Agility meets Governance of Enterprise IT

(Focus on Enterprise Resource Planning post implementation phase)

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Abstract

Achievement of continuous competitive advantage in an ever changing business environment together with distinct advancement in technology, require enterprises to consider more efficient ways in their quick responding abilities and in their taking advantage of IT possibilities. Many studies confirmed the important role of Agility and IT/ERP governance in ERP post-implementation phase in this respect. Additionally it was found that agility affects ERP post-implementation phase in various ways and continuous improvement of this phase with customization and business process reengineering plays a vital role for an improved superior agility. Impact and influence of ERP systems in supporting business operations is significant, therefore the effect of post-implementation modification initiatives need to be closely examined. Since these influences of ERP PIP are not adequately studied, there is still gap in the literature regarding this (Oseni et al., 2014). This master thesis addresses the research problem about the lack of knowledge on how IT/ERP governance and agility influences ERP post-implementation phase.

To reach this goal, three research questions were identified and a review of the related terms of agility, IT/ERP governance, ERP post-implementation phase and business environment was performed through literature studies. The first question to find the current literature status of ERP post implementation with focus on IT/ERP governance and agility is answered by reviewing of existing literature relating to the topic as an essential first step and foundation when undertaking a research project (Baker, 2000). The second question to find the result about agility affect on ERP post implementation, a qualitative research approach known as Relational Analysis is performed on nine related articles of four selected online journals from last one year. Third question to find the influencing factors impacting the ERP post implementation regard to IT/ERP Governance or/and agility is answered by determining these factors through literature analysis performed on the various related literatures included in foundation. A conceptual research model based on the existing literature is proposed to provide a visual representation of the relationship between the involved concepts.

The outcome of the first research question is a table, which summarizes the main literatures topics, focus, and literature support. Outcome of second research question

support the mutual promotive relationship between ERP post implementation and agility. Outcome of third question is list of influencing factors impacting ERP post implementation regard to IT/ERP Governance or/and agility. Finally a revised conceptual model is derived to visualize the interpretations of the findings of the research. The findings of the research could be important theoretical contributions to the body knowledge of business information systems. The research has bridged the knowledge gap among agility, IT/ERP governance and post implementation, in relation to the way on how they influence ERP post implementation. This research has specific focus on ERP post implementation with regard to agility and IT/ERP governance.

Keywords: Agility, IT/ERP Governance, ERP post implementation, Dynamic business environment

Foreword / Acknowledgements

We want to thank the following people for their support and help during the Practice Oriented Research Proposal. They all have been important facilitators in the process of setting up the paper and we are grateful for their encouragement and backup.

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1. Introduction

1.1 Problem Statement and Motivation

Many enterprises now days work in a complicated and dynamic business environment, with the goal to improve profits, decrease internal costs, increase market percentage, apply the changes in business processes due to changing environment, and output optimisation of internal resources by implementing state of art integrated business applications (Gede Rasben Dantes, 2011). Due to these factors many companies are implementing Enterprise Resource Planning (ERP) applications to achieve the defined business goals.

ERP systems are packaged suites of application software, which are capable of fully integrating business processes, and are selected for business process integration, management of enterprise and optimisation (Grabski et al., 2011). After implementation, ERP systems need post implementation modifications to maintain, update, and further align the system with the organization's functions and strategies (Oseni et al., 2014). Modification in ERP post-implementation phase (ERP PIP) includes all forms of maintenance, enhancements and upgrades (Cao et al., 2010). Since significance of ERP systems in supporting business operations is high, therefore the impacts of post-implementation modification initiatives need to be closely examined. As the impacts of ERP PIP are not adequately studied, there is still gap in the literature regarding this (Oseni et al., 2014).

In this research influence of agility and IT/ERP governance on ERP PIP is examined through literature analysis. Recently in most literature businesses agility is a key concept. In order to survive organization needs to quickly and constantly adapt to the changes in business environment (Guldentops & Ataya, 2014). IT Governance is claimed to have an essential role in delivering superior agility, implying that, the managerial IT capabilities are more important for the responding capability than the technical capabilities (Tallon, 2007).

Therefore motivation and objective of this research is to fill this gap and analyze the ERP PIP in depth by literature analysis with a focus on agility and IT/ERP governance. Current status and influencing factors of this relationship is established with foundation

of relevant literatures and then a relational analysis to find out the agility influence factors in ERP PIP.

The detail structure and organization of this research is provided in sub-section 1.4.

1.2   Research Goals and Questions

This work will examine the ERP PIP effect based on literature review and online journals to enhance the in-depth understanding about the ERP PIP and the influence of IT governance and agility. The main focus will be on ERP governance as a part of IT governance and the role of agility especially in ERP PIP. This will be achieved by analysing various levels of ERP governance and the role of agility in the ERP PIP. The goal of this thesis is to contribute to ERP PIP research. There are various papers to determine the importance of IT/ERP governance in ERP PIP and other papers determining the importance of agility in the same. This paper tries to collect these relevant literatures and provides the recent status of these influences on ERP PIP. Then some of the relevant indicators to measure the influence of agility in ERP PIP are derived.

In summary this thesis work will provide details about influence of IT governance and agility in ERP PIP through various literatures study and try to answer the selected research questions.

The thesis work will contribute to current ERP research by answering following research questions (based on literature):

1. What is the current status of the ERP PIP with focus on IT/ERP governance and agility in literatures? (RQ1)
2. How does agility affect ERP PIP? (RQ2)
3. What are the different factors impacting the ERP PIP regard to IT/ERP Governance or/and agility? (RQ3)

To answer these questions, a literature review and relational analysis was initiated. In the next sections the research method and the roadmap of the thesis are explained.

1.3   Research Methods

In general there are two research paradigms in information systems (IS) research: design science and behavioral science (Commandeur, 2009). Design science paradigm is originated from engineering disciplines and it is a relative young discipline, while behavioural science has its origin from natural science research methods and is quite old in practise. Where design science helps to create innovations and aims at utility, the behavioural science helps to develop and justify theory therefore in this research behavioural science is chosen as guiding principle. In the latter case there are three main types of research approaches, namely quantitative and qualitative and mixed. Quantitative research relies primarily on the collection of quantitative data, qualitative relies primarily on the collection of qualitative data and mixed require the mixing of quantitative and qualitative methods (Johnson & Christensen, 2012).

As the purpose of this research is to answer the questions that lead to an explanation regarding influence of IT/ERP governance and Agility on ERP PIP, combination of both qualitative and quantitative method will be used. The qualitative method is used to answer the first and third research question since it is mainly relies on document studies and quantitative method is used indirectly in the relational analysis for answering the second research question. It is considered indirectly because the process of collecting data involves qualitative data that are quantified to get descriptive measurements like frequencies. Therefore this mixed method endorse the exploratory and explanatory nature of the research and also supports the employed interpretive philosophy (which is discussed in chapter 2).

1.4   Roadmap

In this section a brief description about the chapters and thesis structure is provided.

Introduction: the first chapter presents the envisaged problem along with topics including thesis statement, research goals and questions, a brief description about the intended methods and thesis roadmap.

Methodology: This chapter provides a detailed description of the research design and methodology, which lead to answer the research questions. It also provides reasons for why a specific choice is selected.
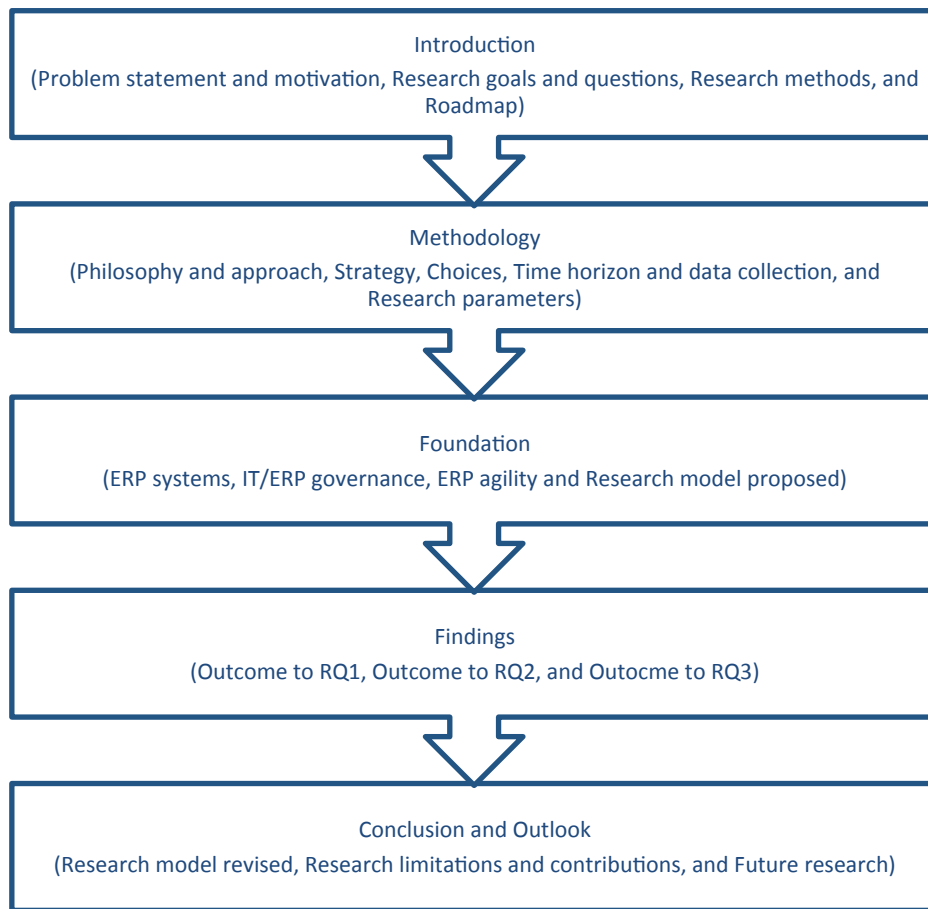
Foundation: The third chapter provides explicit explanation of all the relevant terms of references to find the answers of the chosen research questions. This chapter is created to provide theoretical foundation based on all the relevant literatures for this thesis work and effective description of all the literature related to research questions and provide the current status of it.

Findings: In this chapter the answers to the chosen research questions are provided with detail explanation. First a summary of all the literature source used in chapter 3 is provided with their corresponding research focus to show the current status of ERP PIP with focus on IT/ERP governance and agility (RQ1). To answer the RQ2, summary results of relational analysis are provided with help of bar charts and consolidation of the findings. For RQ3, based on the foundation of literature review of chapter 3, a summary of various factors influencing ERP PIP with focus on agility and ERP PIP are provided.

Conclusion and Outlook: This chapter provides a conclusion to the thesis including its finding and implications to the interested academician and practitioner. A revised research model is provided based on the findings, and in the end a further research outlook is provided, which may provide the insight for future studies in this area.

Road map can be summarized in figure 1. The map visualizes the research process to provide an overall view and a better tracking to the path taken in the research from introduction through methodology until conclusions.

Figure 1 Research map for thesis

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┌─────────────────────────────────────────────────────────────────────┐
│                            Introduction                               │
│  (Problem statement and motivation, Research goals and questions,     │
│                     Research methods, and                             │
│                           Roadmap)                                     │
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                                 ↓
┌─────────────────────────────────────────────────────────────────────┐
│                            Methodology                                │
│  (Philosophy and approach, Strategy, Choices, Time horizon and data   │
│                     collection, and                                   │
│                     Research parameters)                              │
└─────────────────────────────────────────────────────────────────────┘
                                 ↓
┌─────────────────────────────────────────────────────────────────────┐
│                            Foundation                                 │
│  (ERP systems, IT/ERP governance, ERP agility and Research model      │
│                          proposed)                                    │
└─────────────────────────────────────────────────────────────────────┘
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┌─────────────────────────────────────────────────────────────────────┐
│                            Findings                                   │
│  (Outcome to RQ1, Outcome to RQ2, and Outocme to RQ3)                 │
└─────────────────────────────────────────────────────────────────────┘
                                 ↓
┌─────────────────────────────────────────────────────────────────────┐
│                       Conclusion and Outlook                          │
│  (Research model revised, Research limitations and contributions,     │
│                     and Future research)                              │
└─────────────────────────────────────────────────────────────────────┘
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2. Methodology

In order to conduct a successful and sound research, it is necessary to use a clear systematic research design. Therefore the way in which this research is conducted may be conceived of in terms of layers that are depicted in figure 2 of the research onion developed by (Saunders et al., 2009).

The purpose of a research study can be classified into categories, namely exploratory, descriptive and explanatory (Saunders et al., 2009). Therefore answers to a research questions may follow either one or a combination of these categories. According to Saunders et al. (2009) exploratory research is a important way of finding out what is happening; to seek new insights; to request questions and to determine development. Hence there are three principal ways of conducting exploratory research: a literature search, 'experts' interview in the subject, and organizing focus group interviews.

As its name indicates, a descriptive research seeks to provide an accurate description of observations of phenomena. According to Saunders et al. (2009), it is important to have a correct idea of the situation in which the author want to collect data before starting the collection of the data. The third category, the explanatory research, looks for explanations of the nature of certain relationships that is, it provides a clearer view of the relationship. It is sometimes referred as casual research for it is conducted to identify the cause and effect relationship (Zikmund, 2013). According to (Zikmund, 2013) the degree of uncertainty about the research problem determines the research methodology. This can be presented in the table 1 below.

Table 1 Research approaches on the basis of degree of uncertainty in the research problem (Zikmund, 2013)

	Exploratory Research (Unaware of a problem)	Descriptive Research (Aware of a problem)	Explanatory or Casual Research (Problem clearly defined)
Possible Situation (Examples)	- Our ERP PIP performance is declining and we don't know why"? - Would people be interested in our new product idea?"	- What kinds of people are buying our product? Who buys our competitor's product?" - What features do users prefer in ERP system?"	- Will performance of ERP PIP improve by applying new updates? - Which of two advertising campaigns is more effective?"

With these provided classification, the purpose of this research is defined to have a mix of both exploratory and explanatory path, as it tries to look for status of the ERP PIP with focus on IT/ERP governance and agility, and tries to explore various factors of

agility affecting ERP PIP. This exploratory research gives new insights and come up with a list of factors that affect it, so it is both relevant for research (rigor) and for practitioners and researchers in the field of business information systems (relevance).

According to (Saunders et al., 2009) the research design could be designed in layers so called "research onion". This could be depicted in the figure 2. The outer most layer mean the chosen philosophy, followed by the research approach, then layer of research strategy, research method, time horizon of the research and in end data collection layer. In the next subsection a brief description of each layer and the intended choice for the planned research is discussed.

Figure 2 The Research Onion (Saunders et al., 2009)
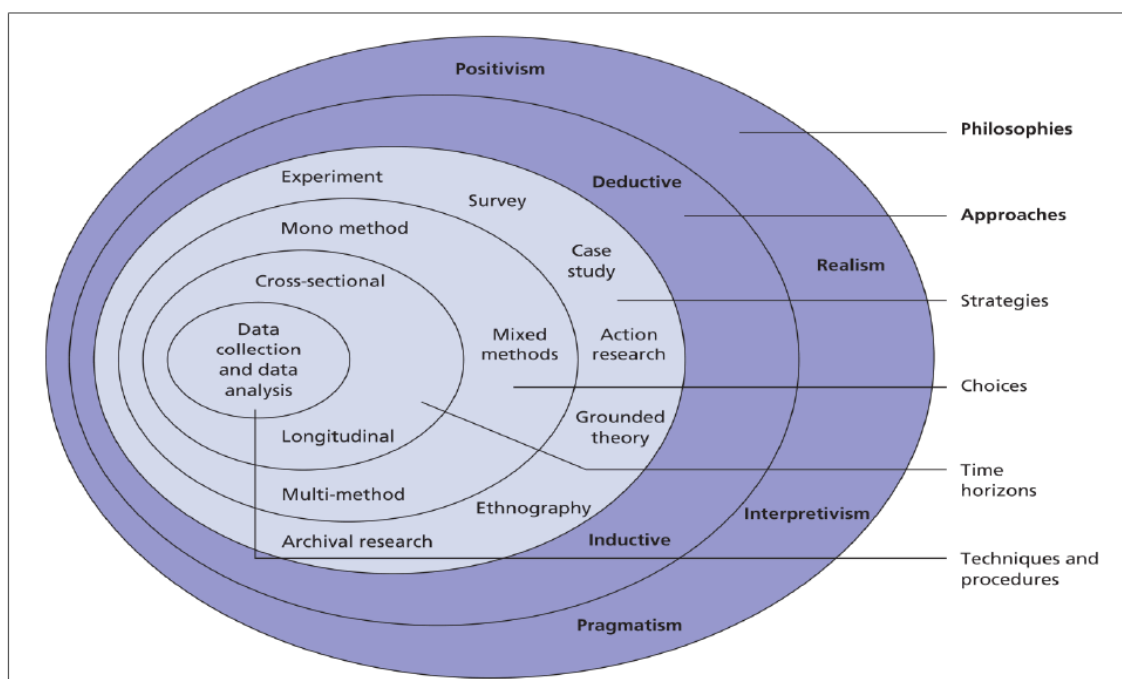
2.1 Philosophy and Approach

Adopting a philosophy is an important part in the research methodology as it ensures that research data is collected in an appropriate and effective manner (Williams, 2011). In accordance with Saunders (2009) it is divided into:

Positivism: This describes the philosophical stand of the natural scientist. This requires working with a detectable social reality and the final product can be law-like statement identical to those in the physical and natural sciences (Saunders et al., 2009).

Interpretivism: Here researchers start out with the assumption that access to reality is only through social constructions such as language, consciousness and shared meanings. In general it attempts to understand phenomena through the meanings that people assign to them. Using this philosophy the researcher does not only interact with environment but also seek to make sense of it through their interpretation of events and the meaning that they draw from them (Williams, 2011).

Pragmatism: It is a position that makes argument that; the most critical determinant of the research philosophy considered is the research question, due to the possibility of working within both positivist and interpretivist positions (Saunders et al., 2009). According to pragmatism, the research design should be planned and conducted based on what will best help you answer your research questions; the result is pragmatic knowledge (Johnson & Christensen, 2012).

Realism: This relates to scientific enquiry and also what the senses show us, as reality is the truth. This philosophy defines that how individual react towards a real world situation (Johnson & Christensen, 2012).

The philosophy that is selected for this research is the interpretive philosophy as it interprets the social world. It is also applicable in interpreting the behavior of the humans or enterprises that fits the elements of sensitivity, resources fluidity and leadership unity that enable the Agility.

According to (Saunders et al., 2009), research approaches are of two types: the inductive and the deductive. The inductive approach starts with data collection and then formulates some tentative hypotheses (research questions/goals), which can be explored, and finally ends up developing some general conclusions or theories. The deductive approach may how IT/ERP Governance and agility influences ERP PIP begin with a theory about a topic of interest and then narrowed down into more specific hypotheses (research questions/goals) that can be tested.

In this research the inductive approach is followed. The reason for choosing this approach is because the work starts by gathering the information about the topic from the related IS literature. The goal is to identify possible patterns pertaining to the relationship between IT/ERP Governance and Agility influencing ERP PIP. This is

analyzed and finally advances to develop a final conclusion with a research model and a list of factors that affect the nature of this relationship.

2.2   Strategy

The research strategy is a general plan about how the research questions are going to be answered. According to (Saunders et al., 2009), the most common strategies that are employed in a research include experiment, survey, case study, action research, archival research, design research, grounded theory, and ethnography. It is also mentioned that these strategies should not be considered as mutually exclusive but the research question(s) and objectives, the amount of current knowledge, the extent of time and other resources leads to its selection.

The main research strategy for this thesis is based on literature review. Goal of the literature review is to identify the sources and content related to the topic and to evaluate the relevance and rigor of the research.

Rigor indicates normally to the intellectual quality of a research and the degree to which the requirement of the research are backed by the research design and analysis (Otten, 2010). Nevertheless, the assessment of rigor is not an objective process rather it is determined with the connection to a set of standards prescribed by the research community that form scientific understanding (National Research Council, 2002). In this research rigor is applied by using scientific research approach and design, and traceability with set of standard practices.

On the other hand relevance has to do with the amount to which a research consider a problem faced by a particular group of people or the extent to which it is practically applicable in the reality. In short, relevance is defined with respect to a particular situation, but not for general relevance to all (Otten, 2010). Therefore, this research is relevant because it directly addresses issues related to ERP PIP (in a specific situation).

The research begins by gathering and reviewing the literature about IT/ERP governance and agility in ERP PIP. Thereafter the research questions were identified. Based on the literature review, a conceptual model is developed for providing a visual view to the relationship among the concepts. To identify relevant literature for developing a through conceptual model and for the collection of the data, search engines like Network of

Libraries and Information Centers in Switzerland (NEMBIS), IEEE Xplore, ACM digital Library, Gartner, Forbes, Springer, Google scholar and Google are used.

