DEVELOPMENT OF AN AGILE ERP FRAMEWORK FOR IMPLEMENTATION: A SYSTEMATIC LITERATURE REVIEW

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Abstract— **Organization has the innovate technology to compete in business. ERP system is one of technological innovations to help the managerial making decision making to improve the performance of companies. Thus, ERP is the important thing for organization's survival. Based on previous research that the organizations have complexity in ERP implementation. According to survey global study (2017) the most companies still use traditional methods to implement ERP, and they have ensured that agile methods are one solution and become the challenges in replacing traditional methods in stages. It considers that agile methods will improve efficiency, the speed of response, relatively achieve the simplicity in managing business processes. Therefore, it is better to understanding comprehensively about an implementation method in order to manage ERP implementation success. Thus, we intend to propose a method approaching the solution to improve the ERP implementation success. This paper, the authors are analyze using Systematic Literature Review to recognize the critical factors for development an agile ERP model that was selected 54 papers for further research. The research findings reveal for identifying the factors of the agile principles in order to improve the ERP implementation. The purpose of this paper is to mapping the critical factors for practices to development of the agile ERP model.**

Keywords— **Development, Agile ERP framework, ERP implementation**

1. INTRODUCTION

In the technology transformation, so the ERP value is the important strategy of organization to ensure that it is possible to provide the best solutions in order to enhance the organization performance. ERP systems can give the solution to contribute to making decision. But in the fact, the organizations still have the complexity in ERP implementation. The Critical Failure Factors (CFFs) of ERP implementation as follows: excessive customization (27%); internal integration dilemma (18%); change management (16%); data quality (16%) [6]. these factors are the challenges for organization to enhance

the quality of ERP implementation. Based on previous research which the critical factors of ERP failure is the implementation method. Therefore, it is better to understand how to develop a new method for manage ERP implementation. Most organizations still use traditional methods of implementing ERP. For this reason, it is necessary to consider using other methods to implement ERP. The agile method is one of the method that should be considered in ERP implementation. Thus, the agile method can give the solution about the inability with the business process reengineering to follow business process of the ERP system available. The goal of this study is for developing an agile ERP model that contribute to enhance the quality of ERP implementation with the answer of the research question (RQ) as follows:

RQ1 How to explain an agile model is used for ERP system?

RQ2 What framework is needed to accomplish the ERP system?

RQ3 What is the Critical Success Factors (CSFs) of an agile framework for ERP system?

2. THEORETICAL BACKGROUND

2.1. AGILE METHOD

The agile model can verify for managing the project system to provide the contribution for support environment change [45]. The agile model is more flexible to treatment change of requirement and increasing productivity [20]. The agile model is effective in some tricky software development to effective business process [36]. The agile model has developed a decision of agile method to more adaptive in process [17]. And methods have gotten a good reputation for managing projects management. Because the agile model has benefit such as Focusing on business needs, on time, collaborating, product quality, developing gradually from a strong foundation, developing iteratively, communicating continuously, and exercising control. So, the agile model can be developed to improve the quality of ERP implementation

