation who have a good understanding of the whole business process in departments and an overall understanding of the functionality of the ERP system that has been implemented. Companies may prefer to have the training to be conducted for power users and in that case, None of above models and methods is designed to address the needs of power users as the mechanism needs to be changed to shift the focus on the key user to transfer the knowledge and then this key user will conduct the internal training for the end users in his respective organisation. This important fact which is a common practice in small and many mid-sized companies have scarcely been investigated by researchers and there are limited models to address training methods to plan for such a group. There is only one research project stating that there is a possibility to conduct a training of ERP to the end users so that end user can implement the system without consulting (Koh *et al.* 2009). They validated the statement, however, as stated before they did not discuss the elements of the model. Results of the review of ERP training models and methods used in the industry are summarised in Appendix A. In the next section, the training models in the academic are discussed in more details and later in the discussion section, Issues related to both industry and academic ERP training models are discussed in one section and gaps found in the literature which required further research and development are reported.

2.4.3 Academic ERP Training

When it comes to ERP Implementation projects, it is reported that the ERP implementation projects are often exceeding the budgets and delivered behind schedule (Martin 1998). ERP Implementation requires modification of the software packages (usually referred to as customisation), and for ERP implementation this is a key area of concern due to its impact on the implementation process and the total cost of the project (Davis 2005). It is very expensive to appoint ERP consultants, and it is reported that the consultation fee is the big portion of the overall implementation cost of the ERP projects (Goel *et al*. 2013) and therefore a high demand is expected from the industry for highly skilled ERP consultants to facilitate the implementation process in the organisations.

To respond to the demand from the industry, many universities started to provide ERP related courses. ERP systems soon became one of the best tools that can showcase business concepts to students (Becerra-Fernandez *et al.* 2000).

With the objective to maximise employment opportunities for students when they graduate, universities went beyond the theory and they introduced hands-on training of the ERP using popular ERP packages that are more on demand in the market, and as a result of this they partnered with top ERP vendors in the industry to gain access to the latest materials and tools needed to develop curriculum for ERP-related course.

Although this partnership could lead to more hands-on training programs, the ERP vendor gets many benefits to having strong support from their product in the competitive market (Hawking *et al.* 2004). Each ERP vendor argues that the ERP package they developed and delivered has incorporated industry's best practices (Hawking 1999). It is also the critical job of the consultant to align the best practices of an the organisation's business process with the ERP package functions and features.

Therefore, despite the benefits of using vendor training tools, models and methods for universities, such materials tend to present the business process from the perspective of that ERP package and therefore it demonstrates easy alignment with the software and become less challenging for students to gain knowledge of the complex business process.

There are limited number of research projects done to form a training model with the objective to fill this knowledge gap in ERP training courses and to propose a training model to address the complexity of ERP implementation that is independent from the perspective of the products and vendors. These models are summarised by highlighting the research methods and theories used by the respective authors that highlight that the new industry demands were not yet addressed in the current training methods and models.

In this section, a detailed description of the articles collected is provided. The objective is to provide a summary of the findings of the articles in regards to ERP training and their contribution towards the topic. Review begins by discussing the work done by Huang.

In the study conducted by Huang (2013), He applied the concepts of CDIO in ERP teaching. CDIO is a collaborative project of four Swedish universities and Massachusetts Institute of Technology (MIT) in the United States with the vision to develop an innovative and open educational framework that can be used for producing engineers of the future. The main objective of CDIO is to provide students with an education that stresses engineering fundamentals. CDIO stands for Conceiving, Designing, Implementing and Operating (CDIO) (Berggren *et al.* 2003). Huang (2013) analysed and evaluated teaching mode of ERP course using CIDO concepts. Also, Huang presented the integration teaching mode of the ERP course in Taiwan to provide guidelines to improve the quality and quantity of talent training in the field of ERP.

Yu (2012) suggested a series of general guidelines for teaching practice based on ERP simulating experiments. With the aim of improvement in the quality of ERP course, Yu (2012) has conducted a study of an innovative open experiment teaching method based on engineering practice education centre for ERP course group. Yu (2012) developed an experiment teaching management system using Java technology running as a web-based solution that can allow the management to keep track of teaching plans, resources as well as evaluations to improve the performance and quality of the course in the ERP group.

Han (2012) investigated the need for engineering students to learn ERP sand table simulation and presented a ERP sand table training solution. He reported the positive impact of ERP sand table training and recommended the proposed solution to be used to improve the management skills of engineering students.

Zhang (2011) reviewed the literature with the aim of analysing different aspects of ERP course design. He addressed the importance of improving the

effectiveness of teaching by selecting the best course content as well as a teaching method. Zhang in his another research article also has focused on the entrepreneurial skills of college students (2011). He proposed a teaching practice in which students can develop their skills in the management and entrepreneurship aspect of ERP. Formation of the contents of the course and the innovative method used to develop the contents has been described in details in their article. The author expected that the result could be used by universities for further development of ERP related courses with the objective of encouraging university students to utilise their skills in their workplace in the future. Zhang (2011) also suggested an innovation model of teaching methods for ERP using a combination of modern technologies in education as well as traditional classroom teaching and practice of computer simulation.