The next step is to answer the research questions. To answer the first research question related to current status ERP PIP with focus on IT/ERP governance and agility is done by reviewing of existing literature related to the topic as an essential first step and foundation when undertaking a research project (Baker, 2000). To answer the second research question, a qualitative research approach known as Relational Analysis is performed. Relational Analysis is a content analysis that begins with the act of identifying concepts present in a given text or set of texts to go beyond presence by exploring the relationships between the concepts identified (Colorado State University, 2011). Third question is answered by literature analysis of the selected literatures to determine the influencing factors of ERP PIP with focus on IT/ERP governance and agility. In summary the research strategy employed for each of the three research questions (RQ) of the research can be summarized in Table 2. In the table it is shown that, an archival research approach is applied for answering the first and the third research questions, and a relational analysis approach is used for the second research question.

Finally the outcome will help in drawing conclusions about the relationship among the concepts under the study and propose further research prospects in this area.

Table 2 - Research question approaches

Approach	Research strategy characteristics	*RQ1	RQ2	RQ3
Archival Research	Acknowledge research questions which focus upon the past and adjustment over time to be answered	X		X
	Makes use of recent and historical documents as the principal source of data.	X		X
Relational Analysis	Study of written documentation or texts		X	

* Research Question

2.3   Choices

While designing the research, the important choice is to be made: whether to use quantitative method/methods, qualitative method/methods, or a mixture of both? Researchers may adopt to use either a mono method quantitative design (for example, data collected through a questionnaire and statistically analyzed) or a mono method qualitative design (for example, data collected using in depth interviews and analyzed as narratives), which is a single data collection approach and corresponding analysis methods. Otherwise, they may adopt multiple methods. Using multimethod quantitative designs the researcher has more than one quantitative data collection approach (for example, both using questionnaire and structured observation) with related statistical analysis methods. Using multimethod qualitative designs more than one qualitative data collection approach (for example, both in-depth interviews and diary accounts) is adopted with corresponding analysis methods. A mixed methods design integrates both qualitative and quantitative data collection approaches and analysis methods (Saunders et al., 2009). As mentioned in section 1.3 in this research, mixed method is used to answer the research questions.

2.4   Time Horizon and Data Collection

Before reaching the core of research onion, the final layer is time horizon over which the research is undertaken. Since this thesis is carried out at particular time duration from March 2014 to November 2014, the chosen time horizon is cross-sectional (Saunders & Tosey, 2013). It is important to consider this time frame and corresponding results achieved.

An important aspect for conducting a research is data collection. Data are of two types namely primary and secondary data. Primary data are first-hand data, collected specifically for the intended research. The secondary data is to use those already collected data for some other purpose (Saunders et al. 2009).

Primary data are mainly collected using one or more of the following (University of Surrey, n.d.):

- Interviews (face-to-face, telephone or computer assisted)
- Questionnaires (paper-pencil-questionnaires or web-based questionnaires)

- Observation

Secondary data are mainly collected using following (University of Surrey, n.d.):

- Online journals
- Web sites
- Conference proceedings
- Electronic magazines

Since this research is literature based hence it depends mainly on the secondary data, which can be derived and narrowed down to mainly online academic databases, online journals, conference proceedings and websites. Recognized experts in their respective fields of study composed these sources. The content and value of general sources of little academic value are not considered and applied in this research. Here the Scholar Google is the exception, which searches academic databases sites and give results having high degree of relevance to the proposed search term.

2.5   Research Parameters

In this section the methods of obtaining the data from the different sources are addressed. These include: a) Search strategy. b) Key search terms. c) Evaluation criteria. d) Data analysis plan

A. Search strategy

The general approach of collecting data and literature, which are relevant to this study, focuses on IT/ERP governance, agility and ERP PIP. Hence the search relied on those terms/ arguments pertaining to these content areas. It might be possible that some of the results based on selected keywords or arguments are not relevant to the research questions because they are originally used for other studies. Therefore an evaluation criteria is employed to avoid such irrelevance. The search engines and databases used for answering the first question on what is the current status of the ERP PIP focus on IT/ERP governance and agility in literature is chosen by taking into account the newness, authority and relevance of data that it may contain. The used databases, search engines and journals include following:

Databases and search engines

- ACM digital Library
- IEEEXplore
- CiteUlike
- Google Scholar
- Google
- Network of Libraries and Information Centers in Switzerland (NEMBIS)

Online Journals

- MIS Quarterly
- Management Decision
- International Business & Economics Research Journal
- IBM Systems Journal
- Industrial Management & Data Systems
- International Journal of Engineering and Management Research
- International Symposium on Information Technology
- Long Range Planning
- Journal of Business Strategy
- Harvard Business Review
- Information Technology and Management
- Conference proceedings

With respect to the second question on how does agility affect the ERP PIP; an up-to-date understanding about the relationship between the concepts of agility and ERP PIP appears to be necessary. This is due to the fact that volatile business environment, ability to sense, shape and respond to changing needs, emerging opportunity in business and unprecedented threats, may affect the course of this relationship (Seethamraju & Sundar, 2013). Since there not sufficient knowledge available regarding how agility influence on ERP PIP (Seethamraju & Sundar, 2013), therefore searching opinion and reading in social platforms (like blogs) is very difficult. So in the further step the content is broaden but the source of search is narrowed down, with a depth analysis within the top-ranked selected online journals (Podsakoff et al., 2005). The chosen online journals based on the evaluation criteria are:

- ACM Journals (available at http://dl.acm.org)

- Emerald Insight (available at http://www.emeraldinsight.com/)

- ISACA (available at http://www.isaca.org)

- ScienceDirect (available at http://www.sciencedirect.com/)

Table 3 summarizes the search made on these four selected online journals. The search was made on journal articles with the main search word "agility", "ERP post implementation" and newness from last one year (2013 and 2014).

Table 3 Search results in online journals

Online Journals	Results meeting the keyword "Agility"	Results meeting the keyword "ERP post implementation"	Result meeting the keyword "Agility and ERP post implementation"
ACM Journals	462	43	2
Emerald Insight	342	42	3
ISACA	28	22	0
ScienceDirect	1558	743	4
Total	2390	850	9

In the third column of table 3, the selection is based on relevance to both agility and ERP post implementation inside the selected online journals article. In table 3 it is shown that the results meeting this predefined criteria are very less compare to total number of results, since most of them do not satisfy the required criteria of newness and meeting both keywords "agility" and "ERP post implementation"

B. Search key terms

For searching database selected keywords are used in order to answer the research questions. They are obtained from the conceptual model with the focus of achieving the purpose of the study. The selected keywords are:

- ERP post implementation
- Agility and ERP post implementation
- IT Governance and ERP post implementation
- ERP Governance and ERP post-implementation

Terms were searched individually and in a group and the resulting articles were then examined and analyzed. The operator "AND" was used to group search.

C. Search evaluation criteria

The criteria, which are considered and checked in order to provide plausible source of data, are following:

- Background information considering reputation of the author and/or publisher for the searched article, which means only published article from selected database and search engines which are recommended by university library are considered.

- Relevance of the reviewed online journal to the research questions and the study purpose, which means the content of the journal, is somehow relevant to the research questions.

- The published work date to consider only the recent ones. It should be at least within the last 10 years and one year at maximum for online journal articles.

- Open access of the article (with university credentials) and its contents without any additional costs.

The process of analyzing these articles is performed manually by reviewing each article at a time with search function.

D. Data analysis plan

In this research the literatures and data are analyzed and organized in three phases. In the first phase, the first research question is dealt by analyzing literatures related to ERP PIP, IT/ERP governance and role of agility in ERP PIP. The relational analysis is served as the input to second phase, dealing the second research question, which tries to find agility related indicators affecting ERP PIP. In this phase a relational analysis approach

is applied. In the third phase, the third research question is covered which in turn dependent on the result of literature analysis of first questions.

In figure 2, the four phases of research parameter are shown.

Figure 2 Research parameter four phases

3.   Foundation

In this chapter, previous research works are reviewed. For the research work the main focus is on the role of IT/ERP governance and Agility in the PIP of an ERP system. The literature review concentrates on existing research and various journals covering topics related to IT/ERP Governance, ERP Agility and roles they play in ERP PIP.

Considering the research questions the literature review is divided into various sub sections based and ordered with regard to the main focus areas from this research. In the first section the ERP Systems, its benefits, implementation life cycle and ERP PIP is described. This is followed ERP/IT governance, where its influence on ERP PIP is analysed with its benefits, market, description of level of its implementation and comparison of various available frameworks of ERP systems. Then in next section ERP agility, role of agility in ERP PIP is described, in which the dynamic market environment is compared with "not very flexible ERP systems" and how the ERP systems could be adapted to the changes by adopting or customizations according to the changes in business process and requirements. Change requests and customisations of an ERP systems and role of ERP vendor/suppliers play a very important role in ERP PIP and it is described in the sub sections.

3.1   ERP Systems

Due to globalization and high competition, ERP solutions are necessity of the most of the small, medium and big enterprise (Park & Lee, 2006). These systems are integrated information systems, which support management of resources and business processes in the organization. ERP systems also integrate various business units together. Also the main expectation for an ERP implementation is to provide the best possible benefits for the organization operations (Dantes et al., 2012).

ERP system combines the business processes of department functions and departments into single unified system. Various software and hardware components supports different business processes in this integrated system. The business processes are combined together into various models and different ERP components are designed in such a way that each software component can support independent models. Finally

these models are combined to form a unified view, which could lead to usage of the organization or enterprise database (Ganesh et al., 2014).

ERP system could also be described as state-of-the-art information system, which improves the enterprise operations and competition quality by removing data redundancy and work and business process improvements (Amid & Kohansal, 2014). ERP systems are used by managers due to various reasons, like cost reduction, enhancement in productivity, improved management of customer relationship, better operation effectiveness and larger chain management (Beard & Sumner, 2004).

3.1.1 Benefits

The main benefits of using the ERP systems are creating integrity in the business process, access to authorized data and the business process in the organization, and real time data creation (Render & Heizer, 2008). The other advantages of using ERP system: for the enterprise it's possible to integrate its complete business activities in order to enhance the capability and competitive effectiveness (Gupta & Kohli, 2006).

SAP ERP is a global, completely integrated application, which satisfy the core business requirements of midsize and large organizations across all industries and market sectors. With the help of this application, companies could perform its financials, human capital management, procurement and logistics, product development and manufacturing, and sales and service, which are supported by analytics functionality, corporate services, and end-user service delivery. It not only improves the organization efficiency but also extend end-to-end business processes to the customers, partners, and suppliers (SAP AG, 2008). Due to global presence, market leadership position (according to section 3.1.2) and importance of SAP business application, some key benefits of SAP ERP are considered and summarized in table 4.

Table 4 ERP System benefits (SAP AG, 2008)

Activity	Benefits
Increased productivity	• Cost control is improved through integrated management of key business processes across the organization • Operational efficiency is improved by extending the business processes reach throughout and beyond the enterprise • Faster response to market changes and challenges from competitors
Reduced costs through increased flexibility	• By using enterprise service-oriented architecture, process standardization, efficiency, and adaptability are improved • Provide possibility to access transactions, information, and collaborative activities across a large business community • Addition of required functionality as needed to support changing business requirements
Optimized IT spending	• Reduction in IT costs using tight integration and optimizing core business processes • Reduce capital expenses by eliminating the need to purchase third-party software • Costs reduction by standardizing enterprise software on a single integration platform • Business expansions are faster and more cost-effective by reducing the complexity of managing homegrown or heterogeneous software applications
Faster, higher ROI	• Applying faster implementation methods that cost less than half of traditional approaches cost • Access to needed functionality is faster using preset defaults and prepackaged, industry specific versions • The value of existing software investments is improved by increasing their use throughout the enterprise

3.1.2 Market and Evolution

There are a number of products in the ERP market. A few popular ERP products, which are widely used, are Microsoft Dynamics, Oracle, SAP, Siebel and PeopleSoft. PeopleSoft has been later taken over by Oracle; however, there are many organizations that use for example PeopleSoft as these have been installed before (Ganesh et al., 2014).

Ganesh et al., 2014 stated that while comparing the various available ERP systems, the inclination is to consider the application costs and features provided by them. In recent

times for Chief Information Officer (CIO), the total cost of ownership (TCO) is used as the main criteria for this comparison. TCO consists of costs such as: software or license, hardware, annual maintenance contract, training, implementation and customization, and acquiring special skills. With these criteria in consideration, the various ERP vendors are inclined to develop products, which optimized the cost experience for the customers. In figure 3, latest statistics of ERP market share is shown; the statistics is based on Columbus (2014), an independent market researcher covering most of the market leaders in ERP systems.

Figure 3 Statistics of ERP market share (Columbus, 2014)
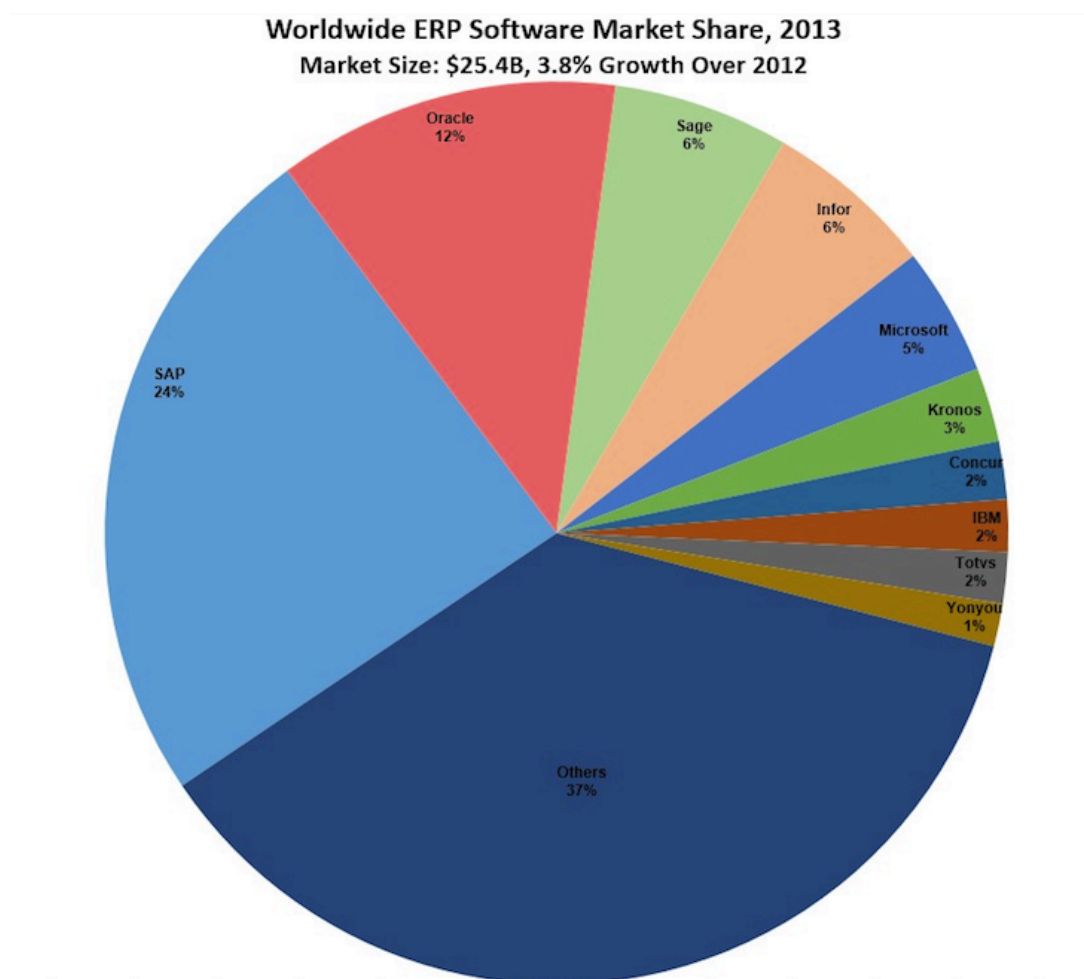
Based on the figure 3, the following key points could be concluded (Columbus, 2014):

a. The worldwide ERP software market increased by 3.8% from $24.4B (Billion) in 2012 to $25.4B in 2013

b. SAP holds the market leadership position in 2013, holding 24% of the ERP software market. Oracle is second with 12% share of this market. Sage and Infor are third and fourth respectively with 6% share, and Microsoft is fifth with 5% of market share.

3.1.3 Life Cycle

ERP implementation walked through the transition from legacy systems into ERP systems. The emphasis is on the process change instead of change in technologies (Guido Capaldo, 2009). Legacy system is referred to out-dated computer systems, programming languages or application software, which are still in use instead of newer upgraded versions (Janssen, 2011).

In this section various steps of ERP implementation life cycle are described based on recent literatures. In accordance to (Gede Rasben Dantes, 2011) the five steps involved in the ERP implementation life cycle are: project preparation, technology selection, project formulation, implementation/development and deployment. Following are the detailed description of these five steps (Dantes et al., 2012):

i. Project preparation – this step consists of defining the project goals and its objectives, calculating project budget and defining the timeline, establishing the enterprise maturity levels, if required considered also the business process reengineering, determining the information technology (IT) financing and investigating the current information systems/ IT infrastructure in use, etc.

ii. Technology selection – this step includes technology selection for example considering right ERP software application, database, and hardware required to support the ERP application. This also includes selecting the right approach and action plan for the ERP implementation, and creating the project team & steering committee with matching skills.

iii. Project formulation – in this step the business master plan is drawn that could be used in creating functional necessity, and creating strategy for implementation & development.

iv. Implementation/ Development – in this step configuration and customization is done to make the ERP system running in production environment.

v. Deployment / ERP PIP – here the system stabilised, errors are resolved, support to users and ERP system maintenances are performed, reports generation, upgrading, adapting systems (customization) to changes in business processes and day to day operations.

Law et al., 2010 states it is very important to have a successful ERP implementation in order to have the competitive advantage for the enterprise adopting the ERP systems. Beside installation of ERP systems, the competitive advantages cannot be achieved without proper maintenances of the ERP systems and adapting it to changing business requirements. The ERP support and maintenance activities can be realised by improvement in its quality and increase in the life span of ERP systems. The better the quality of ERP PIP the better will be the chances for an enterprise to achieve the competitive advantage.

For a good quality of PIP there are several critical success factors (CSF), which influences ERP PIP. (Ram et al., 2013) CSF could be defined as a tool to identify management's information requirements and strategic priorities.

Some of these CSF for successful ERP PIP are listed below (Law et al., 2010):

- **Implementation Strategy (CSF 1)**: vanilla approach having minimal allowed customizations and if its necessary then only with strong justification and by approval of senior management.
- **Organization & Infra-structure (CSF 2)**: clearly defined roles and responsibilities for operation and support of ERP PIP activities. Also to have documented procedures, guidelines, and automated helpdesk systems, working together with organizational units and providing the right environment to the stakeholders to do their jobs.
- **Client–Vendor alignment and co-operation (CSF 3)**: ERP PIP strategy should be aligned to the vendor's services and its product strategies and practice.
- **Support & Participation (CSF 4)**: Different measures to increase level of support and participation by the stakeholders.
- **Ability to influence ERP expertise from various Sources (CSF 5)**: ERP PIP strategy should be supported by use of various sources of ERP expertise to protect against the turnover of IT employees.

- **Communication & Co-ordination (CSF 6)**: organizational structures should be conducive for the improvement in communication and co-ordination at all levels among various organization functional units.
- **ERP PIP strategy and focuses (CSF 7)**: to emphasize the organizational strategic focus together with operation.
- **Quality of ERP implementation (CSF 8):** stable and highly usable ERP system is critical for the effective performance of ERP PIP operation.

In figure 4 all CSFs and its influence on successful ERP PIP is shown.

Figure 4 A framework of CSF of ERP PIP (Law et al., 2010)
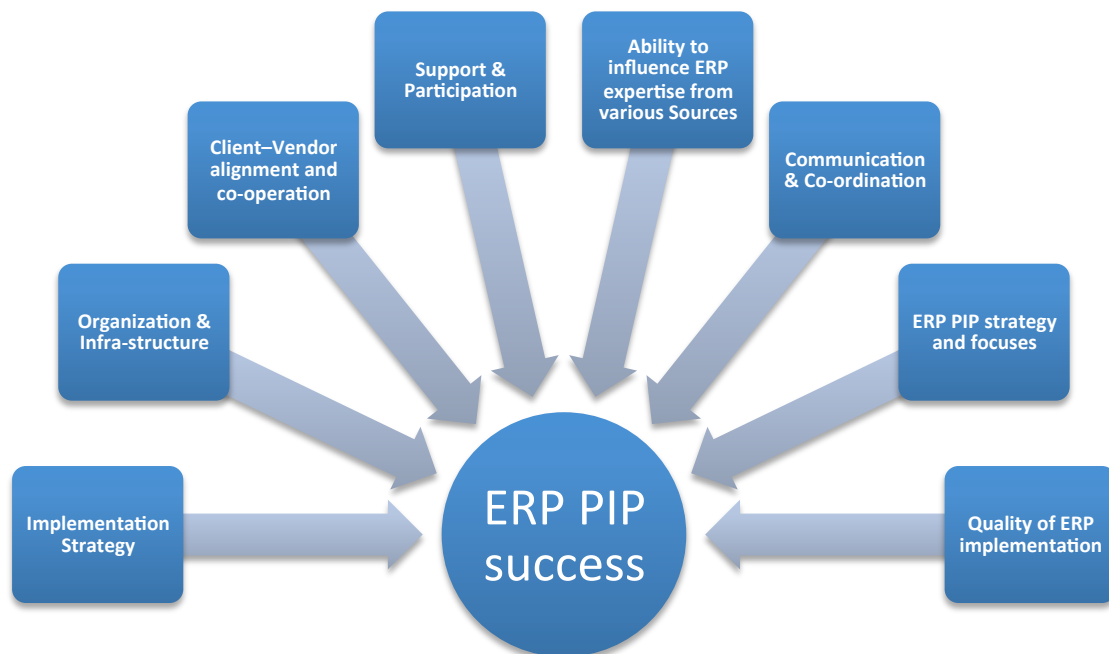
Implementation of the ERP is very complex since this information system influences practically all the employee and process in an organization (Usher, 2010). According to (Khanna & Arneja, 2012) the ERP implementations are normally one of the biggest IT investments considered by an organization. These implementations costs can easily increase to very high amount and it can be even more than the cost of the ERP software itself, so to lower down these implementation costs the right measures, like a concrete ERP strategy could have meaningful cost saving impact which can significantly increase the ROI (Return on Investment) (Khanna & Arneja, 2012).