2.2. AGILE METHOD PRINCIPLE

The principle of the agile method is to satisfy customers and make changes to business processes that aim to provide the role of the application to work optimally. The principle of the agile method also consists of process, people, product, and practice factors, which focus on meeting business needs, sending in a timely manner, collaborating information, communicating and interacting intensively and clearly, as well as carrying out a strict supervision process in an effort to improve organizational performance [56 and 57]. The principle of the agile method can be shown in the following table:
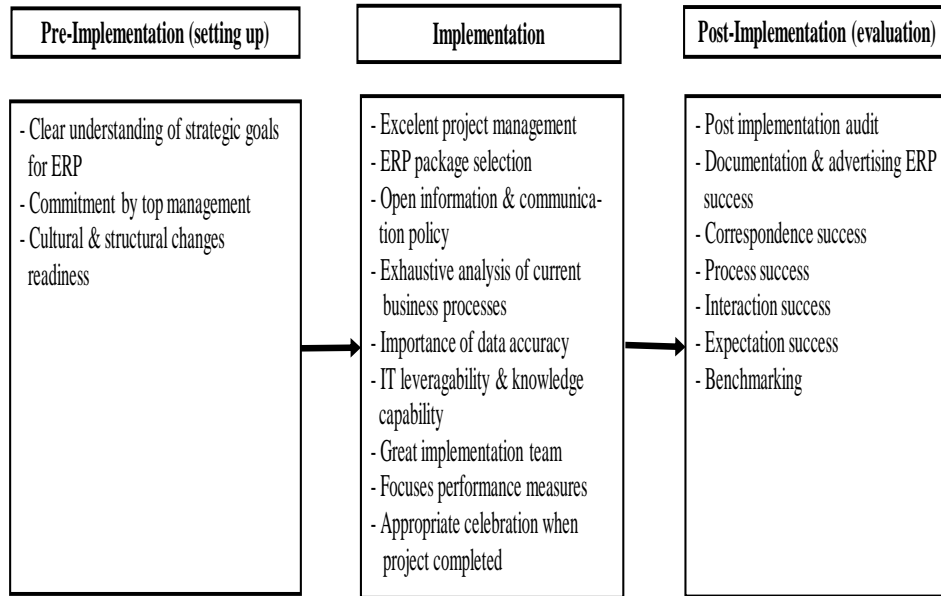
Table I. The Principles of the Agile Approach

COMPONENTS	FACTORS
Focus on the business need	Understand & respect true business priorities
	Establish valid business case
	Ensure continuous business sponsorship & commitment
	Guarantee delivery of minimum usable subset
Deliver on time	Timebox the work
	Focus on business priorities
	Always hit deadlines
	Build confidence through predictable delivery
Collaborate	Involve the right stakeholders at the right time throughout the project
	Ensure team members are empowered to take decisions on behalf of they represent
	Build a one team culture
Never compromise quality	Agree the level of quality from outset before development starts
	Ensure quality doesnot become a variable
	Test early, test continuously & test to appropriate level
	Desing & document appropriately
Build incrementally from firm foundations	Do appropriate analysis & enough design up front to create foundations for subsequent work
	With each delivered increment
Develop iteratively	Build business feedback into each iteration
	Recognise that most detail should emerge later, rather than sooner
	Embrace change
Communicate continuously and clearly	Make full and proper use of agile practices
	Provide opportunites for those interested to keep themselves informed project through visible activity and outputs
	Keep documentation lean and timely
	Manage stakeholder expectations at all levels
	Always aim for honesty & transparency
Demonstrate control	Make plans & progress visible to all
	Measure progress throuht focus on delivery of products
	Use appropriate level of formality for tracking & reporting

The principle of the agile method will build from an iteration to iteration and new features that can be added to the next iteration. It aims to harmonize changes in business processes and increase and add value to a system development project. The principle of the agile method will make a process of change in the development of information systems. The agile principle is used as an approach to developing a responsive and dynamic system of change so that it is possible to work proactively to manage changes in business processes and work more intelligently in order to improve the effectiveness and productivity. The agile methods issues are responsive for achieving information system project success, with focus the factors such as strategies, agile project management, systems, process, management, methodology, technologies, people and organization [58].

2.3. FRAMEWORK MODEL

The benefit of ERP system requires an understanding of IT-enabled organizational by developing the emergent business process [23]. The development of agile framework is an example for achieving simplicity of the business process.