Following the objective of enhancing the quality of the ERP courses, Xu (2010) has investigated a comprehensive ERP training system in Zhuhai University in Beijing, China. The system (which the author highly recommended as an effective approach) is designed to increase the overall competency of university students in the management field. The system is called ERP-CPTS which stands for ERP comprehensive practical teaching system.

Following a result oriented approach and based on the constructivism learning theory, Xu discusses the major contents of the system that address the objectives of the course. Also, Xu studied ERP teaching methods and evaluation techniques, and main elements of the system are described in details followed by the theories that elements designed based on. The author concluded that obtaining the high level of competency among students can be achieved in the ERP-CPTS by the use of combined training methods based on learning theories.

With the objective of improving ERP training, in another study conducted by Scott (2009), a multimedia tool has been developed by ERP vendor to have professional movie clips and screen captures and used as an optional tool during the course among members of the sample group with the objective to assess computer self-efficiency. Sample group consisted of 239 undergraduates and graduate students of a university in the United States. The research was conducted by asking

undergraduates and graduate students to fill up a survey questionnaire after the ERP course. Scott (2009) used a multi-analytic approach, partial least squares (PLS), a neural network (NN) analysis and structural equation modeling (SEM) in the study. One major contribution of her model is a prediction of the Computer self-efficiency (CSE) outcomes.

In a conference article published in 2009, Deng *et al*.(2009) presented the framework used for teaching the course. They offered their experience of conducting ERP course since 2003. A practical teaching framework was designed to improve the quality of the course. As shown in the Figure 2.14, Main part of his framework includes lab experiments (which was developed using Zachman's Enterprise Architecture (EA) framework as well as extracurricular activities). In addition to that, they have an internship as the third part of the framework.

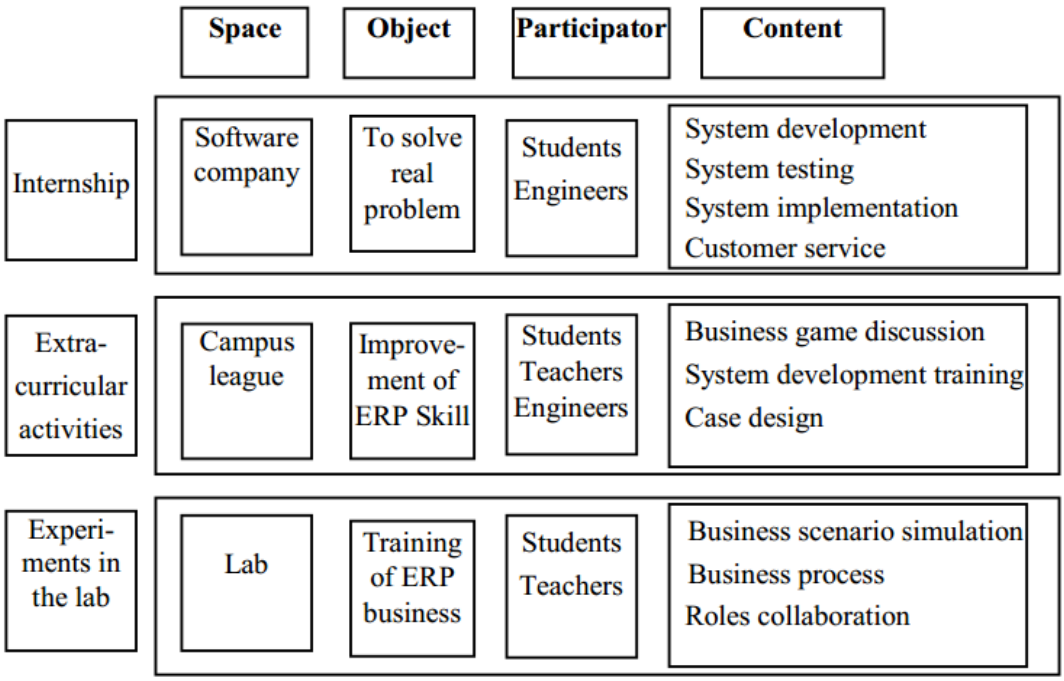

Figure 2.14 An ERP practical teaching framework

Source: Deng et al. 2009

A unique feature of their framework was an internship program for a real company to let students understand the concepts in real work. Authors claimed that the model was applied in practice in teaching and training of ERP systems with

positive results. The article could have been much more useful authors elaborated the evaluation methods of the training framework. Probably one of the success factors of this teaching framework is the experience; students gained through the internship and real environments.

In another study conducted by Winkelmann and Matzner (2009), they represented a model for the development of the ERP course at the University of Koblenz-Landau in Germany. The study focused on medium-sized ERP systems that allow students to explore knowledge of the ERP system in different ERP market segmentation. Figure 2.15 demonstrate their ERP course development project in more details.