Therefore IT governance of the ERP systems is very important (Usher, 2010). To realize this importance, IT governance audit in ERP PIP is useful in order to ensure that the benefit realization happens in tangible, measurable and qualitative ways, the alignment with the business objectives achieved, the service to the users is improved and the risks are mitigated. This audit should evaluate whether the ERP include all the key processes and locations, as required in scope, and the impact of changes to business processes with a view to see if productivity increased. Additionally it should make sure that ERP system delivers the promised levels of uptime and response to user problems. This audit would also cover the method of computing the service level agreement (SLA) metrics and their steadiness. Here the main focus is on two important areas of governance: the alignment to the business and the benefits recognition. The documentation of the expectations and objectives at the early stage together with the metrics should be used as benchmark during this audit. The auditor should also find out if there have been any changes to the business processes during the period to influence the ERP and to ensure only the proper changes are made (Sayana, 2004).

Implementation or any upgrading in these systems could require changing business processes and may require large investment in employees training. The ERP system involvement is a continuous process for an organization as the ERP information system is evolving with time and adopting new technologies. For an organization, which has implemented the ERP system, this is quite challenging. The latest ERP systems include a significant amount of new technology, for example web services, integrated analytics, monitoring of business activities, portals, data hubs, and repositories. These needs to mastered in order to use them properly. In fact it's more important for the organization that has implemented the ERP system to stabilize the operations before making major enhancements to the ERP system (Usher, 2010).

3.1.4 Post Implementation Phase

The ERP PIP commences as soon as the system goes live. The duration of the post implementation phase can be affected by the overall solution stability at the time the system goes live (Usher, 2010). For the purpose of this research work ERP PIP is considered for the duration of at least six years. This is because a newer version is released by large ERP software vendor every three years, so six years is considered to

be sufficient time for an organisation to assimilate the enterprise systems environment and experience its benefits and challenges (Seethamraju & Sundar, 2013).

Most of the organizations focus only on the completion of an ERP system and implementation value created as the final goal rather than a milestone (Grande & Chatzidakis, 2013). In spite of having open issues, they proceed and make plans to handle these issues post go live. This leads to the possibility of longer go-live period, depending on how these issues are addressed. The governance level in an organization determines how well these risks are evaluated, and how adequately plans are prepared and executed to address issues, which are delayed for post go live (Usher, 2010).

Grande & Chatzidakis, 2013 stated in ERP PIP, the systems are up and running and significantly involved in business and IT operations of the organization. Costs vary from high for small firms to very high for large firms, (Weston, 2001) (Yu, 2005) which cumulated over a period of time of several years, depending on the complexity of the ERP system. (McGinnis & Huang, 2007) Because of this complexity, replacement of an ERP system has become excessively expensive. Therefore an ERP system is unlikely to be replaced, once it is implemented. (Grande & Chatzidakis, 2013) In this phase, the ERP systems are likely to be leveraged, upgraded, expanded and refined to meet new or updated business processes and IT infrastructures. Therefore the ERP systems are subject to continuous improvement, continuous efforts after system start-up will impact the final success of this system.

Zhu et al., 2010 stated that only when ERP PIP succeeds, the entire ERP initiative could be considered successful. (Grande & Chatzidakis, 2013) ERP PIP success is a complex concept involving a number of perspectives such as organizational performance and the financial return on investment in ERP. Making profits from ERP systems demonstrate the post-implementation success of ERP. (Zhu et al., 2010) At the post-implementation phase, an enterprise is able to conduct business using the ERP system and then starts to realize the benefits that the system provides. (Davenport, 1993) The ERP system directly influences the operational and managerial processes and (Zhu et al., 2010) therefore these processes are regarded as the practices to get direct benefits from the use of an ERP.

3.1.5 Summary

In this section of ERP system, a detailed introduction into this system is provided for better understanding of ERP PIP. Definition of ERP system according to various journals and literature and the benefits it provides to the organizations, gives insight into the importance these application.

Implementation life cycle of ERP, which include project preparation, technology selection, project formulation, implementation/development and deployment (Dantes et al., 2012), are explained because these are important steps for an organisation to include ERP system in its business environment.

Here special focus is provided for ERP PIP phase and its implication for the organisation implementing it, which is important to answer the research questions. Continuous improvement (Grande & Chatzidakis, 2013) and IT governance is key to manage the same (Usher, 2010).

3.2 IT/ERP Governance

Governance – in general - is about finding who makes each type of decision, who has input into the decision, and determining the accountability of roles (Lingyu et al. 2010). IT Governance could be described as "specifying the framework for decision rights and accountabilities to encourage desirable behaviour in the use of IT" (Weill & Ross, 2004).

Bernroider, 2008 stated that the value of IT in organizations has resulted in the view that IT governance should be evaluated to advocate or facilitate business objectives and to phase out risks during IT implementation. Tsai et al., 2011 indicated that IT governance is very important, because issues related to information and technology are far more complex, and significantly affect the entire business, for example in case of the ERP system. Additionally, the IT governance is a steady process, needing continuous review and adjustment and includes various approaches, including risk management and change management. IT Governance Institute, 2003 mentioned that focus of IT governance is on two main factors: IT's delivery of value to the business and mitigation of IT risks. To consolidate it can be said that influence of IT governance on ERP system is crucial. Therefore in this section influence of IT governance on ERP systems based

on various literatures is provided. This section is structured/broken down into various sections based on RQ1 and RQ3: status of IT/ERP governance and its various factors influencing ERP PIP. Since the focus of the research is on finding influencing factors related to ERP PIP with focus on IT/ERP governance, based on various literature studies this section is organized. First a detail description of IT governance for ERP PIP is provided with its benefits, later a deeper analysis into IT/ERP governance, implementation of IT/ERP governance and also providing its alternative by using horizontal mechanism, then various IT/ERP governance frameworks are analyzed and compared to find the best possible framework for ERP PIP and finally in maturity model section various available maturity models are compared and their relevance to ERP PIP is provided.

3.2.1 Benefits

In this section benefit of IT/ERP governance is provided with main focus on ERP systems in order to make better understanding about its impacts in the organization.

IT governance responsibility is normally assigned to board of directors and executive management. It is an essential part of corporate governance and consists of the controls and organizational structures and processes that make it sure that enterprise IT maintains and develops the enterprise strategies and objectives (IT Governance Institute, 2008). IT/ERP Governance influences the mechanism, processes and systems by which a business runs. It has been proven that a company having good IT governance is more profitable than the one, which don't have it in place (Weill & Ross, 2004).

One of the major area of expertise in the IT governance is strategic alignment, which ensures the connection business and IT strategy; defining, maintaining and justifying the IT value proposition; and aligning IT operations with enterprise operations (IT Governance Institute, 2007). Because of this expertise IT governance could align business and IT efficiently and successfully. With the help of effective IT governance, organizations will certainly increase business profits and decrease expenses (Saetang & Haider, 2014).

ERP implementation is better when there is better IT decision process in place (Weill & Ross, 2004). It is further mention by (Usher, 2010) that more tough decisions are required to be made during an ERP implementation because it not only affects change in technology but also the primary processes, and how business needs to be done. (Weill & Ross, 2004) IT decision making is common but more important is to keep accountability and proper formal communication about the process related to decisions making. (Usher, 2010) Since these decisions are mostly organisational level changes they require executive sponsorship and governance at senior management levels of the company.

3.2.2 IT Governance with Focus on ERP Post-Implementation

In this section the focus is mainly on influences of IT governance on ERP systems and PIP. Here the IT/ERP governance is provided in more detail since it important for RQ1 and RQ3, to find its impact on ERP PIP.

IT governance contain five domains namely: IT strategic alignment, IT value delivery, IT risk management, IT resource management, and IT performance management (IT Governance Institute, 2003). IT governance of ERP PIP could be improved with: first is by focusing on strategic alignment area, the top management should assure that ERP strategy is aligned according to business strategy, decisions about technology investment are aligned with business goals, and the ERP organizational structure supports the business model and direction. Second is by focusing on value delivery area, the completeness, quality, and reliability of ERP systems must be confirmed, and assure ERP investments provide a balance of risk and benefit, and that there are agreeable budgets. Third is handling with risk management area, the directors must supervise the efficiency of internal controls and ensure that the ERP risks are reduced, transferred, accepted effectively by risk management. Fourth is to deal with IT resource management area, they must comprehend the general architecture of the organization's ERP applications portfolio as well as its strategy of asset management, and monitor the way in which the management determines necessary ERP resources needed to achieve strategic goals. Finally is by focusing on performance management area, in the end they must supervise the development of key ERP performance metrics and also inspect and evaluate senior management's performance on ERP operation strategies. Thus, these

five provided domains, which leads to effective measurement of IT governance by the boards of directors are very important (Tsai et al., 2011).

For an effective IT governance of ERP PIP the following issues are important to consider (Usher 2010):

- **Accountability**: Accountability could be compared similar to words such as enforcement, answerability, responsibility, blameworthiness and liability. It basically denotes the responsibility of the actions performed. For example in project team, someone is accountable when this person accepts his responsibility to deliver the agreed milestones. So there is no confusion and blame game to happen later on. For the thesis purpose accountability could be explained as taking the necessary ownership to deliver the results irrespective of the given situation i.e. to take responsibility to deliver it. In short this could be considered as taking the ownership. Collective accountability is when everyone in the team or organisations takes the responsibility to deliver the result.
- **Ownership**: In context of the IT governance, ownership means "self-directed behaviours and initiative relating to an individual's or organization's responsibilities towards a desired outcome".
- **Decision Making**: How decisions are made and who is making decisions, are primary focus of decision making. It is important that business and IT should have a proper handshake on business related IT decisions. Joint committees and business with IT membership could be helpful in realising this (Weill & Ross, 2004).

According to (Gartner, 2008) its often the case that enterprise do not realise the importance of enterprise-level governance until they realise the gap between IT-oriented governance and the governance needed for ERP PIP. Scope of IT/ERP governance is broader than enterprise IT governance, also when it is built on the same. IT Governance of ERP covering multiple business units needs high level of user participation and frequent coordination and collaboration across the user groups in an association with the IT department.

Figure 5 below shows the overview of ten key components of IT/ERP governance as suggested by Gartner.

Figure 5 Overview of key components of IT/ERP Governance (Gartner, 2008)
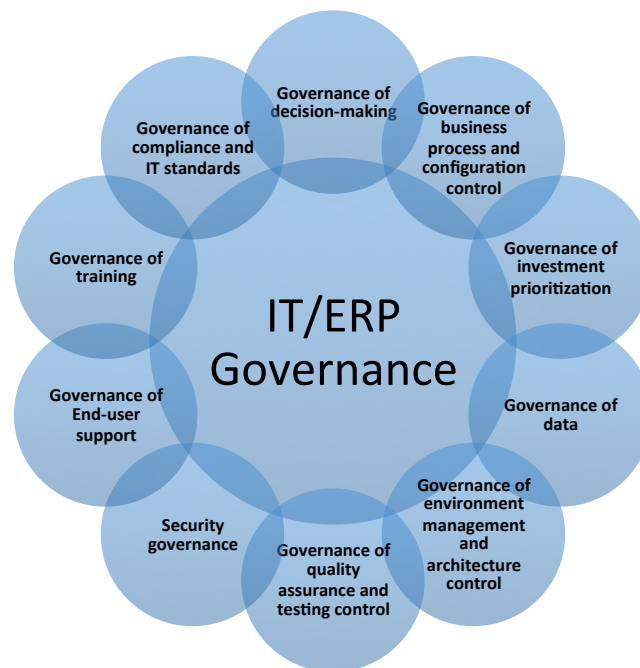
Brief descriptions of these key components of IT/ERP governance are as follows (Gartner, 2008):

1. **Governance of decision-making**: ERP decision-making governance is about a framework showing how the decisions should be made regarding matter concerned to it. This framework also helps in aligning the enterprise business strategy and culture with the ERP related decisions. It determines input rights against decision-making control and accountability to stimulate required behaviors in the application of, and adaptation in the ERP system. Depending on the kind of decisions, input and decisions rights will change accordingly. The ERP decision-making process includes decisions about implementing business processes, configuration of ERP and IT system support, this covers activities like investment in ERP, resource hiring, providing capital, organizing the work force and process change. Also it is important to consider the right stakeholders in a decision-making system because this will influence other involved stakeholders and systems. With this governance decision rights are balanced among various levels, covering from top management, business unit leaders and end users.

2. **Governance of business process and configuration control**: This control makes it sure that required attention is given while making decisions to change how the ERP system in PIP is utilized. It is important that involved stakeholders are associated for the business process and configuration control success. Users should associate to find out the way work is performed and how process changes are implemented. It is also important to make it sure by them that changes made to configuration don't bring negative consequence to other areas.

3. **Governance of investment prioritization**: This governance structure helps to prioritize the changes in configuration, improvement in system, and modifications in application supplied by the vendor into a connected master plan that includes the necessity of user requirements, business actions, deficiency of resource, and limitations of budget.

4. **Governance of data:** ERP provides the possibilities, in which way the organization should work with its data. It provides single data repository therefore eliminating redundancy of data in business functionality included in the system. It also provides enhancement in the capacity to share data across the organization. All the modifications in the way data is stored and utilized should also be reflected in data governance. ERP system influences different business units, functional domain and departments of an organization, therefore the ERP data governance should make sure data consistency and support responsibility, ensure required inter- and intra enterprise data security, data quality, and facilitates compliance with various requirements and data standards.

5. **Governance of environment management and architecture control**: There are regular updates and changes in ERP systems. To harmonize the running business operation with changes in business enhancements is difficult and sometimes they contradict with each other. The situation gets more complex due to regular patches, fixes and new software release by ERP supplier. It is important to setup environment governance across ERP application in order to avoid these interruption and disharmony due to changes in business environment. This governance is about development and management of the process for maintaining different application environments like test, development, training and production; which is harmonized for support and development works. It is also about application governance of vendor-supplied patches, fixes, and new releases in a sequence and time frame that

fits ERP PIP production operations schedules and also the requirements of development environment.

6. **Governance of quality assurance and testing control**: These are feature of ERP governance that is addressed, internally among concerned stakeholder groups and externally with third party solutions providers. It is important to keep in place the processes and methods to make it sure that the required stakeholders are involved at the right time to test the system changes.

7. **Security governance**: This governance ensures the processes and methods to maintain suitable security access to each units of business application. Security in ERP system is different from other IT applications because former not only covers application access, database access, web portal and other non application feature in a single business area but also in multi stakeholder view. ERP security governance begins with project implementation by defining access rights to every process component. In ERP PIP a process is developed to request, approve and maintain changes in security.

8. **Governance of End-user support (Superusers):** Superusers are key units in support to infrastructure of ERP system. They are in the front row of users and point of contact between business and IT department, providing IT with the flexibility to focus on technical aspects of system support. The governance of Superusers encloses the processes and methods that keep their network performing and actively supporting in PIP support.

9. **Governance of training**: Post-implementation training governance is not confined to superuser group. According to Gartner it is less efficient when ERP training is provided by the end-user of concerned department than when responsibility of the ERP training is given to a single point of contact, regardless of the fact that this contact belongs to business or IT department. It is important to create rules regarding management and delivering ERP training. As a first step in training governance, an agreement is reached between ERP users and IT department regarding training structure, its organization, locations and responsible person for the course content and delivery. Then formal processes are defined to make sure that the training is delivered to the right target group in right time, and training feedback is received and acted upon.

10. **Governance of compliance and IT standards**: In order to provide better control of ERP application by the user community, many of these applications provide possibility to the end user to make their own report and changes to the application configuration. This also minimizes the time for changes to be implemented that don't need IT programming knowledge. Even though these changes don't need any programming skills, it has to ensure that they comply with the IT standards. Irrespective of the fact who make changes, weather the IT department or end-users, the rules to govern these changes should be in place regarding the way in which this should be done, testing, and migrating these to ERP production environment. In addition it is also important to make a common agreement about responsibility for compliance, and building processes for monitoring solutions to assure that they are compliant.

In summary, at first a brief description of governance and need of IT/ERP governance is provided, which is followed by brief understanding of IT/ERP governance expertise, benefits and responsibilities. Later the focus goes more deep in analysing how IT governance influence ERP PIP (RQ3) with brief description of its various domains and how it influence the ERP systems. Afterwards various issues related to IT/ERP governance (by Usher, 2010) are described, which need to be considered for effectiveness of this governance. Also it is mentioned that scope of IT/ERP governance is bigger than just IT governance, since it require high level of user participation of multiple business units and frequent coordination and collaboration across various user groups. In order to cover all the important government issues, Gartner provided ten key components of IT/ERP governance covering key areas of ERP PIP (RQ3) such as decision-making, end-user support, security, quality assurance and testing, training, environment management and architecture control, data, investment prioritization, business processes and configuration control, and compliance and IT standards, which is also shown in figure 5, and brief description of each one of them with its implication on ERP PIP is provided.

3.2.3 Implementation

In order to analyze the ERP PIP with the focus of IT/ERP governance, it is also important to analyze its implementation impact and other factor affecting ERP PIP. This section will make emphasis to this point of view by reviewing literatures and try to find answer to RQ1 and RQ3.

According to (Usher 2010) governance of any important change in an enterprise is essential for the success, but governance of ERP systems is more important. IT/ERP governance, which is much critical in the sense that ERP implementation involves major change in enterprise, processes changes at all three levels including strategic, management and operation. The major changes happen during the ERP implementation and this needs that the enterprise accepts its business impacts and is ready to make strong agreement. It is further stated by (Weill & Ross, 2004), enterprise senior level management support, governance and sponsorship are crucial in making these decisions.

The accountability and ownership of super users of ERP systems is well defined in making important decisions. Enterprise having good IT/ERP governance in place acknowledges ERP PIP easily. A recognisable maintenance and support for budget should be assigned (in general for at least next few years after post implementation of the ERP system) and there is consistent governance structure in place (Usher 2010).

Few researchers in information system have support moving from a governance focus to a capabilities focus and from analysis of functional structures (that command governance) to structural overlays that facilitate platforms (which support IT-enabled business actions) (Sambamurthy & Zmud, 2000) (Ciborra, 1996). Aforesaid change moves the focus from a static or relatively fixed, structure perspective to a more dynamic perspective that identifies the emerging nature of the organizational pattern and the processes by which they develop (Ciborra, 1996). Horizontal mechanisms are one of such platform perspective (Brown, 1999) (Galbraith, 1994).

Horizontal mechanisms are structural overlays and devices that boost existing governance models in the organizations. They help to assist collaboration, coordination, and communication among different business entities (Brown, 1999) (Galbraith, 1994). They may contain both structural overlays (such as roles and groups) and nonstructural

devices (such as co-location and job rotations) that reduce hurdle to collaboration and coordination (Brown, 1999). These horizontal mechanisms are important for ERP PIP. Since ERP systems link IT and business functions over the whole enterprise (Gallagher et al., 2011), horizontal mechanisms build lateral capabilities that cover functions or business units and expedite coordination without commonly communicating using the formal hierarchy (Galbraith, 1994), competence that are important to ERP PIP.

Using horizontal mechanisms as a conceptual framework, a different perspective is chosen, which can be used to examine the arrangement of post-implementation activity. Horizontal mechanisms are conceptualized and studied in various literatures and they are organized into four types: formal groups, formal roles, informal networking practices, and cross-unit human resource practices (Gallagher et al., 2011).

The potential use of these types in ERP PIP support, are summarized in Table 5.