Table II. Framework for ERP Implementation - Adopted from [37]

Pre-Implementation (setting up)	Implementation	Post-Implementation (evaluation)
- Clear understanding of strategic goals for ERP - Commitment by top management - Cultural & structural changes readiness	- Excelent project management - ERP package selection - Open information & communication policy - Exhaustive analysis of current business processes - Importance of data accuracy - IT leveragability & knowledge capability - Great implementation team - Focuses performance measures - Appropriate celebration when project completed	- Post implementation audit - Documentation & advertising ERP success - Correspondence success - Process success - Interaction success - Expectation success - Benchmarking

2.3. OVERVIEW OF ERP IMPLEMENTATION

ERP implementation has the significant affect in order to improve the organization performance to process change [22]. The other case, the challenge of ERP implementation can provide the competitive advantage of organizations to increase operational to be more effective [2]. The key success factors of ERP system as follows [25]:

a. Identifying change of system configuration changes to confirm business conditions;

b. Recruiting human resource as requirement skilled personnel within the conducting training programs;

c. Developing project plan to change management;

d. Decides with the consultant to determine of software and hardware components;

e. Go-live for timely ERP systems.

2.4. AGILE METHOD FOR ERP IMPLEMENTATION

An agile method for ERP implementation has been devised for combining agile of ERP systems, as follows: [35]

a. Envision – To construct an understanding concept of the purpose of using the system.

b. Iterate – To recognize the ERP solution for requirements of the user satisfy.

c. Decide – To determine of the ERP selected

The framework to evaluate post-implementation process to prove the trial system, checking reliability, data integrity, system utilization, and examine the benefits of ERP implementation [43].
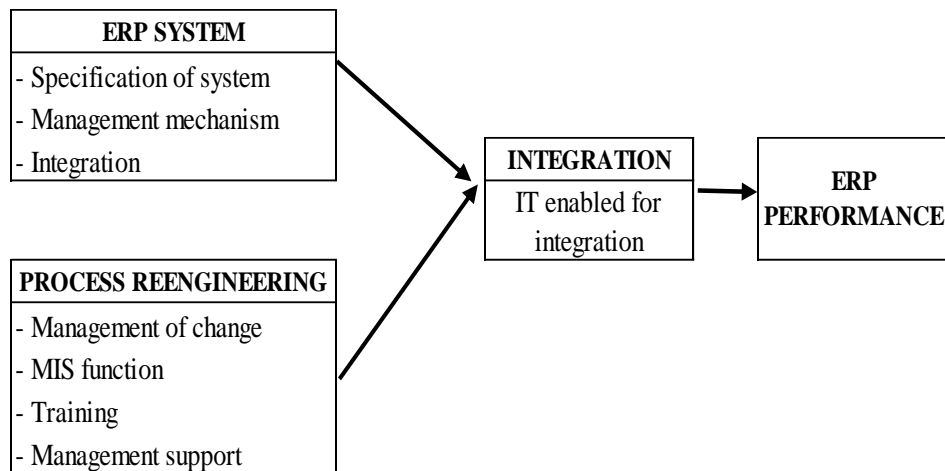
Fig. 1   An agile framework of ERP implementation

3. RESEARCH METHOD

This paper uses a literature review that is adjusted to the provisions by [55].

3.1. DATA SOURCE

The search method conducted by researchers in this research is to use keywords by determining the search string as follows:

a. ("agile") AND ("methods")

b. ("new") AND ("framework" OR "agile" AND "framework")

c.   ("erp") AND ("implementation" OR "agile" AND "framework")

Search terms assigned according to "agile framework ERP implementation" for searching the papers.

3.2. DESCRIPTION FOR INCLUSION CRITERIA AND EXCLUSION CRITERIA

In this study, the authors used a series of selection inclusion criteria and exclusion criteria to select appropriate papers to answer research questions.

Table III. Inclusion and Exclusion of Papers Selected

Inclusion criteria
- The criteria of studies are the describe agile method and ERP implementation approaches
- The papers published between 2005 and 2017.
- The conference or journal with computer science or information system.
- Studies included articles where the review of literature was the key article.
- The papers that according to quantitative research or qualitative research or a mix both.

Exclusion criteria
- The studies are not related to the topic of this study.
- The papers were the published before of the year 2005.
- The studies with non-academic databases.
- Duplicate articles found on the digital libraries
- The study is not written in English.
- The studies are not covering agile framework ERP implementation.
- The papers have a weak analysis, such as unpublished paper, opinion and poster session.