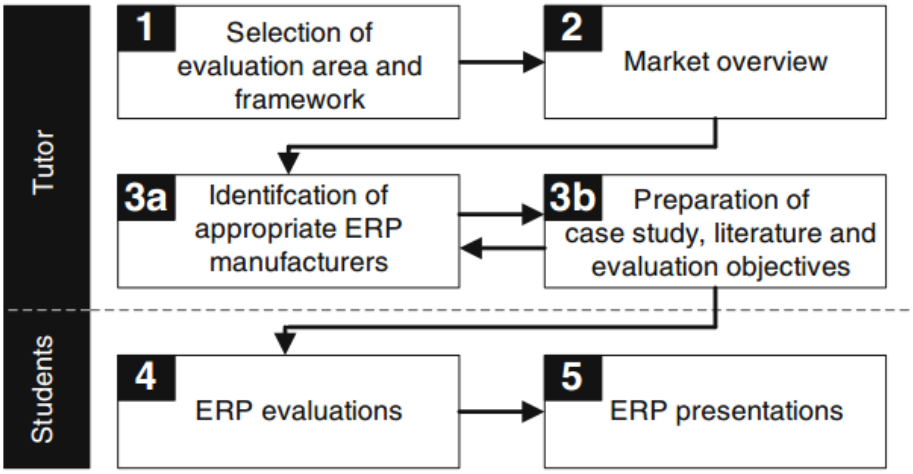

Figure 2.15 A model of ERP development course

Source: Winkelmann & Matzner 2009

Winkelmann argued that despite the fact that SAP is the market leader in this industry and they already have a strong academic collaboration with many educational institutions, the opportunity of experiencing other ERP systems might bring more conceptual knowledge of the ERP systems for students. In the model that was presented by Winkelmann, he focused on improving the evaluation skills of students.

Students were asked to present their model for 60 minutes for participants and to showcase how they found the ERP package meeting the requirements given by lecturer as an example in real business.

The strong point of the course was to engage real companies in the process. Winkelmann mentioned in the conclusion that in the beginning, ERP manufacturers were not interested and even careful to deal with the university not to allow competitors to steal their ideas. However, as an outcome of the training, students were very satisfied and scored very high in the exam. Despite the innovation in the teaching model and valuable experience of attending such course, the focus of the course was to address the ERP evaluation skills and other elements like implementation was out of the scope of the model.

In another research study conducted by Moon (2007), for the first time, ERP at universities has been used not mainly for the purpose of teaching ERP implementation but as a tool to empower professional skills for engineering students. In a collaborative work of Carlos University and Syracuse University in the United States by focusing on four main categories of professional skills including communication skills, teamwork, leadership and other professional skills. Authors tried to design and build a curriculum that contributes toward the advancement of university graduates in the area of interpersonal skills. Despite the novelty of the research, the main contribution is toward interpersonal skills and ERP is just a tool that is used during the process. As a result, the model cannot be directly applied in any ERP related course.

Shtub (2001) in his research study in 2001 has investigated about a model that can be used in teaching and training of ERP systems. His model was discussed in the review of industry training model. However, his model can be applied in industry and university settings. In the context of the university, courses were designed for MBA students in business schools as well as engineering students for engineering school. Results and experiences from the case studies showed the effectiveness of the training and show the potential of expanding the framework, and its tool to support the more complex business process.

In a n article published on 1999, Stewart *et al*. (1999) with a vast experience of teaching ERP concepts in practical courses represented the difficulties in the process of designing and developing university course contents. The objective was to design a course to be practical and useful for students after they graduate. Authors also represented their concern for designing a course that should maintain its academic values and standards.

Experience was gained through a case study of teaching for more than 400 students of postgraduate degree. Teaching implementation issue consists of topics addressed in three subjects:

1. Process Engineering
2. Issues in Information Technology Management
3. Case Studies

Summary of the experience gained by the lecturer in Stewart's research were reported and the main difficulty was to set up the R3 server and train internal staff. In addition, supervising students and handling their assignment and research project was a time consuming task. On top of that, the cost of upgrading and hosting the environment was very high and finally developing of the contents to support flexible delivery was experienced to be complex. In the end, Stewart concluded that that practical training on R/3 product from SAP could bring high student satisfaction (Mahapatra & Lai 1998; Stewart *et al.* 1999).

2.5 DISCUSSIONS

While each model reviewed in the literature is providing its unique benefits and could demonstrate the usefulness and effectiveness through different case studies and training provided by universities and training providers, they lack a few number of key elements that are required in the ERP training programs defined in problem statement that can be summarised in Table 2.2.

Table 2.2 Summary of the gaps found in the literature

Gaps	Descriptions of The Gaps
In-Depth Training	Existing training models are not designed for independent implementation
Power Users	Existing training models are not designed for power users.
Workplace Project Based Learning	Existing training models are not assessed based on the implementation
Short Term Training	Existing training models are supporting continuous long term training
Open Source ERP Training	Existing training models are not supporting open source ERP systems

2.5.1 In-Depth Training

To summarise the key issues, they are not designed for implementation independently, and ERP training models still need to rely on an external consultant for implementation. However, more research and investigation is required to address the demand from organisations that want to provide in depth training for their in-house team to act like ERP consultant. They are also not designed for the targeted audience.

2.5.2 Workplace Project Based Learning

Most training models and methods are assessed based on feedbacks from participants, and researchers do not investigate other forms of feedback from activities that can directly contribute to the participant's workplace.

2.5.3 Short Term ERP Training

Another finding from the literature that can be reported is that most training programs are supporting continuous long term learning. Most training models and methods (promoted by vendors and supported by the literature) are suggesting long term continuous learning programs. However, a clear scope is needed in this research project (i.e.: having an exit point that clarifies when the process is ended), and a clear scope of what to expect at the end of the training is required.

Lastly training models from the literature are not supporting open source ERP. Most of the training models are inspired by their vendor methodology or model, and few of them are product independent, but open source ERPs cannot be applied to them.