Table 5 Use of different types of horizontal mechanisms in ERP PIP (Gallagher et al., 2011)

Type	Description (potential use in ERP PIP support)
Formal groups	Stable, regular teams that perform within the current hierarchical structure: Permanent work group assigned with maintaining and improving the ERP over its working life, which may be cross functional in constitution.
Formal roles	Intermediary who help in communication, information gathering and decision-making across different mutually dependent organizational entity: Domain expert having substantial technical and/or functional ERP skills, who engage in ERP maintenance/development activities when required, may report to both functional business unit and IT organization, generally called as "super user"
Informal network practices	These practices includes activities (like co-location, interdepartmental activity, and IT-based communication mechanism) which help in interdepartmental communication and voluntary problem resolution: To locate both ERP functional and technical subject matter experts (SMEs) during support/development activities in ERP related workshops and roundtables e-mail and intranet discussion boards
Cross-unit human resource practices	Human resource and development exercise that help to align interests, influence managerial behavior, and support accountability: Regularly moving functional resource into post-implementation support unit, or ERP technical employee into functional units, provide development of common understanding and realization of various task requirements and difficulty.

In summary, in this section at first the impact of IT/ERP governance on ERP system is provided. It is also mentioned that senior level management plays important role in ERP decision making since changes in ERP system impact all processes in all three levels of the organization namely strategic, management and operation.

Consistent and good IT/ERP governance acknowledges ERP PIP easily by assigning right budget and using recognizable ERP PIP support and maintenances activities. It can also be concluded based on some researches that due to emerging nature of the organization (dynamic market condition), there is a change in focus from static or relatively fixed, structure perspective to a more dynamic perspective and this is realized by using horizontal mechanism. This is an important finding for the research model where dynamics business condition is an initiating factor and this connection could be useful for ERP PIP and serve as a boost to existing IT/ERP governance (RQ3). In the end a brief explanation of various types of horizontal mechanism are provided to show its potential use in ERP PIP.

3.2.4 Frameworks of ERP System Implementation

In an uncertain and dynamic business environment, making steps towards grabbing opportunities should be in alignment with the enterprise strategy (COBIT5, 2012). The success of such alignment can be measured and monitored by IT governance frameworks, for example COBIT's goals and metrics can define such measures and establish monitoring to ensure that business alignment is achieved and maintained and performance can be measured (ISACA 2012). In this section the RQ1 status of IT/ERP governance influence on ERP PIP and dynamics market that is the part of research model in figure 10 are searched with the help of evaluating relevant IT governance frameworks focussing on ERP PIP. Also for RQ3 various aspects of ERP PIP in relation to these IT/ERP governance frameworks are analyzed.

For an effective governance it's more important to know the answers to the three important questions namely: who has the rights to make decision, under what considerations these decisions are made and to find the right decisions to be made for productive management and utilizations of IT (IT Governance Institute, 2007). For the ERP PIP above mentioned three decision questions are important and these are being considered in Lingyu framework (Lingyu et al., 2010), which is explained in subsection 3.2.4.1. Based on the literature from Reza et al., 2013, for the profitable IT and the mapping of business necessity with IT, implementing the strategy and internal control framework by enterprise management are important. IT governance is basically employment of frameworks for identifying and detecting the best profitable practises, which for ERP is provided by the frameworks: COBIT and ITIL. Therefore the IT

governance frameworks provided by COBIT 5 and ITIL are also important for ERP systems, the details of these frameworks are provided in subsection 3.2.4.2 and 3.4.2.3 respectively. It is also to be noted that most of the literatures about IT governance frameworks lacks focus on ERP PIP phase but these have rather general focus on ERP system and ERP implementation. Therefore in this section, including some aspects of ERP systems and ERP implementations shows the nearest possible relation of ERP PIP with IT governance frameworks.

3.2.4.1   Lingyu

Based on the definition of IT governance and requirements of ERP application, a framework is developed by Lingyu. The framework basically includes strategy and tactic, orgnaisation, arrangement and mechanism and Key performance Indicator (KPI) measurements. Together these four components formed a close cycle of ERP implementation (Lingyu et al., 2010).

The brief description of these phases and its implication for ERP PIP is mentioned below (Lingyu et al., 2010):

- Strategy and Tactics (act as one): ERP systems strategy should be aligned with organisation business needs and missions. It should be able to align with the business requirements to provide maximum possible profits and proper management of ERP application implementation risks. This could be achieved by choose between business process reengineering (BPR) and customising to fill the gap between business processes and ERP best practises.
- Organisation: The structure and typical organisation hierarchy and the duties of these organisation units could be described as below (Lingyu et al. 2010):
  - o ERP Strategy Committee (STRC) main responsibility includes business IT alignment, IT risks assessment, IT investment optimisation, and reaching the IT goals
  - o ERP steering committee (STEC) is mainly dealing with IT structure and responsibility assignment, IT architecture approval, review and approval of IT budget and plans, and monitoring performance.
  - o ERP executive board (EXEB) is mainly dealing with right allocation of business resources, ERP governance, sponsor for various modules of ERP,

requirement identification and acquirement, and ERP system application level control.

- o Chief information officer (CIO) main responsibilities are explain and show the ERP system value, management and assessment of day-to-day ERP development.

- o Function areas (FnA) mainly suggest module specific functional areas and right operation of ERP application.

- Arrangement and Mechanism: ERP governance assigns the responsibility for ERP systems implementation decisions. In table 6 one such typical arrangement is shown. For example here the responsibility of STRC, lies in ERP strategies, principles, and investment and prioritisation. For FnA the key decisions areas are BPR Vs. Customising, and controlling area.

Table 6 - Preferred decision capability of organisation entities (Lingyu et al. 2010)

Organization	Key Decisions				
	ERP Strategy	ERP Principles	BPR VS Customizing	Controlling Area	Investment and Prioritization
STRC	√	√			√
STEC		√	√	√	√
EXEB			√	√	√
CIO	√	√	√	√	√
ArC			√	√	
FnA			√	√	

- KPI measurement : This has been categorised into performance measurement (indicators), IT control profiles (measure the effectiveness of control), awareness (risks) and benchmarking (performance relative to standard). Balance Scorecard is basically used to measure the KPIs, which normally contains four different perspectives namely financial, customer, internal and learning and growth perspective.

In summary (Lingyu et al., 2010), the Lingyu framework is IT governance framework developed to meet the requirements of ERP system. For ERP PIP, the four phases of

this framework is significant because each one of these provide benefits of IT/ERP governance (RQ3). Choosing the right strategy between BPR and customization to provide maximum possible benefits is significant for all ERP implementation phases including PIP. The organization units responsibilities like STRC (risks assessment and investment optimizations), STEC (monitoring performance), EXEB (IT/ERP governance, and identification and acquirement of requirements), CIO (daily ERP development), and FnA (correct operation of ERP system), are significant in this analysis. Later it mentioned how IT/ERP governance assigns responsibilities, for example FnA has the key decisions areas BPR Vs. Customising, and controlling area. KPIs to measure performances, control effectiveness, risks and benchmarking performances, are helpful to measure if the required benefits are achieved. In short strategy, organization, assignment of responsibilities, and KPIs of IT/ERP governance are significant for ERP PIP.

3.2.4.2   COBIT

COBIT means "Control Objectives for Information and related Technology". COBIT is a compilation of best methods, metrics, indicators and processes about IT evaluation and control areas. This standard was provided together by ISACA (Information System Audit and Control Association) and ITGI (International Tobacco Growers' Association) and the latest version is COBIT5, which was released in 2012 (Changizi, 2012). As mentioned in (Reza et al., 2013) Information System Audit and Control Association (ISACA) was formed in USA, COBIT5 business framework, the latest edition, with focus on IT management and governance is result of 16 years of long research and collaboration of large IT companies having enterprise specialists, and (Teyyebi, 2010) it is drawn up by function based attitude in about 4 domains, 34 function and set of 318 control goals in IT evaluation area.

Below the major areas of COBIT IT governance are described (COBIT5, 2012):

a) Strategic alignments: This area ensures planning of communication, business, and IT, and makes IT operations aligned with enterprise operations.

b) Increasing value: This area creates IT value and emphasizes on costs optimization and meeting the exclusive value of IT.

c) Resource management: This area focuses on investment optimization related to IT resources (for example applications, information, infrastructure and human resource). Key issues in this area are Optimization of knowledge and infrastructure.

d) Risk management: In this area top management needs information about risk, perception about capability of adaptation's needs, formulating the risks associated with organization, and changing risks responsibilities in organization.

e) Function management: This area is pursuing and controlling, strategy implementation methods, project performance, resource utilization, IT processes functions and services supply (Haghshenas, 2012) (Parvizi et al., 2012).

It is very important to establish value creation, risk management and that investment in information technology to be in reversible logic, control and IT governance, during an ERP implementation (Kieviet, 2006). The essential areas of expertise in IT governance are defining topics which Chief information officer (CIO) needs to examine in order to lead IT of an organization (Alaeddini, 2009). COBIT process model is linked to the main area of IT in order to create a link between the needs of the operational managers and expectations of executive managers for the enterprise advantages (Reza et al., 2013).

All components of COBIT are interrelated and provide support to organization needs with strategy management, control and assurance, as shown in figure 6. In this figure the relationship between business goals and IT goals could be seen. IT goals could be further broken down into Key activities, which are performed, by responsibility and accountability chart. IT goals and processes are measured: for efficiency by performance indicators, for outcome by respective outcome measures, and for their maturity by respective maturity models. Audit of these goals and processes are done with control outcome tests, which is derived from control objectives. Furthermore the control of IT goals and processes is done with control objectives: audited with control design tests based on control practices, and implemented with control practices (Reza et al., 2013). All these connection of activities like MM, accountability, and controls are important for ERP application as well.

Figure 6 Connections of COBIT components (COBIT5, 2012)
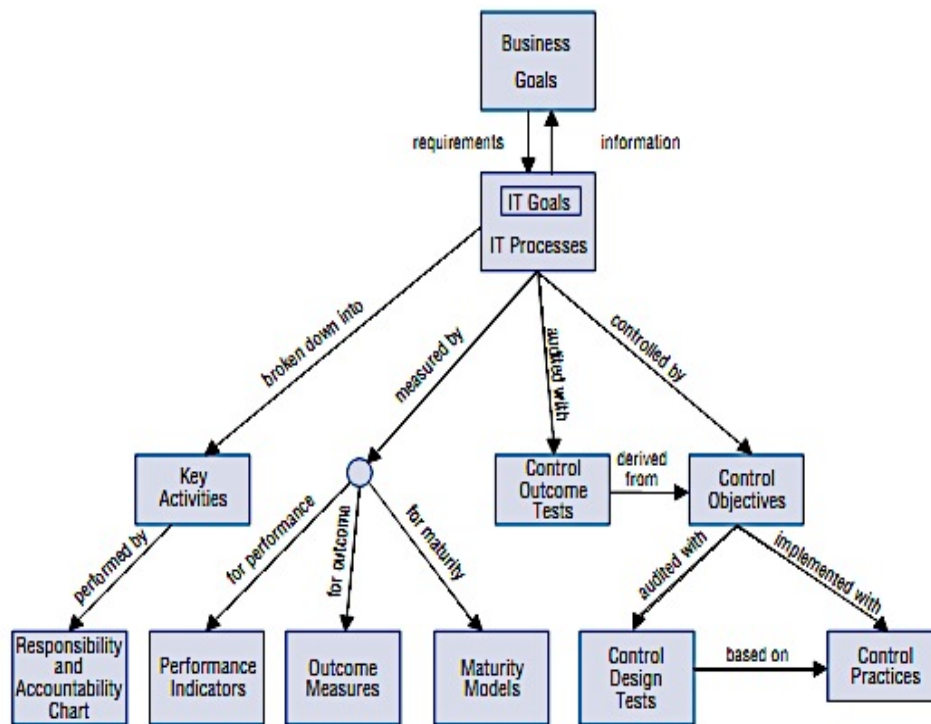
For ERP system, COBIT is the most appropriate framework because of following reasons (Reza et al., 2013):

a) COBIT uses all the relevant information in order to allocate IT resources to the enterprise's processes.

b) COBIT not only provides essential needs of quality and security, but also provides 7 other benefits: efficiency, effectiveness, confidentiality, integration, availability, providing requirements, and reliability.

c) COBIT is particularly useful for CEO (Kieviet, 2006).

In summary, COBIT is collection of methods, metrics, indicators and processes about IT evaluation and control areas. For ERP system, COBIT is significant by establishing value creation, risk management, investment optimization and proving IT/ERP governance. These areas of expertise are required by CIO to examine, and thus it is also important for RQ1 and RQ3 to examine the factors related to IT/ERP governance in ERP PIP. The process model of COBIT provides a connection between needs of operation (PIP) and expectation of organization (business). COBIT control objectives helps in auditing IT/ERP process goals (performance indicators and maturity) with

control outcome tests. In figure 6, connection of activities like MM, accountability and controls are shown which is significant for ERP system and PIP as well. In the end it is concluded that COBIT (as IT/ERP governance framework) is the most suitable for ERP and PIP because it not only helps in efficient allocation of IT/ERP resources and provide several benefits, but also useful particularly to CIO and CEO.

3.2.4.3   ITIL

In management of IT service area, Information Technology Infrastructure Library (ITIL) is a popular choice (Reza et al., 2013). First edition of this framework was published in year 1989 and later in year 2000, second edition was published with addition of some processes. In year 2007, third edition of this framework was published having some basic changes compared to second edition. ITIL is a collection of best practises and it is an operational framework for the IT service providers in an enterprise having complex structure (Yamakawa et al., 2012). Implementing this framework makes IT system management an easy managerial decision making process. For the needed services of an organization it is possible to measure and evaluate the changes in data and its availability (Nuripurpuravi & Khajehasanirabari, 2012) (Symons, 2005).

ITIL framework is based on IT services life cycle, which has focus on strategy processes, service designing, providing expectations and transferring service, service provider's operations and continuous service improvement (Moeinzad, 2011).

In an organization with application integration, ERP systems, and organizational IT dependencies, the possibility of application to be down is not acceptable for the business. Therefore, the IT goal is to provide service to the organization continuously or with minimum interruption, to make changes to the application, infrastructure or hardware quickly and to get it back in operation as soon as possible. With ITIL enabled IT function this is possible by proceeding in a systematic way, and recognizing where impacts from changes in one piece of hardware, or application, is likely to occur. The benefit of the ITIL implementation resulted in a 10 -15% reduction in operational IT expenses, and greatly improving delivery and value (Duffy & Denison, 2008).

(Hui, 2009) Mentioned ITIL as one of the most complete model in IT services management all over the world and this could be implemented in almost all businesses

and enterprise environments and fits well among them. For successful implementation of ERP systems, ITIL play a critical role by using the best practises and process management. According to (Yamakawa et al., 2012) this framework provides knowledge, abilities and skills, which could be expertise by training and supporting tools.

In summary, IT/ERP governance framework provided by ITIL has main focus on services: strategy, design, expectation and transfer, operation and continuous improvement. In ERP PIP, providing continuous service is important and with ITIL enabled IT/ERP functions this possible. This not only reduces the operational (PIP) IT/ERP costs but also improves delivery and value. So here the RQ1 and RQ3: status and factors of IT/ERP governance in ERP PIP are in focus. In short it could be also said that it is one of most complete model that could be implemented in almost all kind of businesses. Knowledge, abilities and skills provided by ITIL could be an expertise for ERP PIP (training and support).

3.2.5 Maturity Model

In this section the maturity model (MM) concept is introduced; firstly the reason is provided why it is important to have MM for ERP system and PIP, then brief explanation of MM is provided, its growing significance in PIP, different types of MM, comparison of different available MM best suited model for ERP PIP based on the selected criteria, and finally the COBIT 5 process capability model and its various maturity levels are discussed. This will help to find important criteria for the RQ3, factors related to IT/ERP governance and agility influencing ERP PIP, and its success and risk factors, which could be influenced by dynamic market (research model).

IT organizations are compelled to regularly evaluate and advance their maintenance capabilities in order to operate ERP systems conveniently, to provide a high quality and a competent usage of the ERP system in the PIP. An improper support in the PIP may cause large costs, not meeting user needs, or even nonperformance of the entire ERP implementation (Ng & Gable, 2010). MM are an appropriate concept to help IT organizations in this threat, because they can focus on both criteria, efficiency and quality (Ahlemann et al., 2005), and have been used in the past to enhance other complex IT-related field like software engineering (Software Engineering Institute,

2006). MM can be applied as tool to evaluate the maturity of a certain area of interest. Furthermore they are suitable tools to evaluate vulnerability or shortcoming and can bring plan for enhancement to achieve a higher level of maturity in the area of interest (Ahlemann et al., 2005). They are also useful to increase the PIP quality.

In the field of information systems, maturity commonly mention to capabilities, processes or objects (Mettler, 2009). It is required that the maturity of ERP PIP can be evaluated in those various aspect as well: (1) maturity of capabilities to support and improve the ERP system according to business objectives, (2) maturity of processes for the ERP systems maintenance, for example user support, continuous training, implementation of changes or software updates, and (3) the ERP system maturity in general, for example the measure to which an ERP system is used in the organization. In general the maturity of ERP systems has been explained in past research using simple stage models that include various phases of an ERP system and aspect of these phases (Holland & Light, 2001) (Millet & Botta-Genoulaz, 2008). These models are of limited complexities and supply a group of maturity levels and a textual detail of activities or aspect that are attach to a particular maturity level. Although some of these models cite to the ERP PIP (Millet & Botta-Genoulaz, 2008), others deal with the full ERP lifecycle, which includes both ERP implementation and PIP (Holland & Light, 2001). The models related to ERP PIP will be explained later in this section with more details.

A growing significance in the PIP of information systems can be realized not only in the ERP literature (Esteves & Bohórquez, 2007), but also in the connection of MM: With traditional MM that branch from the software development domain for example the CMMI for Development there has been a growing significance in the development of models that help organizations, in information systems operation and maintenance, and IT services management (Software Engineering Institute, 2006). Actual research that investigated the ERP PIP from the IT organization viewpoint primarily concentrates on two main attributes: the ERP systems maintenance, and related success and risk factors (Hecht, 2012).

MM normally contain a number of dimensions or process areas at various levels of maturity, with an explanation of success related aspect for the different maturity levels, dimensions or process areas (Fraser & Gregory, 2002). Concerning its common

elements, a MM could be either descriptive or prescriptive in nature (De Bruin et al., 2005). Descriptive models consolidate a domain model (for example a process model), which explain how the focused domain should visually be, and how some activities should be performed. Completely prescriptive models on the other hand only give what needs to be performed and how a possible roadmap for improvement looks like, but they do not suggest on how to do a specific activity. In order to clearly differentiate these different aspects, a MM can be divided into three different subsystems, including a domain- or process model that defines the domain in focus, an improvement model that give a roadmap for improvement, and an assessment model that is helpful to employ the MM within an organization (Kajko-Mattsson, 2002) (Hecht, 2012).

For the purpose of research some models are chosen and compared, which satisfies the following conditions (1) the 5 popular models that are most appropriate for the ERP PIP in focus compared to all identified models, and (2) these are either public available or sufficient information on the contents of these models is accessible (Hecht, 2012).

(Hecht, 2012) The eight IT-related capabilities for ERP PIP have been used as criteria to calculate in how much elements of the models support the development and improvement of key capabilities in ERP PIP. The used scale for this analysis is shown in Table 7.

Table 7 Scale used for analysing MM (Hecht, 2012)

Scale		Meaning
○		Not at all
◔		Contents do not cover an improvement of this capability, but there are some contents that may be adapted
◑		There are some contents that can be used for an improvement of this capability, but it is not a major focus
◕		This capability is a major focus, but ERP related aspects have to be added
●		Contents support the improvement of this capability fully or only minor adaptions are required

The result of the analysis and the coverage of the different criteria are shown in Table 8. Below the selected models evaluated in depth are described in brief, and the consequences of the analysis are discussed (Hecht, 2012).

1) The CMMI for Development (CMMI DEV) (Software Engineering Institute, 2006) is a famous MM developed by the Carnegie Mellon Software Engineering Institute. Objective of this model is the improvement of software development and maintenance processes, whereas the focus is on large software development projects than software maintenance. The model consists out of 22 process areas that cover the four categories Process Management, Project Management, Engineering, and Support.

2) CMMI for Services (CMMI SVC) (Software Engineering Institute, 2009) is another MM of the Carnegie Mellon Software Engineering Institute that focuses on the processes improvement and quality in service organizations. The architecture is similar to the previously introduced CMMI for Development. It covers in total 24 process areas that are grouped by the four categories Process Management, Project Management, Support and Service Establishment and Delivery. The CMMI for Services created upon existing CMMI models and combine concepts and best practices from other service-oriented standards and models like the Information Technology Infrastructure Library, ISO/IEC 20000, Control Objects for Information and related Technology and the IT Service CMM.

3) The Information Technology Service Capability MM (IT SCMM) (Niessink et al., 2005) focuses on process improvements in organizations, which provide IT services, for example software maintenance, IT operation, or network management. The level of analysis of the model is the organization including all the activities, single IT services are not treated independently. It focuses on the service delivery process – which starts from an analysis of customer requirements to the point of IT service evaluation. Objective is the assessment of capabilities in the provision of IT services, and the identification of possibilities for improvement. The maturity of IT service organization is explained in 22 key process areas that are grouped into the three categories Management, Enabling and Delivery.

4) The Software Maintenance MM (S3M) was proposed by April et al. (April et al., 2005) for the domain of software maintenance. Focus of the model is the auditing of

external service providers, and also the model can be used for an improvement of capabilities of internal organizations, which are responsible for software maintenance. The model structures supports activities in 18 key process areas that are combined by the four process domains Process Management, Request Management, Evolution Engineering and Support to Evolution Engineering.