3.3. DATA COLLECTION

The authors manage and collect data by searching for titles, keywords, abstracts, and conducting a full-text analysis to determine and find information that matches the selected paper. Based on the results of data processing, the researcher will process by grouping into the following:

a. Studies found: It was a paper found in accordance with the keywords that matched the topic of this research.

b. Candidate selection: It is a paper by reviewing the title, keywords, and abstracts that are in accordance with the topic of the research.

c. Selected: An optional paper for conducting an overall review, as material for mapping and further analysis.

Table IV. Source of Studies

Source	Studies Found	Candidated Studies	Selected Studies
ACM	154	10	5
Elsevier	836	56	8
Emerald	753	35	13
IEEE	955	31	7
Inderscience	567	7	1
Other	81	67	10
Springer	1090	29	3
Taylor & Francis	412	39	5
Wiley Online	190	9	2
	5038	283	54

The following are the steps carried out by authors in processing data based on 54 papers selected to carry out further analysis in finding answers from research questions
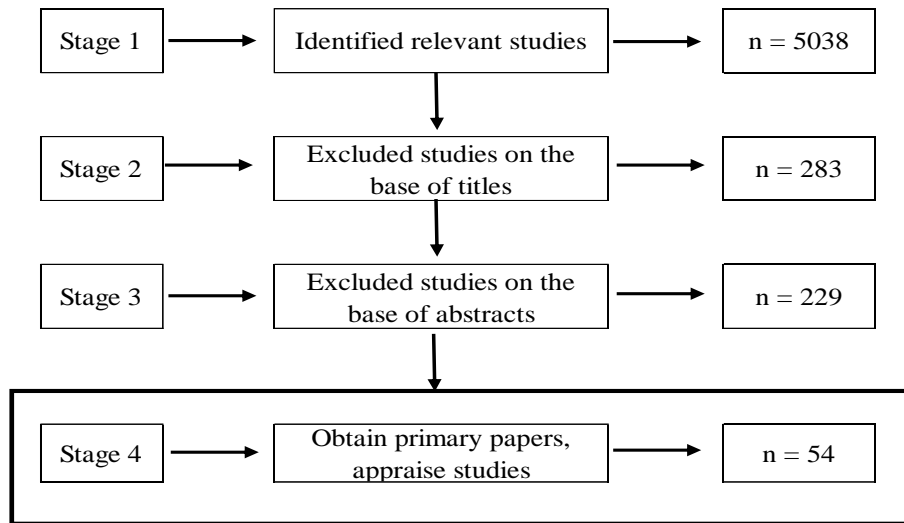
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┌─────────┐      ┌──────────────────────┐      ┌──────────────┐
│ Stage 1 │ ───> │ Identified relevant  │ ───> │  n = 5038    │
└─────────┘      │ studies              │      └──────────────┘
                 └──────────────────────┘
                            │
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┌─────────┐      ┌──────────────────────┐      ┌──────────────┐
│ Stage 2 │ ───> │ Excluded studies on  │ ───> │  n = 283     │
└─────────┘      │ the base of titles   │      └──────────────┘
                 └──────────────────────┘
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┌─────────┐      ┌──────────────────────┐      ┌──────────────┐
│ Stage 3 │ ───> │ Excluded studies on  │ ───> │  n = 229     │
└─────────┘      │ the base of abstracts│      └──────────────┘
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┌─────────┐      ┌──────────────────────┐      ┌──────────────┐
│ Stage 4 │ ───> │ Obtain primary       │ ───> │  n = 54      │
└─────────┘      │ papers,              │      └──────────────┘
                 │ appraise studies     │
                 └──────────────────────┘
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Fig. 2   Stage of Studies Selection Process

Figure 2, the authors have reviewed all papers based on keywords, titles, and abstracts which are mapping to match the inclusion criteria. Stage1, Based on 5038 papers selected that acknowledge relevantly are selected papers for detailed reviews. Stage2, Based on 283 papers as candidate selection. Stage3, based on 229 papers for detailed reviews. Stage4, Based on 54 papers as the main papers for processing data to answer the research questions.