2.5.4 Open Source ERP Training

Open source ERP systems are becoming popular these days, especially for SMEs which have limited budgets to spend on expensive proprietary systems. There is a lack of research in the area of training for open source ERP systems. None of the above training models used any open source ERP systems and most of them are following the materials and methods supported by property ERP providers through their academic alliance programs (a common example is SAP Academic Alliance ®).

2.5.5 Learning Theories

In this section, learning theories will be introduced that can address the research gaps reported in the previous session. Theories are shown in Table 2.3.

Table 2.3 Learning theories that can fill the research gap

Theories	Description
Iterative Development Model	This theory is used for development of a subset of system or product requirements and refines it iteratively until system fully delivered.
Training Cycle Model	This theory is generic and widely used as the foundation for the development of training models.
Project-Based Learning Approach	This theory is supporting the hands-on training and can be used to maximise the knowledge transfers during training course

Source: Rylatt & Lohan 1997; Thomas 2000; Victor 2003

Review of the literature and gaps found in the literature shows different training models defined by trainers and organisations as a reference to follow in a systematic approach to achieving the goals. Roger Buckley and Jim Caple in their book (theory and practice of training) argued that a close study of most of the training models reveals that they consist of same stages even though their models are presented and defined in different formats or stages and regardless of the format of the training models steps and the main process are very similar to four main activities (Buckley & Caple 2009). Buckley and Caple (2009) addressed the steps of the training model as a basic model of a systematic approach to training and it is shown in Figure 2.16.

Figure 2.16 A basic model of a systematic approach to training

Source: Buckley & Caple 2009

In fact, the systematic model demonstrated in Figure 2.16 was first introduced by Rylatt (1997) and in his book (Creating training miracles). Rylatt (1997) suggests a training or development cycle to be used as a model for training developments in organisations to represent a systematic approach to training and development with four stages that later on used as a reference model by training specialists like Roger Buckley and Jim Caple (2009) to refine it to propose their models. Figure 2.17 shows the diagram for the training cycle proposed (Rylatt & Lohan 1997).

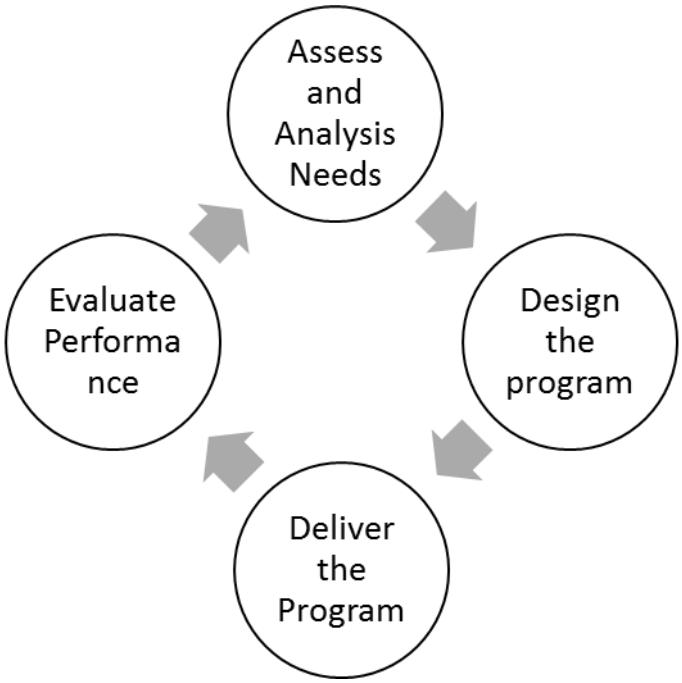

Figure 2.17 Training cycle model

Source: Rylatt & Lohan 1997

The first stage of the training cycle is asessing and analysing needs and this stage is needed to perform an initial assessment of the needs to identify the right topics that need to be covered during the training. There are various ways to analyze the needs for the training which can be divided into qualitative and quantitative.

The second stage is called designing the program and at this stage. Based on the results of the first stage, the contents of the training are developed. It includes content development and training methods to be used (face to face, online and other forms of training) together with writing activities and course quiz.

The third stage of the model is called delivering the program. In this stage, a trainer conducts the training course for the participants. This stage involves applying learning methods effectively followed by the learning plan to make sure all training needs can be addressed and delivered to participants.

The final stage includes evaluate performance and it defines the evaluation framework or measurements that can be applied to gather information (qualitative or

quantitative) from participants to measure the successfulness of the training course and to see whether the training could achieve the goals and objectives or not.

Benefits of the training cycle model to be used as the base theory to form a new ERP training model can be useful especially because training cycle model is a generic model and is not product or industry specific makes it a good choice to be the base of the proposed ERP Training model. It is based on the cycles allowing researcher maximum flexibility to define a model that can be refined. Apart from the benefits, relying on this theory alone may render issues such as there is no exit point in the model, and it is obvious that ERP training cannot continue forever. Another problem with this model is that evaluation stage is defined to be right at the delivery stage. Therefore applications based on training cycle theory expected to have focused on evaluation after the training is conducted.

Referring to the research gaps, the ultimate objective of defining a new model is cover the gaps to make sure there is an in-depth training and making sure those participants can implement the ERP package independently. Therefore, the model has to be developed with the objective to cover that gap and to make sure that training is practical and the topics covered can apply directly into participant's workplace.