5) The Corrective Maintenance MM (CM3) was introduced by Kajko-Mattsson (Kajko-Mattsson, 2007) and focuses on curative software maintenance processes. The model structures corrective maintenance activities in four primary processes containing Front-End Problem Management, Back-End Problem Management, Emergency Problem Management and Testing. Moreover the model contains four supportive processes including Release Management, Predelivery & Prerelease Maintenance, Education & Training, and Service Level Agreement.

Table 8 Analysis of selected MM (Hecht, 2012)

	CMMI DEV	CMMI SVC	IT SCMM	S3M	CM3
1. Integration of functional subject matter experts	◔	◔	◔	◔	◔
2. Training	◕	◕	◑	◔	◔
3. ERP change requests management	◕	◑	◑	●	◑
4. Implementation methods for ERP changes	◔	◔	○	◔	○
5. Testing	◕	◔	◔	◕	◕
6. Management of ERP modifications	◑	◑	◑	◕	◔
7. Evaluation of software updates	◑	○	◑	◔	○
8. Management of ERP upgrades	◑	◑	◑	◔	○

The CMMI SVC and the IT SCMM both show major gaps in the area of ERP changes and hence consider being less suitable for the domain of ERP support. The CM3 gives

the least coverage as it focuses only on corrective maintenance and nothing on the implementation of software improvements that are a main activity in ERP support (Hecht, 2012).

Overall the CMMI DEV and the S3M provide the best possibilities for the selected criteria. However, both these models have strengths and weaknesses in various areas as indicated in Table 8. The CMMI DEV has its strength in the broad range of different areas that are included in the model. But its weakness is that most instructions are too generic to be applied in the context of ERP support. For example in criteria 4: Implementation methods for ERP changes, the model provides very general instructions on how to perform and structure decisions in a given process area, therefore these instructions can not be applied in complex decision that is required to be made during the development and maintenance of ERP systems (Hecht, 2012).

The S3M has its strength in its focus on software maintenance and provides extensive best practices in this area. Its weakness is that in beginning it was not developed for the ERP systems support. Therefore it shows considerable gaps in aspects that are of high relevance for ERP systems like training, implementation methods for ERP changes or the evaluation of software updates (Hecht, 2012).

In short (Hecht, 2012), these maturity models have many drawbacks that have been recognised based on the literature review: Models in the context of application maintenance do not focus on standard software in general or ERP systems in specific, and hence need large adaption's before they can be applied in an ERP PIP context. Moreover the focus of these models is mainly on large software development or maintenance organizations, and lesser on internal IT/ERP organizations that might differ in size as well as in their responsibilities to independent software development and maintenance organizations. Third, majority of the chosen maturity models are mainly prescriptive and do not give much information on how to realize a specific improvement activity.

The COBIT 5 process capability model provides controls to measure performance governance processes or management processes, and identify the areas of improvement (COBIT5, 2012). Table 9 shows different levels MM from COBIT 5 and brief

description of the same. These play an important role in IT/ERP governance in ERP PIP (Usher, 2010).

Table 9 Brief descriptions of MM levels in COBIT5 (COBIT5, 2012)

Level	Description
0	**Incomplete process**— The process is not implemented or fails to accomplish its purpose.
1	**Performed process** — The implemented process accomplish its process purpose.
2	**Managed process** — Now the level 1 performed process is implemented in a managed way (planned, monitored and adjusted) and its work products are appropriately established, controlled and maintained.
3	**Established process** — Now the level 2 managed processes is implemented using a defined process, which is capable of achieving its process results.
4	**Predictable process** —The level 3 established process now works within specified limits to accomplish its process outcomes.
5	**Optimizing process** —The level 4 predictable processes are continuously improved to reach appropriate current and future business goals.

In summary, S3M and CMMI are best possible MM for ERP PIP based on the chosen criteria in table 8. These suits perfect with criteria 3: ERP change request management and satisfy partially in rest of all the criteria of evaluation. As mentioned MM helps in satisfying eight chosen IT-related capabilities of ERP PIP, these capabilities help in agility and IT/ERP governance in ERP PIP, and trying to find the answer of RQ3.Also the controls of COBIT 5 process capability model influences the IT/ERP governance of ERP PIP (RQ3) (Usher, 2010), COBIT 5 framework is discussed in section 3.2.4.2.

3.2.6 Summary

This section IT/ERP governance starts with the introduction about governance and IT governance and provide benefits of it in ERP implementation and PIP. Here it is important to mention that IT/ERP governance is essentially important for top management and executives, to make sure that enterprise IT/ERP maintains and develops the enterprise strategies and objectives. Later a section on IT governance with focus on ERP systems and PIP is provided to find answers to research questions, with issues based on literature by Usher and deep insight into IT/ERP governance in regards to ERP PIP. This is followed by analysing its implementation impact and influencing factors in ERP PIP. Different types of horizontal mechanism are described, which is important for organization dynamic perspective. In the last section three important types of ERP system implementation frameworks are described and their benefits are analyzed with respect to IT/ERP governance and ERP PIP. In the section MM, various models are compared and analyzed having significance in ERP PIP and

recommendation for S3M as the best suited MM is deducted. Here is link between MM and ERP agility is also deducted, using chosen IT related capabilities of ERP PIP. In summary this section provides a valuable insight for our RQ and research model.

3.3   ERP Agility

In this section the focus is on alignment of ERP solutions and organisation changing business needs to find answer of RQ1 and RQ3: current status (based on literature) and factors impacting ERP PIP with regard to agility and partially to RQ2: How agility affect ERP PIP. To find these answers, first an evaluation about dynamic market (which is also relevant for research model) in which organization operates is provided. This is followed by evaluation why ERP system is not so flexible (not very agile). Later, the possibilities to improve ERP agility are analyzed by section alignment of ERP with organization requirement and need of customizations in ERP PIP. For agility of ERP system in PIP, customization is considered to be an important factor and the extent to which customization is required is described next. Since external providers mostly develop ERP system, so their role in PIP is important and this role in ERP PIP support and customization is provided afterwards. In the last section, the insights to role of administrative and circumstantial factors in ERP PIP with regards to agility are provided. In figure 7, all these considered factors (based on literatures study) and connection to ERP agility in PIP is shown.

Figure 7 Connection between various factors in ERP agility in PIP
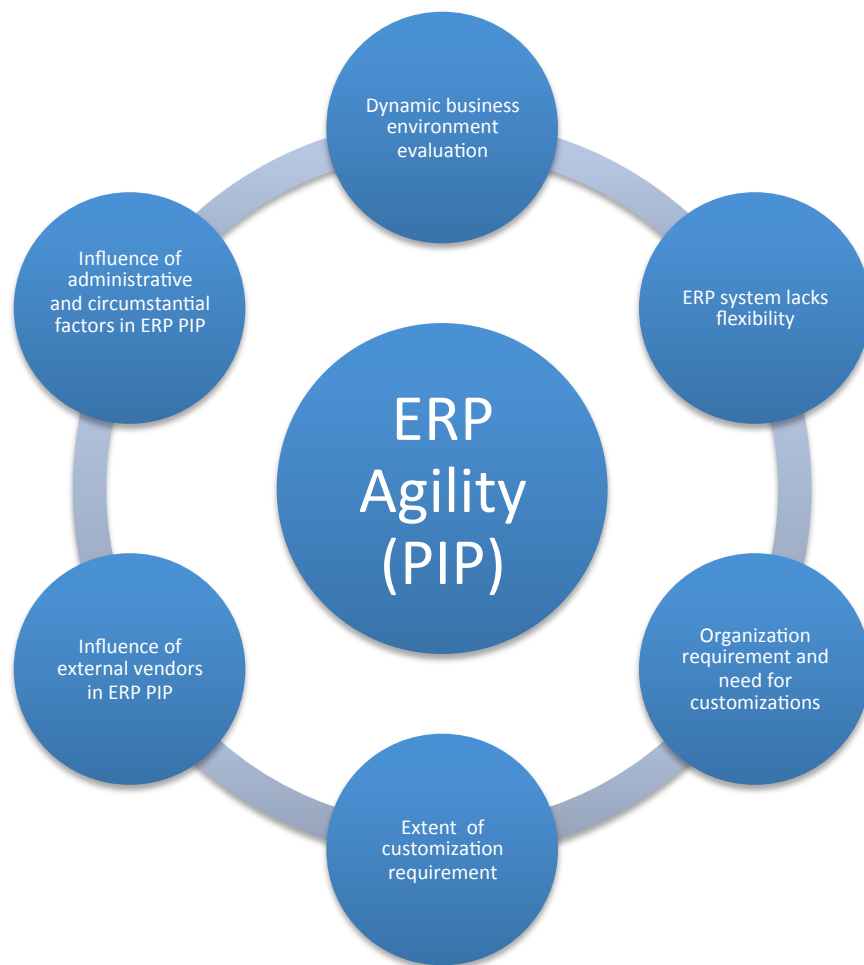
3.3.1 Evaluation

Today enterprise works in highly dynamics business environment due to the open market, fast and easy communication, sophisticated computing and globalization (Kharabe 2009). According to (Parente, 1996) dynamic business environment with regard to customer orientation could be defined as "the changing composition of customers and their preference towards market products." In dynamic environment customers services could be improved by periodic interaction of internal business unit to share knowledge and capabilities.

The main goal of enterprise design is to minimise the ambiguity according to the hypothesis by Organisational Information Processing Theory (OIPT). The degree and kind of the ambiguity varies with different departments in an enterprise, so managing it requires various modes of coordination. The ambiguity and modes of coordination to

handle it should be matching (Kharabe, 2009). ERP is an automated information system and plays a major role in such coordinating system (Flynn & Flynn, 1999). In a dynamic market, it is important to have a better coordination in an enterprise to deal with the uncertainty and ERP system could provide a great advantage when used properly by the enterprise.

Agility and enterprise ability to perform is mainly dependent on the potential of the information system in use. ERP systems belong to the class of information systems and it has ability to affect enterprise output through agility, digital options and enterprise alertness, also through improved strategic processes including competences, goals achievements and further expansion (Sambamurthy et al., 2003.) (Kharabe, 2009).

In summary, this section finds that open market, fast communication, advanced computing and globalization leads to a highly dynamic market environment (research model). Several literatures show that (RQ1) with this market conditions customer satisfaction could be improved with regular communications among various business units in an organization so that knowledge and capabilities could be shared. Also minimizing ambiguity is an important goal of enterprise design, which could be possible by using right coordination. The ERP system plays a major role in this coordination to deal with the uncertainty in dynamic market (research model). ERP agility affects organization output by improving strategic processes including competences, goals realizations and further expansions, which are useful in PIP (RQ3).

3.3.2 "Lack of" Flexibility

ERP system is a complete, integrated business solution that automates and combines various business processes related to distribution, production and operations (Davenport, 1998) (Kharabe, 2009). There are two main properties that differentiate the ERP system from previous classes of Information systems. At first there is enterprise wise integration of various processes including finance, sales, marketing, manufacturing, warehousing, purchasing, production, etc. (Markus & Tanis, 2000). In most of the cases the ERP system is leased or licenses purchases by the ERP vendor, and the standard system is built on the business model which is considered as the best practise in the industry, rather than specific business process needs of the enterprise (Sharma & Yetton, 2003). Due to this, the ERP solutions are normally considered as

inflexible, rigid and difficult to change and implement. The enterprise faces various challenges in terms of enterprise change management, business process realignment and resources. There are many literatures on ERP implementation but quite a few of them address the ERP PIP (Kharabe 2009).

In summary, in this section a reason is provided why ERP agility in PIP is so important to investigate. Based on various literatures (RQ1) it can be concluded that ERP system is quite inflexible, rigid and difficult to change therefore not agile (RQ3). But challenges such as enterprise change management, business process realignment and resources, require ERP PIP agility (RQ2). Furthermore limited research in this direction (RQ1) leads to focus on ERP PIP agility: factors and ways to improve it (RQ3).

3.3.3   ERP Customizations

There are extensive researches about the alignment of ERP systems with the enterprise requirements. This alignment is important for ERP agility i.e. it can be adapted or tailored to business needs. The enterprise has its own tailored business processes, where as ERP systems are built on the standard processes provided by the ERP manufacturer or vendors. So there is need to make an alignment between these business processes and standard processes inbuilt in ERP systems, either enterprise needs to adapt its processes or customise the ERP systems (Kharabe 2009).

Most of the studies related to alignment of ERP system focus on the pre-implementation and implementation phase, and a very few of them focus on post-implementation phase (Ngai et al., 2008). In Table 10 below some points based on various literatures (RQ1) related to ERP PIP agility are mentioned.

Table 10 Key points related to ERP PIP (Law et al. 2010)

1	Change made to the original ERP functionality to match the business requirement is referred as customizations. This change could be enhancement in codes, creating or modifying the user interfaces, reports, alerts, and enhancement of features provided by the ERP system (Dittrich & Vaucouleur 2008).
2	In "Vanilla" ERP implementation, there are no changes made to the standard ERP systems. The configuration table and parameters provided by the standard ERP systems are used to meet the requirement of implementing company (Parr, 2000) (Christina & Siew, 2005) (I. Yakovlev, 2001).
3	Customization involves additional cost and risks to an ERP implementation and maintenance project (Davenport, 1998) (Robert & Craig, 2006).
4	Due to customizations, migrating to newer version or system updates could be more cost intensive and so it creates issues for current support and maintenance activities (Robert & Craig, 2006) (K. Kumar, 2000) (Light, 2001).
5	In most cases vendors supply ERP system and its maintenance and support is vendor driven. Sometimes the enhancements and software patches provided by ERP vendors are incompatible with the customized older version of ERP solution in use by the enterprise (Ng, 2001) (Celeste et al., 2002).
6	Time limitation for the warranty of ERP system provided by the vendor is crucial. After the new release the support to older version of ERP systems ceases (Robert & Craig, 2006).

According to (Law et al. 2010) the points need to be considered in the ERP lifecycle are: degree of customization, selecting among total in-house implementation, or employing external consultant, or total outsourcing, and management of interest of various stakeholders. In PIP, it is important for the company to decide about the extent of customization in order to align the functionalities and to meet the user requests. In order to optimize the costs, alignment with best practices, and employing right amount of human resources, the enterprise needs to make right decision about either to depend on the expensive external resources for ERP management and support activities or to develop an in-house capability. If these major decisions are not taken properly then impact could be very adverse.

In summary, in order to be agile, it is important that ERP system can be adapted to enterprise business requirements (RQ2) because agility require alignment of ERP services with the organization (changing) business requirements (dynamic market), also relevant to research model. Customized business processes of the organization need to be aligned with ERP standards business processes provided by ERP vendor (agility factor of RQ3), which is possible by either enterprise adapting its processes or ERP system customizations.

Table 10, which is based on various literatures related to ERP PIP agility is relevant for RQ1: status of ERP PIP with focus on agility. To measure the extent of agility in ERP

PIP (RQ2) it is important to decide about the extent of customization in order to align ERP functionalities with user needs. For an efficient ERP agility in PIP (RQ3) it is important to decide either to rely on external resources for ERP PIP activities or develop an in-house capability so that costs and resources are optimized with alignment to ERP best practises.

3.3.4 Depth of Customization

The dynamic change in business environment needs frequent update in the ERP system. The depth of ERP customization is a strategic decision that affects both the costs and the risks related to support and upgrade (in PIP) of the ERP business application (Davenport, 1998). Tailoring the ERP systems includes the report change, change in the programming code, user interfaces etc. to align the ERP functionality and processes with the enterprise business requirement called Customization (Dittrich & Vaucouleur 2008). ERP systems are complex and customizing is not an easy task. A typical customization needs system and functional expertise, and its challenging for the consultants and parties involved in it (Dittrich & Vaucouleur 2008). In some ERP systems for example Oracle, the ERP vendors do not provide the customers access to the source codes (Law et al. 2010), so customization needs involvement of ERP vendors.

In past literatures it has been shown that heavy customization leads to more cost and implementation risks (Harris, 2004) (Davenport, 1998). It needs lot of time and work for business analyst and programmers, and therefore increases cost and return of investment could be difficult to be realized (Robert & Craig, 2006). Also migrating to future releases and applying updates to the customized ERP system could be difficult task (K. Kumar, 2000). Avoiding customization is difficult but its favorable mostly, specially when there is migration or update to a new release of ERP system (Robert & Craig, 2006). Many enterprise are favoring aligning their business requirement in the ERP system by configuring the ERP system with parameters and tables provided in the application and business processes reengineering (realign their business processes with adopted ERP system inbuilt processes), instead of customization due to risks involved. Customization is the last choice otherwise it is considered to be the only choice at strategic level (Law et al. 2010).

In summary, dynamic change in business environment triggers (research model) changes in ERP system in PIP. Amount of ERP customization to make ERP more agile in PIP (RQ3) is strategic decision affecting both costs and risks in ERP PIP activities (support and upgrade). ERP agility need it to align its functionalities and processes with enterprise business needs, so agility requires ERP customizations (RQ3). These customizations needs certain expertise and in some cases (for example Oracle), ERP vendor plays an important role in ERP PIP agility (RQ3) since they have the in depth system and functional expertise. Literature studies also show that (RQ1) too much customization leads to large costs and risks factors (RQ3) because it will make migration to newer releases and updates in customized ERP (PIP) a difficult task. Therefore agility (for migration and updates) requires avoiding over customization in ERP PIP (RQ3). Business process reengineering (RQ3) is adopted by organizations to match their business processes to ERP, to make it more agile in PIP (in terms of migration and future upgrades) and reduce risks.

3.3.5 Role of External Vendor

Most of the enterprises have underrated the effort needed for support, upgrade and maintenance (PIP) activities of the ERP systems. It is essential for them to understand the important support and management activities difference between traditional in-house information system and ERP system (Law et al. 2010). Support and management activities of in-house traditional information systems include periodic support (for example handling coherent errors), and customization or modification (for example making changes in system features to meet the user requests), which require in-depth system knowledge can be handled more or less independently by the enterprise (Vessey & Weber, 1983). The main skill oriented support activity is enhancement and modification that requires programmer work time, documentation quality (P. et al., 1981), interface support, business rules related to software application (Chapin, 2000) and supporting users request. Most of these activities could be handled by internal support system except only in special cases the help of external consultants is required, so implementing enterprise have control about the key decisions for upgrading the system and timing to develop a new version of the same (Law et al. 2010). The same is not true for the ERP systems which is provided by the external vendor, here the key decisions about the upgrade and migration activities are not entirely dependent on the

implementing company, but its more dependent on the ERP system supplier (Law et al. 2010). Most of times the ERP PIP support activities are dependent upon supplier technical support services, providing the software patches, and in addition to minor and major application version releases (Celeste et al., 2002). According to a research ERP PIP support and maintenance could be classified in nine types as shown in figure 8 (Celeste et al., 2002). Few of them are internal requests and others are external ERP supplier oriented (Ng, 2001) (Celeste et al., 2002). Internal requests consist of improvement, modification, bug fixing and user support requests. External supplier oriented requests consist of upgrading the functionality or minor improvement, ''patch maintenance standard'', ''patch maintenance adaptive'', ''patch maintenance corrective,'' and ''technical upgrade'' (Celeste et al., 2002). According to (Law et al. 2010), based on the internal skills and capability of the enterprise and difficulty of business demand, enterprise can select the right strategy between outsourcing and practicing a hybrid model. Good tie up and closer cooperation between ERP vendor and enterprise is essential for the successful ERP implementation and further activities related to ERP PIP. This is even more important because the ERP supplier road map for upgrade and policies related to its support influences the internal support activities of the enterprise. Due to high dependence on ERP vendor to provide future updates and bug fixes, which has major impact on the ERP PIP activities, it is difficult for the enterprise to break the contract with the vendor. For the adopting enterprise the "guaranteed level of service quality" from the ERP vendor is important, therefore it is also important to "place a higher perceived value on vendors' abilities to provide ongoing upgrade and maintenance".

Figure 8 Showing different types of ERP PIP support and maintenance activities and their orientation (Ng, 2001) (Celeste et al., 2002)

Selection of the ERP vendor depends on its capability and approach to provide services for ERP PIP: upgrades and support activities. Cost could be major issue when the company goes for complete outsourcing of ERP activities due high billable hours charges by the suppliers. In most of the cases companies uses the consultancy services of suppliers or its partner companies together with an internal ERP support team. Normally this team is assigned in joint projects together with the ERP supplier/ External consultant (King, 2005).

Most of the enterprise using ERP, subscribe to supplier support and maintenances services, mainly due to following two reasons (Law et al. 2010):

• ERP skills are not easy to get and expensive, so it is important for the enterprise to make sure that the required services are available when required,

- It also insures that the enterprise gets the required software updates, services patches, new major and minor application releases in future and required support to continue operations.