3.4. DATA ANALYSIS

The analysis of data categories utilized in this study was:

a. The number of article type published based on the data source.

b. Research type that supported an agile method, framework model, and ERP implementation approach.

c. The number of study relevant with this research.

d. The quality score for each article type.

4. RESULT

The authors have examined for the mapping activity for the answer to research questions.

4.1. SEARCH RESULTS

The authors processed 54 papers as the main paper. The results of data processing is shown in Table V. The mapping CSFs of component according to literature shows that It indicates the component factors consist of organizational, process, people, systems, technology.

Table V. Mapping CSFs components using the literature

CSFs	COMPONENT	Research focus Agile	Framework	ERP	Freq	REFERENCES
ORGANIZATIONAL	Baseline and Sprint realization			√	1	[28]
	External pressures			√	1	[51]
	Trust			√	1	[51]
	Benchmarking		√		1	[5]
	Change management plan	√		√	8	[30]; [31]; [32]; [38]; [47]; [51]; [52]; [18]
	Clear goals & objective		√	√	2	[33]; [38]
	Common knowledge	√			1	[21]
	Completeness: sustained, maintained		√		1	[5]
	Continuous integration, improvement	√			3	[18]; [20]; [21]
	Customer collaboration	√			2	[20]; [45]
	Customer involvement	√			2	[21]; [45]
	Daily discussion	√			1	[21]
	Effective & timely communications	√	√	√	9	[26]; [30]; [31]; [33]; [38]; [47]; [5]; [48]; [20]
	Effective method	√			1	[18]
	Evaluation of Management			√	1	[47]
	Evolving and hierarchical specification	√			1	[21]
	Funds			√	1	[28]
	Individual and interactions	√			1	[20]
	Interaction success		√		1	[5]
	Knowledge management			√	2	[12]; [47]
	Lean, flexibility & iterative	√			1	[44]
	Learning loop	√			1	[21]
	Management support & commitment		√	√	11	[26]; [28]; [30]; [31]; [32]; [38]; [47]; [51];
	Commitments & emotional involvement		√		1	[5]
	Organization readiness & transparancy			√	4	[26]; [30]; [38]; [52]
	Organizational change, structural & cultural	√	√	√	14	[18]; [12]; [30]; [53]; [5]; [24]; [25]; [12]; [30]; [47]; [51]; [5]; [24]; [25]
	Project Management		√	√	8	[12]; [26]; [31]; [38]; [51]; [52]; [5]; [48]
	Responding to change	√			1	[20]
	Size of organization		√		2	[24]; [25]
	Small cross-functional teams	√			1	[21]
	Transformation leadership		√		1	[12]
PROCESS	Agile implementation	√			1	[27]
	Business implication and requirements			√	2	[30]; [32]
	Business process alignment		√		1	[8]
	Business process behaviors, dependencies		√		1	[8]
	Business Process Reengineering	√	√	√	9	[26]; [28]; [30]; [38]; [47]; [51]; [53]; [18]; [5]
	Code review	√			1	[45]
	Improve the quality of ERP system	√			1	[16]
	Implementation time			√	1	[28]
	Process champion success		√	√	4	[31]; [47]; [5]; [48]
	Product vision	√			1	[21]
	Simplicity	√			2	[20]; [45]
	Availability of usage frameworks		√		1	[5]
	Value objects, activities, goals, dependencies		√		1	[8]
	Working software	√	√		4	[20]; [18]; [24]; [25]
PEOPLE	External consultant support		√	√	4	[26]; [31]; [48]; [24]
	Lack of human & financial resources			√	1	[33]
	Motivated people	√			1	[20]
	Outcome review	√			1	[21]
	People interaction	√			1	[20]
	Skill manpower			√	1	[28]
	Time allocation	√			1	[45]
	Unattached communicative team	√			1	[21]
	User training and education	√	√	√	11	[26]; [30]; [31]; [33]; [32]; [38]; [51]; [52]; [18]; [5]; [48]
SYSTEM	Delivering frequent releases	√			2	[21]; [18]
	Minimum change requirement	√			1	[45]
	Progress monitoring	√			1	[21]
	Regular intervals	√			1	[18]
	Tailoring	√		√	3	[17]; [12]; [30]
	Technical excellence & good design	√			1	[20]
	Validation practice	√			1	[21]
	Cost, schedule, planned functionality			√	2	[32]; [51]
	Excessive customization			√	1	[32]
	Information quality		√		2	[25]; [8]
	Post implementation audit		√		3	[5]; [24]; [25]
	Sistems quality		√		2	[24]; [25]
	Software development			√	2	[12][30]
	System integrating			√	2	[32]; [52]
Technology	Alignment IT with business			√	1	[32]
	Data fill in			√	1	[28]
	IT legacy systems management		√		3	[5]; [24]; [25]
	Technological (infrastructure)	√	√		2	[18]; [5]