The above objective is referring to the fact that the model should be designed to support the learning process that provides participants knowledge and skills that can be more relevant to the work environment and can be practical and in their real implementation projects. It can be more beneficial in today's workplace, as traditional assignment based works are being replaced with project-based activities (Siegel 2000).

Project Based Learning (PBL) can be defined as an educational model and method that organises learning around practical projects containing complex tasks that are related to a challenge or problems for students to solve (Thomas 2000). PBL focuses on engaging participants to collaboratively investigate and solve the problem that is represented as a project (Moursund 2001; Musa *et al.* 2011).

Adopting PBL model in the proposed model has many benefits. First of all, PBL is described as a key learning strategy for creating independent thinkers and learners (Bell 2010) and therefore adopting this model can directly contribute to addressing one of the gaps found in the literature which was the lack of training that is practical and allow power user to implement independently. Another benefit of the PBL is the increase in participant's engagement that provides higher attitude toward the project.

In fact, the theory was used to form academic course for ERP systems by Gerogiannis, and it shows the potential of the theory to be adopted for in-depth ERP training model. Gerogiannis (2006) applied a Project Based Learning (PBL) approach in the ERP training course at technological Education Institute of Larissa. He divided students into separate groups so that they worked together using a live version of the ERP system (SAP R/3®). In his study, teachers played a role of facilitator for the projects rather than a lecturer. They concluded that by using their practical project based training method students are allowed to run small ERP projects using the live ERP based on SAP R/3.

As shown in Figure 2.18, theories can contribute to the model definition and their benefits can relate to the problems of existing ERP training models and methods. They are used later in Chapter 4 to develop an ERP training model to fill the gaps.

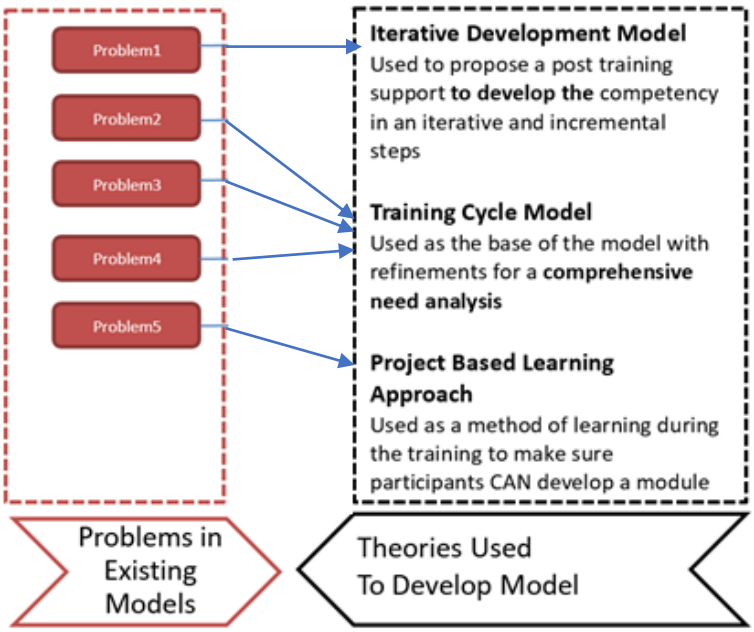

Figure 2.18 Contribution of theories to address research gaps

2.6 CONCLUSION

Although many articles presented a training model and explored training methods the above mentioned training methods and approaches suffer from a limitation regarding the targeted audience.

Most articles assume that implementation is done alongside the training from the vendor and none of them addressed a training approach that can allow end user not only to use the system but also to be able to implement and maintain the system. A training model that can cover the implementation procedure for power users is required.

There is a group of participants for ERP training. They act as consultants. They are neither students who are lacking the knowledge of business process, nor end users who are working on a day to day basis with ERP package but they are power users who are key users in the organization who have a good understanding of the whole business process in departments and overall understanding of the functionality of the ERP system that has been implemented.

Companies may prefer to have the training conducted for power users who are the key users in the organisation who have a good understanding of the whole business process in departments and an overall understanding of the functionality of the ERP system that has been implemented. So the mechanism is to focus on the key user to transfer the knowledge and then the key user will conduct the internal training for the end users.

This important fact which is a common practice in small and many mid-sized companies have not been investigated by researchers yet and there is no model to address training methods to plan for such group. There is only one research stating that there is a possibility to conduct a training of ERP to the end users so that end user can implement the system without consulting. They validated the statement, however, as stated before they did not discuss the elements of the model. ERP training is not only an important area of research in the ERP systems for academicians, but it is playing an important role in the ERP Implementation and is a critical success factor of million dollar investments in the ERP, and its result has great potential to be applied in industry. This chapter aimed to provide a critical review of ERP Training models to shed some light on the past and present and at the end research gaps have been identified. It is suggested to for researchers to conduct more in a study in the areas to address the gaps with new training models and methods.

Concerning the first chapter, four main objectives are defined in this research project. The first objective of this research was to review the methods of ERP training and to identify gaps and problems. To achieve the first objective, this chapter aimed to provide a comprehensive literature review of ERP Training to shed the light on the past and present. In the end, research gaps have been identified, and suggestions has been provided to fill the gaps in this area. Also, this chapter served as a foundation for the next chapter that demonstrates the research methodology used during the rest of this research.