ERP systems functionality and technology are changing and improving with time (K. Kumar, 2000), and so the new versions and updates are continuously released for the customers. Since the last few years there is increase in frequency of new ERP system versions/releases. Looking it closely, in 90`s the average interval between two application releases are 3 years, which has been shortened to average of 1.5 to 2 years in recent years (Robert & Craig, 2006). This implies the enterprise is forced to update the system since the old release support will be expired soon. Also the ERP suppliers put pressure on the enterprise to migrate the ERP application to the newer version in order to continuously receive the future support (Songini, 2004). The migration is expensive and the migration cost is also growing at the average of about 19% in past years (Songini, 2004). Even when these services from the suppliers are expensive, the enterprise continue to use them due to risk and inherent costs involved in not using them (Law et al. 2010). In perspective of ERP PIP customization and support, for an enterprise the value of supplier services is of great importance due to expertise, costs and technical availability required. Besides this, it is also important for an enterprise to be careful about the over customization of the standard ERP system in implementation or PIP, since this could risk the entire ERP application (Davenport, 1998). Also making major customization internally could jeopardize the nature of standard ERP system, this could be enhanced due to lack of specialized ERP skilled resources. So the enterprise deliberately tries to keep customization to minimum (for example by using "Vanilla" approach) and wait for the future updates and new releases from the ERP supplier (Parr, 2000) (I. Yakovlev, 2001).

In summary, support, upgrade and maintenance are important activities in ERP PIP for agility (RQ3). In comparison to traditional in-house system, ERP system is more dependent on external ERP vendors (RQ3) for PIP in terms of upgrade and migration activities because they provide technical support, software patches and version releases to help the PIP agility.

Agility of ERP PIP is possible by using various PIP support and maintenance activities. These activities are either oriented to internal requests or external ERP vendor as shown in figure 8 (RQ3). Some other factors like internal skills and capability, and complexity of business requirement (Dynamic market) (research model and RQ3) could led an organization to chose between outsourcing and hybrid model. Due to high involvement of ERP vendors in ERP PIP (agility), it is important to place a higher perceived value on vendor's abilities to provide PIP continuous upgrade and maintenance (to make PIP more agile) with guaranteed level of service quality (RQ3).

High cost in PIP due to large billable hours by vendors is an important factor to select the suitable ERP vendor and combine the external consultancy services with internal ERP (PIP) support team (RQ3). Subscription of vendor services could be a viable option in PIP to reduce cost and get the latest updates, service patches and new application releases in future (to cope with agility of ERP) to continue with PIP support and operation (RQ3). Finally, it is concluded that technology and functionality in ERP system are changing continuously with time and new features are added by ERP vendors, which make ERP more agile for changing market and business (RQ2). It is also shown that avoiding over customization is an important factor to minimize the risks of conflict of these upgrade and migration with the organization customized ERP system (RQ3) and thus also improves agility.

3.3.6 Administrative and Circumstantial Factors

Administrative and circumstantial factors are important to consider in any Information system implementation and it should be equally valued in ERP PIP. ERP support and maintenance activities are rewarding only when there is active involvement of internal information system resources, users, suppliers and other stakeholders to work together. It is important that the various stakeholders work together closely not only in ERP implementation but also afterwards in PIP, and share knowledge and various information among them (Law et al. 2010). There could be sometimes conflict and difference of opinion among stakeholders (Smith & McKeen, 1992). This could bring doubt and make things complicated in both implementation and ERP PIP. The enterprise should take proper measures to solve this conflicts among stakeholders arises due to difference of opinion in political and business concerns (Law et al. 2010).

Also without proper resource management the situation could be more troublesome in ERP PIP support and operations. Periodic updates, patches, new releases and bug fixes should be properly and correctly tested before applying them to the production environment (I. Yakovlev, 2001). So proper investments in in IT/ERP infrastructure such as additional hardware and software are essential. Also developing and retaining the right ERP skilled resources is important and challenging for the ERP PIP. Lack of right skills could create problems and difficulties in ERP PIP support and improvement activities (Law et al. 2010).

Furthermore to develop the skills and growth, the proper quality training is important for ERP PIP. Internal skills necessary to manage and support the ERP system could be developed with quality user training customized to enterprise business requirement and processes. Also skills to make and develop quality state of art documentation and training manuals are important (Scott, 2006).

In summary, administrative and circumstantial factors are important for ERP agility. With active involvement of ERP resources, users, suppliers and other stakeholders in ERP PIP, not only sharing of knowledge and information is easier but also it helps to solve conflicts due to various external factors related to political and business concern (research model: dynamic environment). So changes in external environment require agility in ERP PIP with proper resource management, conflict resolution, and information sharing among various stakeholders (RQ3). Other important factors in ERP PIP agility (RQ3) are development and retention of right ERP skilled resources and proper investment in ERP infrastructure. These factors are required to minimize the problems and difficulties in ERP PIP support and improvement activity, therefore making it more agile. The last factor, the proper quality training (RQ3) customized to enterprise business requirement and processes is important for skill development and growth in ERP PIP. This will help in agility not only by improving ERP PIP support and manage activities, but also make it more adaptive with quality state of art documentation and training manuals.

3.3.7 Summary

The section ERP agility is focused on agility and ERP PIP, based on the research questions. Connection between various factors in ERP agility in PIP is shown in figure

7, which also depicts various sections considered for this section. First section evaluates dynamic market situation with possible answers to RQ. This is followed by literature research showing how ERP lacks flexibility and importance for ERP adaptation i.e. customizations. Next section focus on organization needs and necessity of customization and this is followed by section covering the depth of customization requirement. It is also concluded that ERP vendors plays an important role in PIP agility and in brief tries to find important factor related to research question. In the end role of circumstantial and administrative factors related to ERP PIP agility is provided with importance of resource management, skills development and trainings.

3.4   Approach / Research Model

In figure 9 a draft research model is shown. This model is based on research question defined and detailed literature review provided in this chapter. In this model it is assumed that IT/ERP governance and agility has an important role in ERP PIP. From the literature analysis it is assumed that dynamic market environment triggers agility, and perhaps even IT/ERP Governance. Based on the summary in this chapter, it can be mentioned that the direction of dynamic market to the IT/ERP governance is not as interesting as direction of dynamic market to agility, so it is shown with dashed line.

Figure 9 Research model proposed
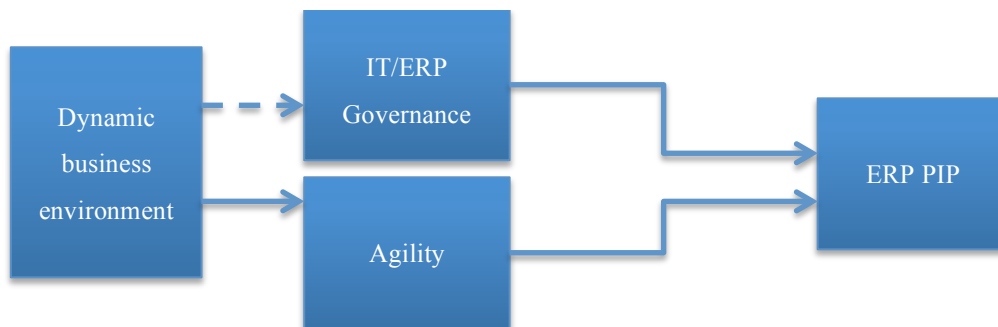
4.   Findings

In this chapter answers to the research question are drawn based on the literature studies in chapter 3. Additionally for answering RQ2 relational analysis is used, which is described in section 4.2.2 and results of the findings in section 4.2.3

4.1   Outcome to Research Question 1

This section is used to answer RQ1: "What is the current status of the ERP PIP with focus on IT/ERP governance and agility in literatures?" Table 11 summarizes the main literatures topics, focus and literature support, which is considered to find the current literature status of ERP PIP with focus on IT/ERP governance and agility. The table collects all the literatures sources considered in chapter 3; as described earlier target was to summarize the current status of ERP PIP with focus on IT/ERP governance and agility. This is achieved by reviewing existing literature related to the topic (as mentioned in section 2.2 of chapter 2).

Table 11 Summary of all the literatures considered with the given focus

Literature topics	Focus	Literature support
ERP systems	ERP Systems	(Park & Lee, 2006), (Dantes et al., 2012), (Ganesh et al., 2014), (Amid & Kohansal, 2014), (Beard & Sumner, 2004)
	Benefits	(Render & Heizer, 2008), (Gupta & Kohli, 2006), (SAP AG, 2008)
	Market and Evolution	(Ganesh et al., 2014), (Columbus, 2014),
	Life cycle	(Guido Capaldo, 2009), (Gede Rasben Dantes, 2011), (Dantes et al., 2012), (Law et al., 2010), (Ram et al., 2013), (Usher, 2010), (Khanna & Arneja, 2012), (Sayana, 2004),
	PIP	(Usher, 2010), (Seethamraju & Sundar, 2013), (Grande & Chatzidakis, 2013), (Weston, 2001), (Yu, 2005), (McGinnis & Huang, 2007), (Zhu et al., 2010)

Literature topics	Focus	Literature support
IT/ERP governance	IT/ERP Governance	(Lingyu et al. 2010), (Weill & Ross, 2004), (Tsai et al., 2011), (IT Governance Institute, 2003)
	Benefits	(IT Governance Institute, 2008), (Weill & Ross, 2004), (IT Governance Institute, 2007), (Saetang & Haider, 2014), (Usher 2010)
	IT Governance with focus on ERP PIP	(IT Governance Institute, 2003), (Tsai et al., 2011), (Usher 2010), (Gartner, 2008)
	Implementation	(Usher 2010), (Weill & Ross, 2004), (Sambamurthy & Zmud, 2000), (Ciborra, 1996), (Brown, 1999), (Galbraith, 1994), (Gallagher et al., 2011)
	Frameworks of ERP system implementation	(COBIT5, 2012), (ISACA 2012), (IT Governance Institute, 2007), (Lingyu et al., 2010), (Changizi, 2012), (Reza et al., 2013), (Teyyebi, 2010), (Parvizi et al., 2012), (Kieviet, 2006), (Yamakawa et al., 2012), (Symons, 2005), (Nuripurpuravi & Khajehasanirabari, 2012), (Moeinzad, 2011), (Duffy & Denison, 2008), (Hui, 2009)
	Maturity model	(Ng & Gable, 2010), (Ahlemann et al., 2005), (Mettler, 2009), (Holland & Light, 2001), (Millet & Botta-Genoulaz, 2008), (Esteves & Bohórquez, 2007), (Software Engineering Institute, 2006), (Hecht, 2012), (Fraser & Gregory, 2002), (De Bruin et al., 2005), (Kajko-Mattsson, 2002), (Software Engineering Institute, 2006), (Software Engineering Institute, 2009), (Niessink et al., 2005), (April et al., 2005), (Kajko-Mattsson, 2007), (COBIT5, 2012), (Usher, 2010),
ERP Agility	Evaluation	(Kharabe, 2009), (Parente, 1996), (Flynn & Flynn, 1999), (Sambamurthy et al., 2003.)
	Lack of Flexibility	(Davenport, 1998), (Kharabe, 2009), (Markus & Tanis, 2000), (Sharma & Yetton, 2003)
	ERP Customization	(Kharabe 2009), (Ngai et al., 2008), (Law et al. 2010)
	Depth of Customization	(Davenport, 1998), (Dittrich & Vaucouleur 2008), (Law et al. 2010), (Harris, 2004), (Robert & Craig, 2006), (K. Kumar, 2000)
	Role of External Vendor	(Law et al. 2010), (Vessey & Weber, 1983), (P. et al., 1981), (Celeste et al., 2002), (Ng, 2001), (King, 2005), (K. Kumar, 2000), (Songini, 2004), (Robert & Craig, 2006), (Parr, 2000), (I. Yakovlev, 2001)
	Administrative and Circumstantial Factors	(Law et al. 2010), (Smith & McKeen, 1992), (I. Yakovlev, 2001), (Scott, 2006)

As mentioned in section 2.2, the relevant literatures are identified by collecting and reviewing the literature about IT/ERP governance and agility in the ERP PIP in various databases and search engines like Network of Libraries and Information Centers in Switzerland (NEMBIS), IEEE Xplore, ACM digital Library, Gartner, Forbes, Springer, Google scholar and Google. In chapter 3, theoretical foundation based on all the relevant literatures for this thesis work and effective description of all the literature related to research questions are provided. Based on this, foundation table 11 shows that some areas like ERP lifecycle, Frameworks of ERP system implementation, Maturity model, and Role of External Vendor in ERP agility are more discussed in selected literatures in comparison to ERP PIP and other areas.

4.2   Outcome to Research Question 2

This section will go in the analysis of RQ2: "How does agility affect ERP PIP?" To examine the influence of agility in ERP PIP a relational analysis is employed to a number of relevant articles in the selected journals manually as described in section 4.2.1 and its findings in section 4.2.2. Later on in section 4.2.3 the results will be interpreted and consolidated which is also explicated in the conceptual model figure 14.

4.2.1 Relational Analysis

One of the options to carry out a content analysis is relational analysis, which is based on conceptual analysis that examines the number of occurrences and relationships among various concepts or phrases in the text (Palmquist, 2001). Hence occurrences of defined views/codes regarding the relationships of the concepts under the study in the journals articles are to be examined using this approach and performed manually (as mentioned in section 2.5, search evaluation criteria). There are some steps that need to be followed in order to carry out a relational analysis (Colorado State University, 2011).

For the purpose of this thesis the following steps (based on the recommendations from the Colorado State University) are employed:

1. **Identifying the Question:** The question is identified as, "how does agility affect the ERP PIP?"

The main focus here is to look at, whether one concept promotes the other one or not, which concept triggers which and which one is top concern for the organizations.

2. **Articles selection:** Selection of articles is done manually (as mentioned in search evaluation of section 2.5) and carefully from the selected journals in accordance with evaluation criteria defined earlier.

3. **Coding:** Codes are given to the same concepts or views highlighted in the visualized conceptual model in figure 9. Frequency and visualization of each code is done manually by using excel and charts.

   Codes are grouped into three affiliation categories as follows:

   i. **Triggering:** Codes in this category reflect the fact that, the first concept stimulate and initiate the second concept, which in turn triggers the third concept. Hence it has following two codes:

      1. Dynamic business environment triggers Agility
      2. Agility triggers ERP post implementation.

   ii. **Promoting:** In this category, codes reflects the relationship between two concepts in which one concept promotes the other or vice versa. Hence it consists of three codes as follows:

      1. Agility promotes ERP post implementation
      2. ERP post implementation promotes Agility
      3. IT/ERP governance promotes ERP post implementation

   iii. **Top concern:** In this category, codes are classified as top concern of the organizations in current dynamic business environment. It has following codes:

      1. Agility
      2. ERP post implementation

4. **Performing statistical analysis**

After assignment of codes to each of phrases, the charts are providing the code frequencies and occurrences in the journals articles and present this in bar charts. With the help of these outputs a comparable visualization of the trend in the views could be made (as shown in figure: 10,11 and 12).

4.2.2 Relational Analysis Findings

As it is mentioned in section 4.2.1, a relational analysis is carried out to understand the nature of the relationship between the concepts. As mentioned in table 3, the analysis is performed on 9 articles, selected and tested carefully against the evaluation criteria, out of 3240 articles searched in 4 online journals. A deeper dive into the results within each code is elaborated in the following by affiliation category:

I.   Top concern

Codes in this category are classified to be top concerns to literature in today's dynamic environment. For example selected online journal articles consider agility or ERP PIP as significant and hence regarded as a top concern for them. Findings in this respect reveal that, agility was mentioned in all 9 online journals with 82 times as a top concern. On the other hand there were only 40 times appearances for ERP PIP in 4 online journals. Figure 10 provides a visualization of the findings in this respect. It reflects the fact that, today's top concern of literatures is to be agile more than to ERP PIP. The findings also do not underestimate the importance of ERP PIP agility. But this interest seems to be less popular especially with advent of disruptive technologies.

Figure 10 Top concerns of selected online journals
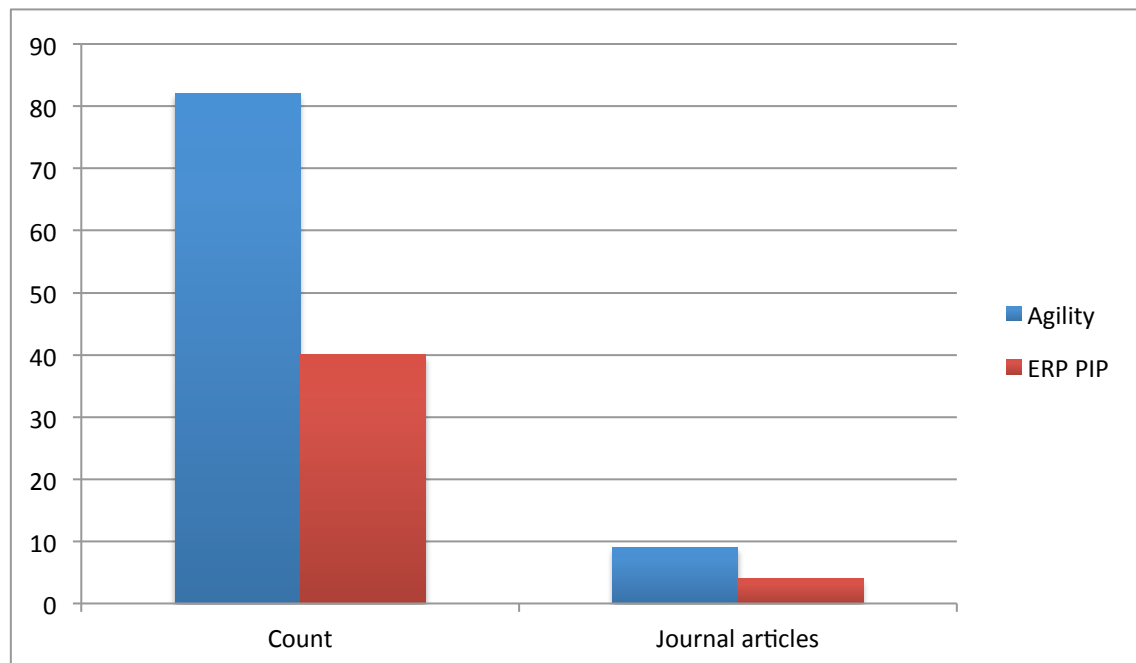
The main statements that support the code with agility as the top concern are summarized in the following main points:

- "Agility should be considered, which is the ability of an organization to respond rapidly to changes in demand'' (Areti et al., 2014)
- "Features of enterprise systems environment (ERP PIP) - integration, process optimization, and best practices-affect agility." (Seethamraju & Sundar, 2013)
- "Agility defined as the ease and speed with which firms can reconfigure, redesign, and realign their processes to respond to these needs, threats, and opportunities, has become an essential capability for business organizations today." (Seethamraju & Sundar, 2013)
- "Built from the literature on flexibility in economics, the concept of agility was further developed in agile manufacturing and in strategic management and information systems literature." (Seethamraju & Sundar, 2013)
- "Agility in responding to environmental changes (transfer production overseas in order to reduce labour costs)" (Iizukaa et al., 2013)
- "Data-integration initiative like ERP could have primary business objectives (PIP): Greater agility and flexibility" (Bilge & Yılmaz, 2014)
- "Companies need agility to face the market demands and environment changes of today and tomorrow" (Sangwan & Kuldip, 2014)

The main statements that support the code with ERP PIP as the top concern are summarized in the following main points:

- "Features of enterprise systems environment (ERP PIP) - integration, process optimization, and best practices-affect agility." (Seethamraju & Sundar, 2013)
- "Some studies argue that IT (ERP PIP) enables agility by improving decision making, facilitating communication, delivering electronic integration, and providing digital options." (Seethamraju & Sundar, 2013)
- "Extension prior research on the post-implementation (PIP) effects of ERP systems in firms and analyses the specific role played by ERP systems on process agility." (Seethamraju & Sundar, 2013)
- "Data-integration initiative like ERP could have primary business objectives (PIP): Greater agility and flexibility" (Bilge & Yılmaz, 2014)

- "Technologies bring with them further flexibility, agility, efficiency, scalability and re-configurability to ERP systems and the operations (ERP PIP) they support – mainly because they enhance the potential for inter-organizational connectivity." (Wan, 2013)

To summarize, considering agility as the top concern most of the author's emphasis on ability to adapt and respond to changes in business environment. While considering ERP PIP as the top concerns most of the author's emphasis on flexibility, process optimization to improve agility and use of advanced modern technologies.

II.   Triggering

In this category, the findings reveals that the code with the view of dynamic business environment triggers Agility is supported and appeared 26 times in 5 of the online journals indicating in one way or another, that it is the dynamic business environment that triggers companies to be agile. Contrary to that the code with the view of Agility triggers ERP PIP is supported 42 times distributed in 5 of the online journals. The difference between these two codes/views could be seen in figure 11 below.