4.2. QUALITY FACTORS

The authors evaluated the related factors of quality scores for published date articles. The results of data processing is shown in Table VI.

Table VI. Quality Scores of Studies (by publication date)

Year	Mean quality score	Number of studies	ACM	Elsevier	Emerald	IEEE	Inderscience	Other	Springer	Taylor &	Wiley Online
2017	3.00	4	0	0	3	0	0	0	0	1	0
2016	2.50	9	1	2	1	2	0	2	0	1	0
2015	2.56	9	0	2	1	0	0	4	1	0	1
2014	2.56	9	1	0	2	3	1	2	0	0	0
2013	2.75	2	1	0	0	0	0	0	0	1	0
2012	2.63	4	1	0	2	0	0	1	0	0	0
2011	2.50	3	0	0	0	0	0	1	1	0	1
2010	2.75	2	0	0	2	0	0	0	0	0	0
2009	2.50	2	0	0	1	0	0	0	1	0	0
2008	2.50	3	0	1	0	1	0	0	0	1	0
2007	2.50	1	0	0	0	0	0	0	0	1	0
2006	–	0	0	0	0	0	0	0	0	0	0
2005	2.33	6	1	3	1	1	0	0	0	0	0
	2.39	54	5	8	13	7	1	10	3	5	2

Table VI shows that the number of papers published shows a relatively stable trend with an average scored 2.39.

5. DISCUSSION

In this section, the authors have shown the result of mapping to answer the research questions.

5.1. HOW TO EXPLAIN AN AGILE FRAMEWORK IS USED FOR ERP SYSTEM?

The purpose of this research question is to show the method aspects used in an agile framework for ERP implementation research. The empirical research that it is an increasing trend.
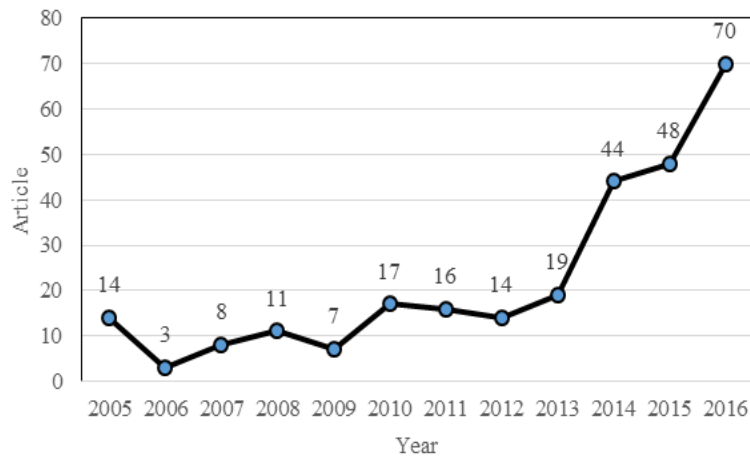

Fig. 3   The number of studies on agile framework ERP implementation

Figure 3 shows that the papers published an upward trend in trends. So, the agile framework for ERP implementation studies has the opportunity for further research.