CHAPTER III

METHODOLOGY

3.1 INTRODUCTION

The purpose of this chapter is to provide a foundation for this research by building a research approach to address the model development and validation. This chapter provides an overview of the methodology used and divide this research into three phases.

3.2 RESEARCH APPROACH

In a highly cited article of determining validity in qualitative inquiry, Creswell (2000) suggested that a validation process in research can be conducted with the user of lens and paradigms assumptions. Table 3.1 shows the lens and paradigm assumptions.

Table 3.1 Validity procedure within lens and paradigm assumptions

Paradigm Assumption/Lens	**Post positivist or Systematic Paradigm**	**Constructivist Paradigm**	**Critical Paradigm**
Lens of the researcher	Triangulation	Disconfirming evidence	Researcher reflexivity
Lens of study participants	Member checking	Prolonged engagement in the field	Collaboration
Lens of people external to the study (Reviewers, Readers)	The audit trail	Thick, rich description	Peer debriefing

Source: Creswell & Miller 2000

Creswell (2000) suggests that validation needs to be done from three different lenses:

1. Lens of researcher who designs the model

2. Lens of the external reviewers

3. Lens of study participants of the research

At baseline, this research starts by reviewing the literature and by exploring the ERP market, leaders in the market and challenges in ERP project and the critical role of ERP training and how it can reduce the risk of failure. Then the research focuses on building a conceptual framework around ERP training, and it reviews major contributions in the past and their suitability to address ERP training in the context of this research needs that was defined in the problem statement and research questions.

Then, considering gaps found in the literature, this research explores the theories that can address the gaps. Using theories and methods in the literature, as the first phase, this research forms a training model that can address the gaps found in the literature. The model will be further described in details and with specifications.

In the next phase of this research, expert's opinion will be used to validate the model. As part of the validation process designing an interview questionnaire is needed to engage a group of ERP and training experts to provide us independent feedback and opinion by examining the model and its elements and main components.

In the third phase of this research, the author will then deliver an ERP training course using the developed model at UNU-IIGH. The focus of the short course will be on functional and technical applications and development of OPTIMIST® GNU Health®, a hospital information system. The facilitators of this short course will be selected among the international experts from UNU-IIGH in the field of health economics and case mix system, hospital information systems, hospital enterprise resource planning and business process in healthcare.

At the final stage of this research, in order to validate the model as an empirical research, two teams (with team members including technical and functional consultants) will be selected, to assess more in terms of their competencies after participating in the training for development of Hospital Information Systems, with

practical investigation (i.e.: via system functional and technical testing using industry standard specifications) and research activities to gain participants perspectives' on training effectiveness in their real project implementation over the period of 6 months support (by utilising the post training support component and supporting the teams via ticketing system). Figure 3.1 demonstrates the framework and related chapters that address the topic.

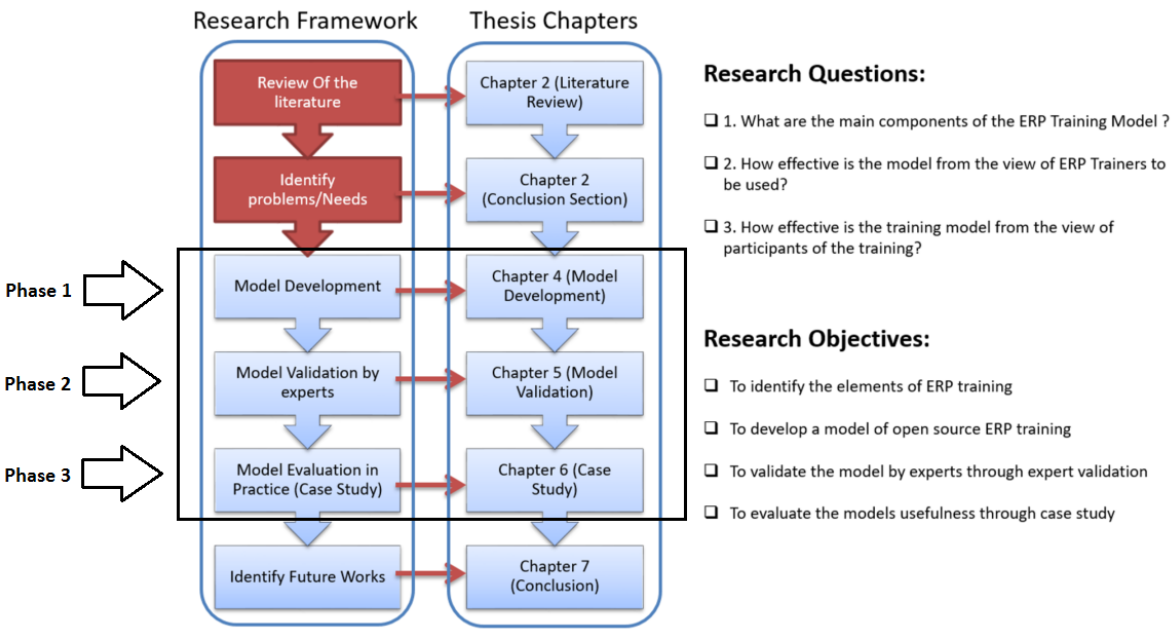

Figure 3.1 Research methodology and thesis chapters

In the next section, research phases will be elaborated with the data collection methods in details.