Figure 11 Triggers comparison
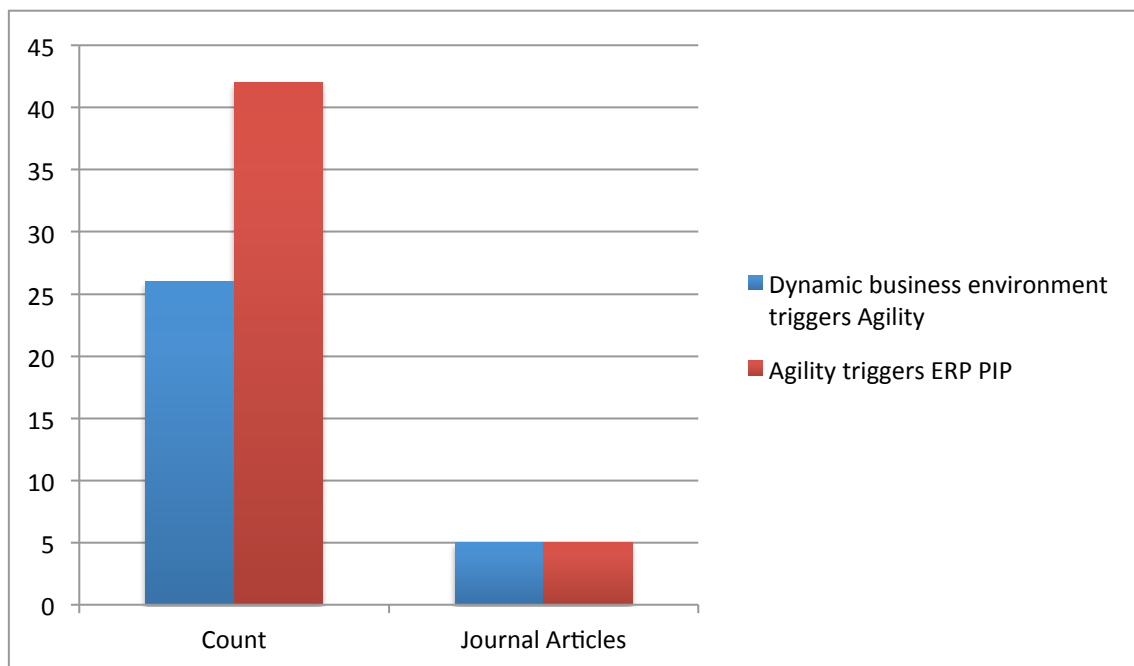
The main statements that support the code with the view of dynamic business environment triggers the agility are summarized in the following main points:

- "Agility is crucial in the current business landscape, characterized by rapid rhythms of change and high degree of uncertainty" (Areti et al., 2014)
- "Agility merges the four competitive dimensions of cost, quality, dependability, and flexibility and moves beyond them to encompass an ability to respond rapidly to any unexpected changes in the market and business environment." (Seethamraju & Sundar, 2013)
- "The key dimensions of agility are the ability to sense or detect changes in the environment with speed and the ability to respond to those changes with speed." (Seethamraju & Sundar, 2013)
- "Agility in responding to environmental changes (transfer production overseas in order to reduce labour costs)" (Iizukaa et al., 2013)
- "Information visible can also increase supply chain agility by enabling buyers and suppliers to respond to environmental changes more quickly." (Lustrato, 2014)
- "As competition increases and markets become even more turbulent, many manufacturers are trying to re-design their operations and ERP systems to have even greater agility." (Wan, 2013)
- "Companies need agility to face the market demands and environment changes of today and tomorrow" (Sangwan & Kuldip, 2014)

On the other hand the statements that supports the Agility triggers ERP PIP are summarized in the following main points:

- "Features of enterprise systems environment- integration, process optimization, and best practices-affect agility." (Seethamraju & Sundar, 2013)
- "In the ERP-system enabled environment, the inadequacies in implementation and poor process optimization prior to ERP implementation are restricting process agility." (Seethamraju & Sundar, 2013)
- "Despite the accumulated knowledge about ERP projects, research on post-implementation effects of ERP systems in general and on agility and innovation in particular is still limited." (Seethamraju & Sundar, 2013)

- "While there is a rich body of literature on ERP adoption and implementation, there is limited research on post-implementation effects and benefits such as flexibility, agility, process innovation, and competitive advantage." (Seethamraju & Sundar, 2013)
- "Data-integration initiative like ERP could have primary business objectives: Greater agility and flexibility" (Bilge & Yılmaz, 2014)
- "Technologies bring with them further flexibility, agility, efficiency, scalability and re-configurability to ERP systems and the operations (ERP PIP) they support – mainly because they enhance the potential for inter-organizational connectivity." (Wan, 2013)
- "Organizational agility is promoted by empowering advanced users to apply changes to models which in turn result in a modification of the enterprise software system (ERP PIP)." (Tony et al., 2013)

To summarize, considering view of dynamic business environment triggers the agility most of the author's emphasis on agility as an important factor for the organization to respond to turbulent and rapid changes of business environments. While considering view of Agility triggers ERP PIP most of the author's emphasis on limited flexibility of ERP PIP, use of modern technology and lack of enough research in this area.

III. **Promoting**

Findings in this category reveal that, the code of Agility promotes ERP PIP have showed up 8 times in 4 of the online journals. In contrast there were 14 times appearances in 2 online journals, for the code with the opposite view and IT/ ERP governance promotes ERP PIP appears 1 times in 1 journal article, which is very less compare to the other two. Figure 12 provides visualization to the differences among these codes.

Figure 12 Promotive influences
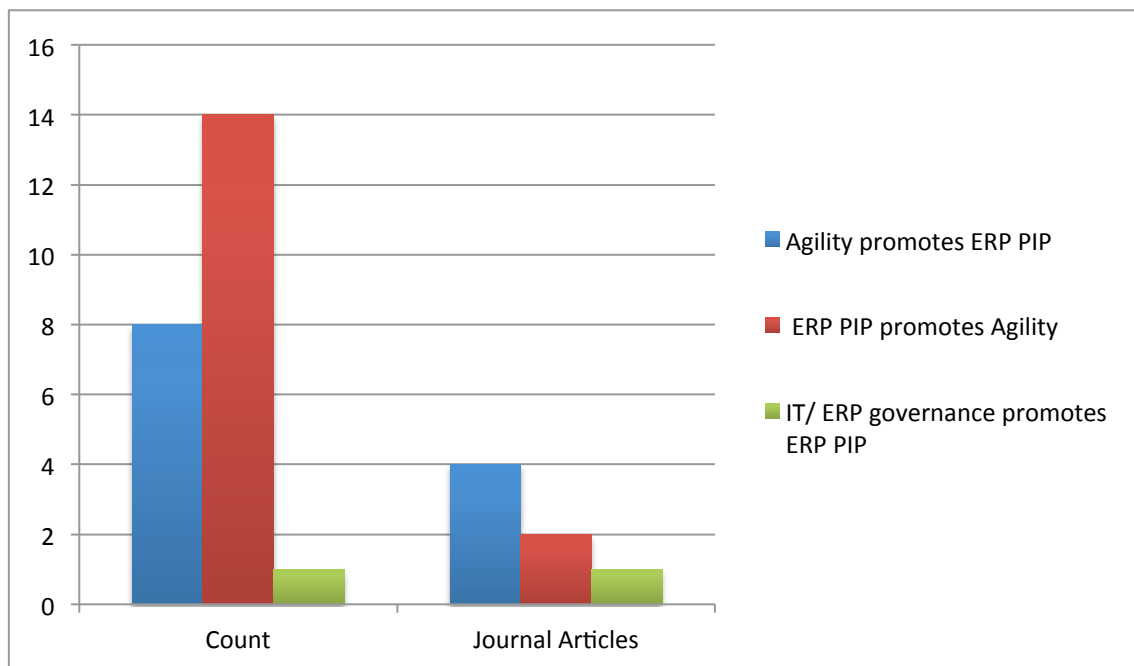
Some of the main statements, which support the path of that Agility, promote ERP PIP can be summarized in following main points:

- "By analysing the impact of capabilities such as integration, process optimization, and best practices enabled by the implementation of ERP systems on process agility, this study contributes to the literature by demonstrating how process agility, an intermediate outcome, is likely to affect organizational outcomes such as cost, efficiency, and profit (ERP PIP)" (Seethamraju & Sundar, 2013)
- "Operational agility refers to the ability to rapidly redesign existing processes (ERP PIP)." (Seethamraju & Sundar, 2013)
- "In order to improve business and IT agility, many organizations are migrating their IT infrastructure (ERP PIP) to Service-Oriented Architecture (SOA)" (Cao & Zhu, 2013)
- "Organizational agility is promoted by empowering advanced users to apply changes to models which in turn result in a modification of the enterprise software system (ERP PIP)." (Tony et al., 2013)

Some of the main statements, which support the path of that ERP PIP promotes Agility can be summarized in following main points:

- "Some studies argue that IT (ERP PIP) enables agility by improving decision making, facilitating communication, delivering electronic integration, and providing digital options." (Seethamraju & Sundar, 2013)
- "Given the investments in ERP systems and the significant risk of failure, it is important for firms to understand the impact of enterprise systems (ERP PIP) on agility e a firm level performance challenge in the current dynamic business environment." (Seethamraju & Sundar, 2013)
- "Even though good IT infrastructure capability, including capabilities delivered by a well-established ERP (PIP) system, could have a positive effect on process agility, centralization of controls and the consequent requirements of new skills to manage improved and new processes could potentially limit agility" (Seethamraju & Sundar, 2013)
- "How do the capabilities enabled by the implementation of ERP environment (PIP) enhance or impede a firm's business process agility." (Seethamraju & Sundar, 2013)
- "Data-integration initiative like ERP could have primary business objectives (PIP): Greater agility and flexibility" (Bilge & Yılmaz, 2014)

One statement, which support the path of that IT/ ERP governance, promote ERP PIP can be summarized in following main point:

- "When processes are simple, standardized, and visible (ERP PIP), you will get higher compliance and there will be less work-around: thus, compliance to process is important for agility" (Seethamraju & Sundar, 2013)

To summarize, considering view that Agility promote ERP PIP most of the author's emphasis on process optimization, empowering users and modification of IT/ERP infrastructure (for example by using SOA architecture). While considering view that ERP PIP promotes Agility most of the author's emphasis on centralization of controls by electronic integration, processes improvement and flexibility. The view that IT/ ERP governance promotes ERP PIP, the author emphasis on simplification, standardization and visibility of process, which are important for its compliance.

4.2.3 Interpretations and Consolidation

Based on the findings in the section 4.2.2, it can be concluded that agility is becoming a top concern of online journal literatures in comparison to the ERP PIP. Agility began gaining momentum especially in recent times with the emergence of disruptive innovations. Hence doing well in disruptive technology, leveraging valuable growth opportunities, avoiding risks and being ahead of competitors appear to be determined by the speed of the response. The findings support that the dynamic business environment stimulates and triggers the need to be agile. On the other hand according to the selected online journals the agility triggering ERP PIP is higher in number of counts. This supports the fact that the main intention of ERP PIP agility is getting most attention in the journals and also dynamic business environment triggering agility is important consideration.

Even though the ERP PIP is less discussed in these literatures, this does not imply underestimating the significance of the ERP PIP. IT/ERP governance is well known for its positive role in ERP PIP (Seethamraju & Sundar, 2013). Being embedded in agility, it could still reach out and promote ERP PIP, which in turn leads to finding of this research where agility promotes ERP PIP. Empowering advanced users to apply changes to models promotes enterprise agility, which in turn result in promoting of ERP PIP (Tony et al., 2013). On the other hand, the findings did reveal that ERP PIP also promotes agility to a greater extent. ERP PIP enables agility by advancing decision making, improving communication, delivering electronic integration, and providing digital possibilities (Seethamraju & Sundar, 2013). This leads to the conclusion that there is a mutual promotive relationship between both these concepts. Since the main focus of this research is to look at this relationship from the side of agility as influencer, only that path of relationship is considered. Figure 10 portrayed these relations with bold and dotted arrows. Therefore, only relationships with bold arrows are of main significance. Based on the findings, process improvement and modernizing IT/ERP infrastructure is important for agility to promote ERP PIP, where as electronic integration, flexibility and improvement of processes are important for ERP PIP to promote agility. Therefore process improvement could be an important factor for this mutual promotive relationship.

4.3   Outcome to Research Question 3

This section will go in the analysis of RQ3: "What are the different factors impacting the ERP PIP regard to IT/ERP Governance or/and agility?" Finding various influencing factors impacting the ERP PIP with focus on IT/ERP governance or/and agility achieve this analysis. In achieving this, findings in chapter 3 are analyzed to determine these factors. In the section 4.3.1-deducted influencing factors impacting the ERP PIP with focus on IT/ERP governance are provided, while in section 4.3.2 -factors impacting the ERP PIP with focus on agility are provided.

4.3.1 Influencing Factors with Focus on IT/ERP Governance

Based on section 3.2.2 literature analysis, the factors are deducted summarized in table 12.

Table 12 Summary of influencing factors on ERP PIP with focus on IT/ERP governance

Focus	Influence factors	Analysis
IT/ERP governance domains influencing ERP PIP (IT Governance Institute, 2003)	IT strategic alignment	Focusing on strategic alignment area, the top management should ensure that ERP strategy is aligned according to business strategy, technology investment decisions are aligned with business goals, and the ERP organizational structure supports the business model and direction.
	IT value delivery	The completeness, quality, and reliability of ERP systems must be confirmed, and ensure ERP investments show balance of risk and benefit, and that budgets are agreeable.
	IT risk management	Supervise the efficiency of internal controls and ensure that the ERP risks are reduced, transferred, accepted effectively by risk management.
	IT resource management	Comprehend the general architecture of the organization's ERP applications portfolio as well as its strategy of asset management, and monitor the way in which the management determines necessary ERP resources needed to achieve strategic goals.
	IT performance management	Supervise the development of key ERP performance metrics and also inspect and evaluate senior management's performance on ERP operation strategies.

Focus	Influence factors	Analysis
Ten key components of IT/ERP governance covering key areas of ERP PIP (Gartner, 2008)	Decision-making	With this governance decision rights are balanced among various levels, covering from top management, business unit leaders and end users.
	End-user support	The governance of Superusers/ end user encloses the processes and methods that keep their network performing and actively supporting in PIP support.
	Security	ERP security governance begins with project implementation by defining access rights to every process component. In ERP PIP a process is developed to request, approve and maintain changes in security.
	Quality assurance and testing	This governance is important to keep in place the processes and methods to make it sure that the required stakeholders are involved at the right time to test the system changes.
	Training	This governance ensures that the formal processes are defined to make sure that the training is delivered to the right target group in right time, and training feedback is received and acted upon.
	Environment management and architecture control	This is about application governance of vendor-supplied patches, fixes, and new releases in a sequence and time frame that fits ERP PIP production operations schedules and also the requirements of development environment.
	Data	ERP data governance should make sure data consistency and support responsibility, ensure required inter- and intra enterprise data security, data quality, and facilitates compliance with various requirements and data standards.
	Investment prioritization	This governance ensures connected master plan that includes the necessity of user requirements, business actions, deficiency of resource, and limitations of budget.
	Business processes and configuration control	This governance control makes it sure that required attention is given while making decisions to change how the ERP system in PIP is utilized.
	Compliance and IT standards	This governance ensures rules to govern the changes should be in place regarding the way in which this should be done, tested, and migration of these to ERP production environment. In addition it is also important to make a common agreement about responsibility for compliance, and building processes for monitoring solutions to assure that they are compliant.

Other factors, which have influence on ERP PIP related to IT/ERP governance based on section 3.2.3, could be summarized in table 13.

Table 13 Factors influencing ERP PIP implementation

ERP PIP implementation influence factors	Analysis
Role of Senior level management in ERP decision making	Since changes in ERP system impact all processes of PIP in all three levels of the organization namely strategic, management and operation.
Horizontal mechanisms as a conceptual framework	Due to dynamics business condition there is a change in focus from static or relatively fixed, structure perspective to a more dynamic perspective and this is realized by using horizontal mechanism. These are conceptual framework, which can be used to examine the arrangement of ERP PIP.

Based on section 3.2.4 frameworks of IT/ERP governance, the deducted factors are summarized in table 14.

Table 14 Influencing factors from IT/ERP governance framework analysis

Frameworks focus	Influencing factors	Analysis
Lingyu framework	Choosing the right strategy between BPR and customization	Provide a maximum possible benefit is significant for all ERP implementation phases including PIP.
	Four phases	Strategy, organization, assignment of responsibilities, and KPIs of IT/ERP governance are significant for ERP PIP.
COBIT framework	Areas of expertise	Value creation, risk management, investment optimization and proving IT/ERP governance
	Process model	Provides a connection between needs of operation (PIP) and expectation of organization (business)
	Control objectives	Helps in auditing IT/ERP process goals (performance indicators and maturity) with control outcome tests.
	Connection of activities	Like MM, accountability and controls are shown which is significant for ERP system and PIP as well (figure 11).
ITIL framework	Continuous service improvement	In ERP PIP, providing continuous service is important and with ITIL enabled IT/ERP functions this possible. This not only reduces the operational (PIP) IT/ERP costs but also improves delivery and value.
	Knowledge, abilities and skills provided by ITIL	This could be an expertise for ERP PIP training and support activities

Based on section 3.2.5, MM helps in satisfying eight chosen IT-related capabilities of ERP PIP, these capabilities help to consider agility and IT/ERP governance in ERP PIP. These capabilities are shown in figure 13.

Figure 13 IT related capabilities of ERP PIP considered to evaluate MM
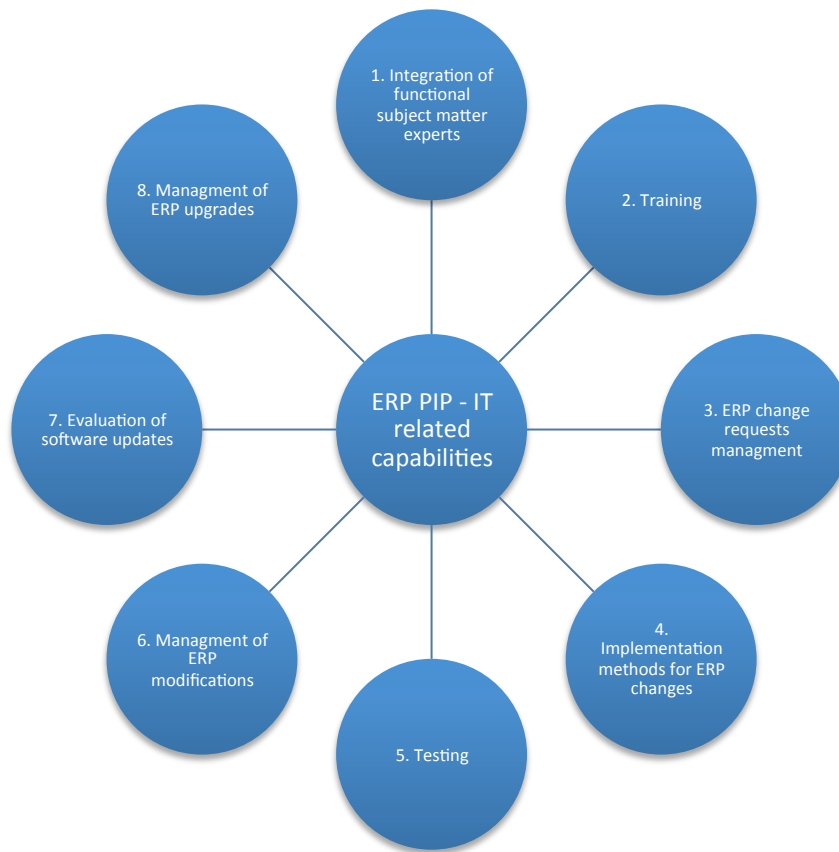
Based on the findings of Hecht, 2012, the eight capabilities with a brief analysis can be summarized in table 15.

Table 15 Analysis of IT capability model for ERP PIP (Hecht, 2012)

IT capability for ERP PIP	Analysis
1. Integration of functional subject matter experts	Capability to integrate key users into their support structures.
2. Training	Capability to provide trainings contingent on the users' specific situation.
3. ERP change requests management	Capability to assess and select ERP change requests.
4. Implementation methods for ERP changes	Capability to make knowledgeable decisions about the implementation method for ERP changes.
5. Testing	Capability to apply described methods for testing ERP changes that include both users and IT personnel.
6. Management of ERP modifications	Capability to manage an actual adaptation or enhancement to an ERP system across its life cycle.
7. Evaluation of software updates	Capability to identify and evaluate relevant software updates.
8. Management of ERP upgrades	Capability to manage ERP upgrades with suitable IT project management practices that formed from previous implementation and upgrade projects experiences.

4.3.2 Influencing Factors with Focus on Agility

Based on section 3.3, the factors affecting ERP PIP with focus on agility is summarized in the table 16.