5.2. WHAT FRAMEWORK IS NEEDED TO ACCOMPLISH THE ERP SYSTEM?

The purpose of this research question is to demonstrate the methodological aspects ued in the framework model for ERP implementation research.
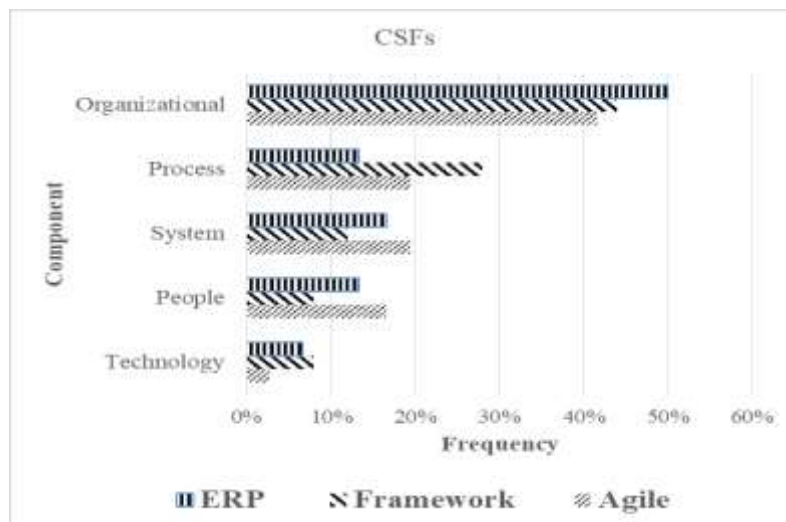

Fig. 4   Summary CSFs Component

Figure 4 show that the Critical Success Factors issue of framework model for ERP implementation have influence in organizational(50%) ; process(13%) ; system(17%) ; people(12%) ; technology(7%). The result of this analysis that the most important of framework model is organizational. So, the organizations readiness have decided to make the organizational change in determine ERP implementation.

5.3. WHAT IS CRITICAL SUCCESS FACTORS (CSFS) OF AN AGILE FRAMEWORK FOR ERP SYSTEM?

The purpose of this research question is to show the method aspects used in agile framework for ERP implementation research. Figure 4 indicates that the CSFs issue of framework model for ERP implementation have influence in organizational(44%); process(28%); system(12%); people(8%); technology(8%). Figure 4 indicates that the CSFs issue of agile method for ERP implementation have influence in organizational(42%); process (19%); system(19%); people(17%); technology(3%). So, the summary based on Figure 4, the CSF issue of an agile framework is organizational. The organizational have the important strategy for identifying an agile framework effectively to support ERP implementation.

5.4. LIMITATION AND FUTURE RESEARCH

This study only analyzes paper based on the SLR approach to recognize the agile model for ERP systems, And also the authors just make analyze for general organizations with the limitations on industry samples. Therefore, the author has accepted that this study has limitations and needs to be improved in future research by proving that agile frameworks are suitable and focus on case studies from various industries as objects with to develop for model agile ERP for enhance the quality of ERP implementation.

6. CONCLUSION

This research has the contribute to identifying the critical factors of an agile ERP model research using SLR methodology and having the significant impact for identifying the critical factors for implementation of ERP. Thus, the agile ERP model can be considered to enhance the quality ERP implementation. The critical factors of model agile ERP are organizational, process, system, process and technology. These factors have significant functions and have important contribution values in supporting quality improvement in ERP implementation. Beside that, agile ERP model has benefit such as focusing on business needs, on time, collaborating, product quality, developing gradually from a strong foundation, developing iteratively, communicating continuously, and exercising control. For this reason, the build of agile ERP model can be considered as the best solution to achieve implementing ERP success for the organizations.

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