3.2.1 Phase 1: Model Design

Referring to the problem statement in Chapter 1, the goal of this research will be to explore training needs for open source ERP development and implementation, and develop a model of open source ERP training.

The first step in the design of the model is to list the gaps in the literature. Referring to the results of the literature review in Chapter 2, below are the gaps:

1. In-depth Training
2. Power Users
3. Workplace Project Based Learning
4. Short Term Training
5. Open Source ERP Training

The model will be developed by the researcher using a systematic method firstly by looking into the gaps found in the literature and then by defining objectives of the model and to use theories that can contribute to the new model components. Referring to Chapter 2, below are the learning theories to construct a model that can address model objectives and to fill the gaps:

1. Iterative Development Model
2. Training Cycle Model
3. Project Based Learning Approach

Figure 3.2 demonstrates the linkage between the objectives of the model and the theories that can contribute to the objectives.

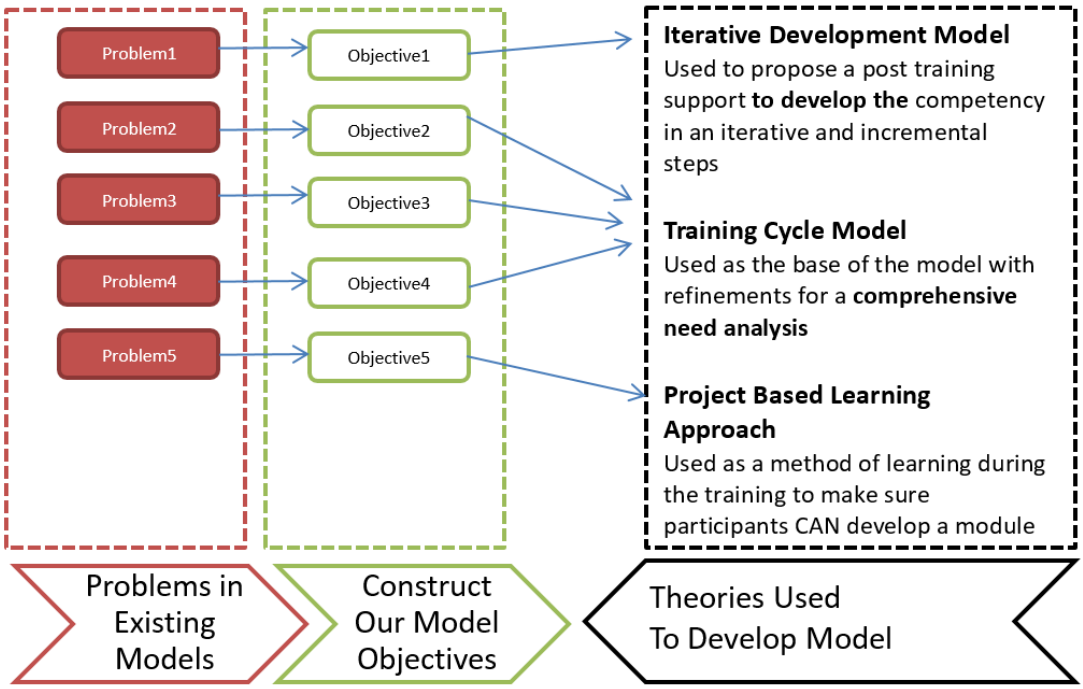

Figure 3.2 Mapping of learning theories to objectives of new ERP training model

The next step of this research is to validate the model. This is done in phase 2 of the research that is described in the next section.

3.2.2 Phase 2: Model Validation

Carson (1986) defined model validation as the process of ensuring that the model is sufficiently accurate for the purpose at hand. In this section, the validation process involved in validating of the new iterative project based ERP training model will be explained.

Creswell (2000) suggested that a validation process in qualitative research can be conducted with the lens of:

1. Researcher
2. Reviewers
3. Study Participants

To validate the model by reviewers, expert panel is used. Research instruments used in this research project are questionnaire in the form of interview as the main instruments. In regards to formulating a question to evaluate and examine the model against its objectives critically there are two common approach, open-ended interview questions or 5-point attitude scale. The literature recommends open-ended interview questions as a standard method to be used in research studies as they allow the expert to express his idea freely and to provide a informative feedback (Turner III 2010). However, in contrast, and in work similar to this research project, Dyba (2000) argues that 5-point attitude scale can be considered as the most reliable measure. |In this research project, the combination of both methods are used. So against each critical components and/or process that is designed to meet one or more objectives of the model, two categories of questions are provided in the interview questionnaire.

Steps are shown in Figure 3.3 which are similar to the process of works conducted by other researchers to validate their models through the expert panel (Beecham *et al.* 2005).