Table 16 Summary of influencing factors on ERP PIP with focus on agility

Focus	Influencing factors	Analysis
ERP PIP agility factors	Dynamic business environment evaluation	ERP agility affects organization output by improving strategic processes including competences, goals realizations and further expansions, which are useful in PIP.
	ERP system lacks flexibility	ERP system is quite inflexible, rigid and difficult to change therefore not agile. But challenges such as enterprise change management, business process realignment and resources, require ERP PIP agility.
	Organization requirement and need for customizations	ERP agility requires alignment of ERP services with the organization (changing) business requirements (dynamic market). Customized business processes of the organization need to be aligned with ERP standards business processes provided by ERP vendor, which is possible by either enterprise adapting its processes or ERP system customizations. For an efficient ERP agility in PIP it is important to decide either to rely on external resources for ERP PIP activities or develop an in-house capability so that costs and resources are optimized with alignment to ERP best practises.
	Extent of customization requirement	Amount of ERP customization to make ERP more agile in PIP is strategic decision affecting both costs and risks in ERP PIP activities (support and upgrade). ERP agility need it to align its functionalities and processes with enterprise business needs, so agility requires ERP customizations. ERP vendor plays an important role in ERP PIP agility since they have the in depth system and functional expertise. Agility (for migration and updates) requires avoiding over customization in ERP PIP, so BPR is adopted by organizations to match their business processes to ERP therefore enhancing agility.
	Influence of external vendors in ERP PIP	Agility of ERP PIP is possible by using various PIP support and maintenance activities. These activities are either oriented to internal requests or external ERP vendor as shown in figure 8. Due to high involvement of ERP vendors in ERP PIP (agility), it is important to place a higher perceived value on vendor's abilities to provide PIP continuous upgrade and maintenance (to make PIP more agile) with guaranteed level of service quality.
	Influence of administrative and circumstantial factors in ERP PIP	Changes in external environment require agility in ERP PIP with proper resource management, conflict resolution, and information sharing among various stakeholders. Development and retention of right ERP skilled resources and proper investment in ERP infrastructure are required to minimize the problems and difficulties in ERP PIP support and improvement activity, therefore making it more agile. Proper quality training customized to enterprise business requirement and processes is important for skill development and growth in ERP PIP agility.

5.   Conclusion and Outlook

This section provides a conclusion with regard to the research questions including summary of its findings and what it implies to the interested academic people and practitioners. A revised research model is provided based on the findings in chapter 4 in section 5.1. Afterwards research limitations and contributions are provided in section 5.2. Finally a further research suggestion is given in section 5.3, which probably might provide the way for further studies in the related area.

In today's dynamic business environment, the governance of agility has a promotive influence in ERP PIP. This thesis is set to explore and understand how agility and IT/ERP governance influences ERP PIP. It has also provided a list of factors that appear to be important for this relationship. The rationale behind the focus on this path in the relationship is that, even though both concepts, the agility and IT/ERP governance, seem to be critical in the success of the companies, the need for agility, particularly in nowadays dynamic business environment, appear to be more discussed in literature than ERP PIP, which is also observed in the findings of RQ2 of this thesis. However the literature on this subject was found to be inconclusive specifically on the following questions:

1. What is the current status of the ERP PIP with focus on IT/ERP governance and agility in literatures?
2. How does agility affect ERP PIP?
3. What are the different factors impacting the ERP PIP regard to IT/ERP Governance or/and agility?

In order to answer these questions, a conceptual model based on the existing literature is proposed to provide a visual representation of the relationship between the involved concepts. Later after the analysis, the revised conceptual model is derived in section 5.1 to visualize the interpretations of the findings of the research. The research analysis answered the first question successfully by summarizing the main literatures topics with focus and literature support, which are considered to find the current literature status of ERP PIP with focus on IT/ERP governance and agility. In table 11 the literature topics considered for this thesis like ERP systems, IT/ERP governance and ERP agility, their

focus and literature sources are provided, which helps in determining the relevant available literatures, which covers the corresponding focus.

As for the second question, the result about agility affect on ERP PIP and the findings of a relational analysis performed on nine related articles of four selected online journals, were consolidated and emerged in conformity to what it was predicted in the initial conceptual model that agility promoting ERP PIP. Definitely, the findings to this question reveal and support the additional fact that ERP PIP also promotes agility to a greater extent by advancing decision making, improving communication, delivering electronic integration, and providing digital possibilities (Seethamraju & Sundar, 2013). There is mutual promotive relationship between ERP PIP and agility, and process improvement is an important factor for the same (as mention in section 4.2.3). Also agility triggering ERP PIP is supported by most of the selected online journal articles, which is also the case in proposed research model.

For the third question, the analysis of thesis answered implicitly by highlighting the factors impacting the ERP PIP regard to IT/ERP Governance or/and agility. At first influencing factors with regard to IT/ERP Governance is detected and analyzed, and afterwards factors regarding agility are mentioned and analyzed. Based on findings of section 4.3.1, the factors with regard to IT/ERP Governance are mentioned below:

1. IT/ERP governance domains influencing ERP PIP
2. Ten key components of IT/ERP governance covering key areas of ERP PIP
3. Role of Senior level management in ERP decision making
4. Horizontal mechanisms as a conceptual framework
5. Lingyu framework factors
6. COBIT framework factors
7. ITIL framework factors
8. ERP PIP - IT related capabilities as influencing factors

Based on findings of section 4.3.2, the factors with regard to agility are provided below:

1. Dynamic business environment evaluation
2. ERP system lacks flexibility
3. Organization requirement and need for customizations

4. Extent of customization requirement

5. Influence of external vendors in ERP PIP

6. Influence of administrative and circumstantial factors in ERP PIP

These factors affect ERP PIP, with regard to IT/ERP Governance or/and agility based on the findings in literatures of chapter 3. When the factors are considered in practice, these could be useful for improving effectiveness of ERP PIP.

5.1   Research Model Revised

Based on the findings and interpretations, an enhanced research model to include and consider these findings as shown in figure 14, which is derived in order to visualize the influence, where the dynamic business environment is depicted as a trigger of agility, which in turn triggers ERP PIP. Since dynamic business environment triggering IT/ERP governance is not significant, it is shown with a dotted arrow. Figure 14 shows the relationship direction from one concept to another with the arrows. Since there is mutual promotive relationship between ERP PIP and agility as derived in section 4.2.3, hence it is shown with a bi-directional arrow. Influencing factors with focus on IT/ERP governance and agility are shown in the box pointing to arrows directing to ERP PIP.

Figure 14 The revised research model

IT/ERP governance influential factors on ERP PIP:

1. IT/ERP governance domains influencing ERP PIP
2. Ten key components of IT/ERP governance covering key areas of ERP PIP
3. Role of Senior level management in ERP decision making
4. Horizontal mechanisms as a conceptual framework
5. Lingyu framework factors
6. COBIT framework factors
7. ITIL framework factors
8. ERP PIP - IT related capabilities as influencing factors

Dynamic business environment

IT/ERP Governance

Agility

ERP PIP

Agility influential factors on ERP PIP:

1. Dynamic business environment evaluation
2. ERP system lacks flexibility
3. Organization requirement and need for customizations
4. Extent of customization requirement
5. Influence of external vendors in ERP PIP
6. Influence of administrative and circumstantial factors in ERP PIP

5.2   Research Limitation and Contributions

This research is not without limitation. The data used in this research are mainly based on document studies, various literatures and online journals. Similar to any other method of data collection, it has its pros and cons. Information may be inapplicable, disorganized or outdated. A considerable effort is applied to mitigate and avoid these risks and other related cons. Every article used undergone strict review and tested against evaluation criteria set in advance that consider newness, relevancy and authority of the data. Therefore, this does not undermine the findings of the research, which in turn resulted in important theoretical contributions to the body knowledge of business information systems. These are represented in that; the research has bridged the knowledge gap among agility, IT/ERP governance and ERP PIP, in relation to the way on how they influence ERP PIP. This would allow interested people to look at agility from the perspective of being a promotive factor of ERP PIP and vice versa. The research has also contributed to the gap by suggesting the need for agility but backed with the IT/ERP governance to deal with current dynamic business environment. Moreover the influencing factors determined for IT/ERP governance in ERP PIP could be a good method for practitioner when it comes to improve the responding capability.

5.3   Future Research

While this research focused mainly on agility and IT/ERP governance that influence ERP PIP outcomes it is clear that there are many other factors that play a role in the PIP. Future research can be conducted to explore these factors for example the level of planning required for ERP PIP and how this plan could be addressed.

The findings of this thesis in respect to the promotive effect of agility on ERP PIP and vice versa, lead into a new dimension that may require further attention and research. IT/ERP governance and agility influence on ERP PIP may be considered as a measurement of a company's ability to optimize its ERP PIP with the business strategy. This paves the way to further research into how to measure the effectiveness of ERP PIP through agility and IT/ERP governance. Furthermore based on enhanced research model in figure 14, a concept/framework could be developed to improve and support business practices. An industry differentiated case study research with interviews could also be a possibility. These are only a few possibilities for further study, however there

is much more that practitioners and researchers can learn about improving ERP PIP success.

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7. List of Figures / Tables

7.1 Figures

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8. Appendix / Appendices

8.1 Screen Shots of Search Made in Various Journals

8.2 Analysis of Top Concept in Research Question 2

Texts	Agility	ERP post implementation
1. (Areti et al., 2014)- ScienceDirect		
"Agility should be considered, which is the ability of an organization to respond rapidly to changes in demand"	1	
"Agility is crucial in the current business landscape, characterized by rapid rhythms of change and high degree of uncertainty"	1	
"SC agility is also known to support supply chain responsiveness and its resilience, which involves reacting to its disruptions in a flexible and adaptive manner."	1	
2. (Seethamraju & Sundar, 2013) - ScienceDirect		
"Effect of ERP systems on agility is contradictory, and research on the post implementation effects of ERP systems on agility is limited"	1	1
"Features of enterprise systems environment (ERP PIP) - integration, process optimization, and best practices-affect agility."	1	1
"Standardization of processes (ERP PIP) has mixed effect on agility and depends on the extent of standardization implemented and whether it included prior simplification."	1	1
"In the ERP-system enabled environment (ERP PIP), the inadequacies in implementation and poor process optimization prior to ERP implementation are restricting process agility."	1	1
"Agility defined as the ease and speed with which firms can reconfigure, redesign, and realign their processes to respond to these needs, threats, and opportunities (Raschke & David, 2005; Sambamurthy, Bharadwaj, & Grover, 2003), has become an essential capability for business organizations today."	1	
"Relationship between a firm's agility and information technologies (ERP) has been studied in the past, the underlying contradictions between information technology (IT) and agility have not been satisfactorily researched (Lu & Rammurthy, 2011)"	1	
"Some studies argue that IT (ERP PIP) enables agility by improving decision making, facilitating communication (Davenport, Harris, & Cantrell, 2004), delivering electronic integration (Nazir & Pinsonneault, 2012), and providing digital options (Sambamurthy et al., 2003)."	1	1
"Others contend that IT (ERP PIP) impedes agility (Overby, Bharadwaj, & Sambamurthy, 2006; Weil, Subramani & Broadbent, 2002) partly due to rigidity of information systems and technology artifacts (Galliers, 2007; Wensley & Stijn, 2007)."	1	1
"An understanding of the relationship between firm agility and information technologies is limited (Lu & Rammurthy, 2011; Nazir & Pinsonneault, 2012)."	1	
"While leading vendors offer a variety of technical and organisational solutions to achieve agility, and software vendors promise this agility through their enterprise systems (ERP) and their suite of applications, their capacity to deliver the required capability has not been empirically studied (Tallon, 2008)."	1	
"With enterprise resource planning (ERP) systems firmly entrenched in most firms today and considered the backbone (ERP PIP) to managing business processes, understanding the influence of these systems on process agility is important."	1	1
"Despite the accumulated knowledge about ERP projects, research on post-implementation (PIP) effects of ERP systems in general and on agility and innovation in particular is still limited (Nazir & Pinsonneault, 2012; Peng & Nunes, 2009; Schlichter & Kraemmergaard, 2010)."	1	1
"With ERP systems associated with agility (Goodhue, Chen, Boudreau, Davis, & Cochran, 2009) as well as rigidity (Galliers, 2007), the underlying contradictions are largely unknown and under researched."	1	
"Extension prior research on the post-implementation (PIP) effects of ERP systems in firms and analyses the specific role played by ERP systems on process agility."	1	1
"Set against a resource-based view, the research analyses the link between ERP systems (PIP) and business process agility from the perspective of the benefits of ERP systems."	1	1
"By analyzing the impact of capabilities such as integration, process optimization, and best practices enabled by the implementation of ERP systems on process agility, this study contributes to the literature by demonstrating how process agility, an intermediate outcome, is likely to affect organizational outcomes such as cost, efficiency, and profit (ERP PIP)(Tallon & Pinsonneault, 2011)."	1	1
"Built from the literature on flexibility in economics, the concept of agility was further developed in agile manufacturing and in strategic management and information systems literature."	1	
"Agility merges the four competitive dimensions of cost, quality, dependability, and flexibility and moves beyond them to encompass an ability to respond rapidly to any unexpected changes in the market and business environment."	1	
"Agility is about the speed to detect and respond to changes in the business environment (Li, Chung, Goldsby, & Holsapple, 2008)."	1	
"Though different facets of agility have been defined and discussed across the literature, operationalization of the process agility construct has only been		

Sheets: Triggering | Promoting | **Top concepts** | +

8.3 Analysis of Triggering in Research Question 2

Texts	Dynamic market environment triggers Agility	Agility triggers ERP post implementation
1. (Areti et al., 2014)- ScienceDirect		
"Agility should be considered, which is the ability of an organization to respond rapidly to changes in demand"	1	
"Agility is crucial in the current business landscape, characterized by rapid rhythms of change and high degree of uncertainty"	1	
"SC agility is also known to support supply chain responsiveness and its resilience, which involves reacting to its disruptions in a flexible and adaptive manner."	1	
2. (Seethamraju & Sundar, 2013) - ScienceDirect		
"Effect of ERP systems on agility is contradictory, and research on the post implementation effects of ERP systems on agility is limited"		1
"Features of enterprise systems environment (ERP PIP) - integration, process optimization, and best practices-affect agility."		1
"Standardization of processes (ERP PIP) has mixed effect on agility and depends on the extent of standardization implemented and whether it included prior simplification."		1
"In the ERP-system enabled environment (ERP PIP), the inadequacies in implementation and poor process optimization prior to ERP implementation are restricting process agility."		1
"Agility defined as the ease and speed with which firms can reconfigure, redesign, and realign their processes to respond to these needs, threats, and opportunities (Raschke & David, 2005; Sambamurthy, Bharadwaj, & Grover, 2003), has become an essential capability for business organizations today."	1	
"Relationship between a firm's agility and information technologies (ERP) has been studied in the past, the underlying contradictions between information technology (IT) and agility have not been satisfactorily researched (Lu & Rammurthy, 2011)"		
"Some studies argue that IT (ERP PIP) enables agility by improving decision making, facilitating communication (Davenport, Harris, & Cantrell, 2004), delivering electronic integration (Nazir & Pinsonneault, 2012), and providing digital options (Sambamurthy et al., 2003)."		1
"Others contend that IT (ERP PIP) impedes agility (Overby, Bharadwaj, & Sambamurthy, 2006; Weil, Subramani & Broadbent, 2002) partly due to rigidity of information systems and technology artifacts (Galliers, 2007; Wensley & Stijn, 2007)."		1
"An understanding of the relationship between firm agility and information technologies is limited (Lu & Rammurthy, 2011; Nazir & Pinsonneault, 2012)."		
"While leading vendors offer a variety of technical and organisational solutions to achieve agility, and software vendors promise this agility through their enterprise systems (ERP) and their suite of applications, their capacity to deliver the required capability has not been empirically studied (Tallon, 2008)."		
"With enterprise resource planning (ERP) systems firmly entrenched in most firms today and considered the backbone (ERP PIP) to managing business processes, understanding the influence of these systems on process agility is important."		1
"Despite the accumulated knowledge about ERP projects, research on post-implementation (PIP) effects of ERP systems in general and on agility and innovation in particular is still limited (Nazir & Pinsonneault, 2012; Peng & Nunes, 2009; Schlichter & Kraemmergaard, 2010)."		1
"With ERP systems associated with agility (Goodhue, Chen, Boudreau, Davis, & Cochran, 2009) as well as rigidity (Galliers, 2007), the underlying contradictions are largely unknown and under researched."		1
"Extension prior research on the post-implementation (PIP) effects of ERP systems in firms and analyses the specific role played by ERP systems on process agility."		1
"Set against a resource-based view, the research analyses the link between ERP systems (PIP) and business process agility from the perspective of the benefits of ERP systems."		1
"By analyzing the impact of capabilities such as integration, process optimization, and best practices enabled by the implementation of ERP systems on process agility, this study contributes to the literature by demonstrating how process agility, an intermediate outcome, is likely to affect organizational outcomes such as cost, efficiency, and profit (ERP PIP)(Tallon & Pinsonneault, 2011)."		
"Built from the literature on flexibility in economics, the concept of agility was further developed in agile manufacturing and in strategic management and information systems literature."		
"Agility merges the four competitive dimensions of cost, quality, dependability, and flexibility and moves beyond them to encompass an ability to respond rapidly to any unexpected changes in the market and business environment."	1	
"Agility is about the speed to detect and respond to changes in the business environment (Li, Chung, Goldsby, & Holsapple, 2008)."	1	

Sheets: **Triggering** | Promoting | Top concepts | +

8.4   Analysis of Promoting Factor in Research Question 2

	A	B Agility promotes ERP post implementation	C ERP post implementation promotes Agility	D IT/ ERP governance, promote ERP post implementation
1	Texts			
2	**1. (Areti et al., 2014)- ScienceDirect**			
3	*"Agility should be considered, which is the ability of an organization to respond rapidly to changes in demand"*			
4	*"Agility is crucial in the current business landscape, characterized by rapid rhythms of change and high degree of uncertainty"*			
5	*"SC agility is also known to support supply chain responsiveness and its resilience, which involves reacting to its disruptions in a flexible and adaptive manner."*			
6	**2. (Seethamraju & Sundar, 2013) - ScienceDirect**			
7	*"Effect of ERP systems on agility is contradictory, and research on the post implementation effects of ERP systems on agility is limited"*			
8	*"Features of enterprise systems environment (ERP PIP) - integration, process optimization, and best practices-affect agility."*			
9	*"Standardization of processes (ERP PIP) has mixed effect on agility and depends on the extent of standardization implemented and whether it included prior simplification."*			
10	*"In the ERP-system enabled environment (ERP PIP), the inadequacies in implementation and poor process optimization prior to ERP implementation are restricting process agility."*			
11	*"Agility defined as the ease and speed with which firms can reconfigure, redesign, and realign their processes to respond to these needs, threats, and opportunities (Raschke & David, 2005; Sambamurthy, Bharadwaj, & Grover, 2003), has become an essential capability for business organizations today."*			
12	*"Relationship between a firm's agility and information technologies (ERP) has been studied in the past, the underlying contradictions between information technology (IT) and agility have not been satisfactorily researched (Lu & Rammurthy, 2011)"*			
13	*"Some studies argue that IT (ERP PIP) enables agility by improving decision making, facilitating communication (Davenport, Harris, & Cantrell, 2004), delivering electronic integration (Nazir & Pinsonneault, 2012), and providing digital options (Sambamurthy et al., 2003)."*		1	
14	*"Others contend that IT (ERP PIP) impedes agility (Overby, Bharadwaj, & Sambamurthy, 2006; Weil, Subramani & Broadbent, 2002) partly due to rigidity of information systems and technology artifacts (Galliers, 2007; Wensley & Stijn, 2007)."*			
15	*"An understanding of the relationship between firm agility and information technologies is limited (Lu & Rammurthy, 2011; Nazir & Pinsonneault, 2012)."*			
16	*"While leading vendors offer a variety of technical and organisational solutions to achieve agility, and software vendors promise this agility through their enterprise systems (ERP) and their suite of applications, their capacity to deliver the required capability has not been empirically studied (Tallon, 2008)."*			
17	*"With enterprise resource planning (ERP) systems firmly entrenched in most firms today and considered the backbone (ERP PIP) to managing business processes, understanding the influence of these systems on process agility is important."*			
18	*"Despite the accumulated knowledge about ERP projects, research on post-implementation (PIP) effects of ERP systems in general and on agility and innovation in particular is still limited (Nazir & Pinsonneault, 2012; Peng & Nunes, 2009; Schlichter & Kraemmergaard, 2010)."*			
19	*"With ERP systems associated with agility (Goodhue, Chen, Boudreau, Davis, & Cochran, 2009) as well as rigidity (Galliers, 2007), the underlying contradictions are largely unknown and under researched."*		1	
20	*"Extension prior research on the post-implementation (PIP) effects of ERP systems in firms and analyses the specific role played by ERP systems on process agility."*			
21	*"Set against a resource-based view, the research analyses the link between ERP systems (PIP) and business process agility from the perspective of the benefits of ERP systems."*		1	
22	*"By analyzing the impact of capabilities such as integration, process optimization, and best practices enabled by the implementation of ERP systems on process agility, this study contributes to the literature by demonstrating how process agility, an intermediate outcome, is likely to affect organizational outcomes such as cost, efficiency, and profit (ERP PIP)(Tallon & Pinsonneault, 2011)."*	1		
23	*"Built from the literature on flexibility in economics, the concept of agility was further developed in agile manufacturing and in strategic management and information systems literature."*			

| Triggering | **Promoting** | Top concepts | + |

(The excel sheet with detail analysis is shown in

KumarDiptanshu_2014_AgilityMeetsGovernanceOfEnterpriseIT_RQ2_AnalysisSheet. xlsx.)