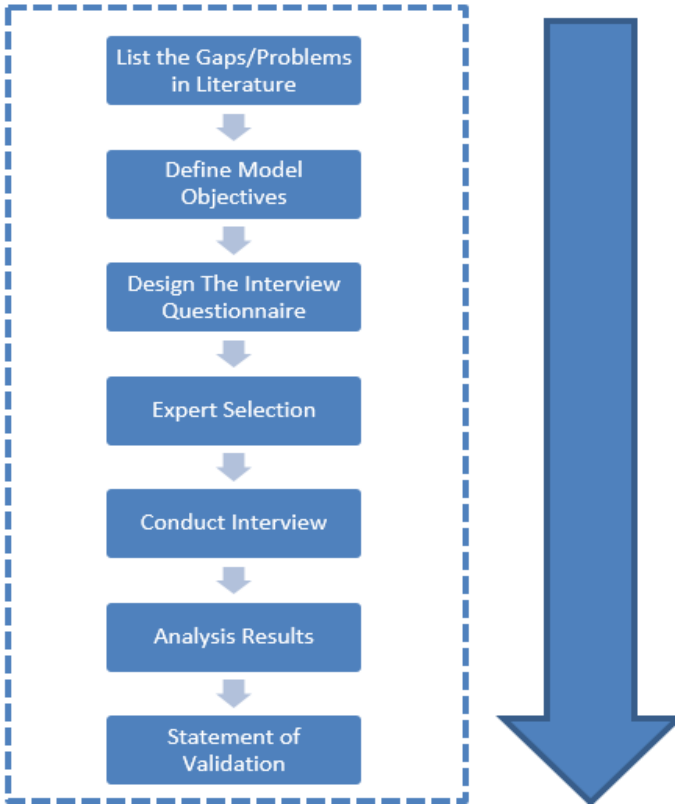

Figure 3.3 Model validation methodology in the research

a. Interview Questionnaire

As part of the validation process, an interview questionnaire needs to be designed to engage a group of ERP and training experts to provide us independent feedback and opinion by examining the model and its elements and main components. This section will explain how questionnaire is designed. Table 3.2 demonstrate the structure of the expert opinion interview questionnaire.

Table 3.2 Expert opinion interview questionnaire main structure

Section Title	Objective
ERP Training Model Expert Feedback	Greetings and set the objective of the meeting
Video Demonstration	
Introduction	Get basic information (name & email)
General Questions	Questions to make sure participant meets the selection criteria
Current Training Methods/Models You Use	Questions to ask about their current methods to make sure participant meets the selection criteria
Validity checking	A simple question that confirms participant at least watched the detailed video demonstration of the model to validate their answer
Model Demonstration	Questions to evaluate the model
Overall Feedback	Question to ask about their overall feedback and the rating on overall effectiveness of the model

To check the validity of the questionnaire in the general question section, questions were asked from participant to make sure they are selected from the sample size. In Section 5, it is asked about the current training methods or models experts are using in order to conduct ERP training for information purpose. In the section 6 confirmation was obtained from a participant about the model demonstration to make sure they watched the entire videos (either in an online meeting or offline demo videos). In section 7,8 and 9 critical questions against three main components of the system that was presented to the expert panel were asked.

In regards to formulating a question to critically evaluate and examine the model against its objectives there are two common approach, open-ended interview questions or 5-point attitude scale. Open-ended interview questions are recommended

by the literature as a standard method to be used in research studies as they allow the expert to freely express his idea and to provide more informative feedback (Turner III 2010). However, in contrast and in research projects similar to the work, researcher argue that 5-point attitude scale can be considered as the most reliable measure (Dyba 2000).

In this research project, a combination of both methods are used. So against each critical components and/or process that is designed to meet one or more objectives of the model, two categories of questions in the interview questionnaire are provided to address that.

The first question is an open-ended question about expert's opinion about the component of the ERP training model. The purpose of asking this open-ended question is to allow the expert to fully express his opinion and to provide his idea about the model based on his experience and viewpoint.

The second question is defined to be used as a summary of the expert's opinion from the evaluation of the component and process within that component. It is added to help the researcher to use it together with the first question in the analysis to evaluate the component and validate the role of the component against the objective that component and its process is targeting to achieve.

b. Sample Size

Regarding the sample size and unlike quantitative research, when the research tends to be more qualitative, it is typical that the focus is on the smaller size and to conduct an interview with a small number of experts (Creswell & Clark 2007). Determination of the total numbers depends on the research questions and parameters in the research study (Marshall 1996). However, as a rule, interview continues until saturation is reached.

A question to find out the magic number further investigated by author in a post in Researchgate® website (Motahar 2015) and findings from five academicians

confirmed that interview could be continued until the researcher realize that there is no new input from experts or simply, interview can be stopped when researcher analyses feedback and see that results that he gets are repeated input.

Therefore, by considering internal factors like research questions and purpose of the study (which is not knowledge gathering from experts but more on receiving feedback for the model validation) as well as external factors like resource availability and timeframe, the author decided to start with five experts and if needed to continue to ten.

The decision to interview ten candidates is similar in other research studies that employed qualitative expert opinion interview questionnaire. For a good example in a research study that was similar regarding methodology and border of this research questions, Washington (2009) stated that a number between 10 and 15 experts appears to be an appropriate range. Therefore, the sample size is set to be 10 to make sure that the sample size selection meets the requirements of the model validation.

c. Expert Selection

In total, 10 candidates are interviewed successfully. In order to make sure that the sample size selection meets the requirements of the model validation, certain criteria are applied to the selection process.

Participants in this research are planned to be from industry as well as academic. Since these two targeted groups have their own characteristics different strategies were used to run the campaign to find and shortlist experts. Table 3.3 lists down the different sourcing channels used to source experts.

Table 3.3 Experts sourcing channel

Experts	Social Networks	Search Engines
Industry Experts	LinkedIn ®	Google.com
Academic Experts	Researchgate ®	Scholar.Google.com