Review of Frameworks in Requirements Engineering (RE)

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ABSTRACT

This paper focuses on analyzing and reviewing frameworks in requirements engineering. The primary success of a framework depends on the purpose and the projected area in discovering for Requirements Engineering (RE). The process in requirement engineering consists of five distinct phases that are requirement elicitation, requirement analysis & negotiation, requirement documentation, requirements verification & validation and requirements management. Requirement Engineering has many distinct proposed solutions for the difficulties inherited and framework suggests possible ways to identify the solutions. Frameworks discussed in this paper are categorized into theoretical, practical and conceptual methods with distinct problems and techniques suggested from the review of literature of RE frameworks. The paper also presents issues for future research in RE frameworks.

KEYWORDS

Frameworks, Theoretical, Partial, Conceptual, Requirements Engineering

1 INTRODUCTION

Requirement engineering is a process of investigating and maintaining the purpose of the system that is projected. Based from understandings through previous research, RE creates opportunities for meeting users goal and highlights the conflict of views, perceptions and goals of stakeholders involved in the implementation process [7]. Frameworks are popularly used to combine techniques of a research problem, topic or area in the field of RE with different framework defined by researchers that can act as important tool for advancing the process in RE [3].

Frameworks also are characterized according to their stated objective, comprehensiveness, relationship to the research focus and content focus. Requirement engineering is a huge field where the phases of frameworks available are for requirement analysis, requirement elicitation, requirement reuse, requirement traceability and requirement engineering process development [5]. This paper reviews and analyses the frameworks of requirement engineering in three different phases conceptual, practical and theoretical with description based on problem statement, proposed solution, RE phases discussed, RE phases not discussed and future research that are available. The paper is organized as follows. Section 2 describes the phenomena applies in theoretical framework in RE, activities of process using this framework method. Section 3 describes the phenomena for practical framework in RE and the activities of the process using this method. Section 4 discusses the conceptual framework in RE. Section 5 provides short discussion on suggestive framework to be applied for RE phases and the gaps exist for future

2 THEORETICAL FRAMEWORKS

Theoretical Framework is a type of framework in research that provides some analysis to help researchers in providing a particular set of questions to ask and creates perspectives to examine a study. In order to study the framework further, studies of research paper applying the tools and models in framework development for requirement engineering are analyses. The problem factor that leads to the development of a certain theoretical framework is because of no tool exist for
experimentation purposes that are suitable for different type of requirement model, integration, analysis and refinement in a holistic manner. MIRA: A Tooling Framework [11], an example of theoretical framework where the model represent requirements and have to be integrated with reference models that defines and structures the results to the relations.

This model exists to enable the advanced analyses on the consistency and completeness of the text requirements and formalization with the models. MIRA is applied for organizing and documenting requirements [11] of embedded systems. Another type of theoretical framework applied for developing variant-rich software systems for managing wide set of requirements in software application. These types of frameworks suggest the non-functional requirements that are often informally defined and the management normally does not provide traceability mechanisms for validation purposes [9]. The reasons for the framework development allow multi-model approach for non-functional requirements at domain engineering, and application engineering levels. Besides the multi-model shows representation [9] of different views that includes non-functional requirements and the relationships between the requirements and the features and functionalities.

The framework suggests constraints over the quality model, affecting characteristics, sub-characteristics and quality attributes. This kind of approach benefits the domain of the requirements, this allows the refinement in configuration models, and validation of metrics challenges the non-functional requirements [5]. Developing a sustainable non-functional framework is current research trends in the requirements engineering field. Research has begun exploring the role of requirements engineering in sustainability software quality where the importance in security requirements is evolved in developing sustainability [6].

Besides framework for modeling software requirements are popular in theoretical framework where the textual requirements specifications are difficult to learn, design, understand, review, and maintain while it’s easily recognize with a requirement analysis tool. However, requirements analysis is not limited to use cases only as they are used to capture only end user-level functional requirement and the requirement documents are usually written in natural languages that are less structured and in imprecise formats. This includes the requirement phase, where the artifacts are created in phases of software life cycle that are modeled and integrated to ensure that traceability, consistency, and completeness are realized [10]. While some theoretical framework in RE consists of key activities that are ontology modeling, goal modeling, process modeling and scenarios generation. The framework is constructed applicable for stakeholders from different functional areas, demanding a single system that satisfies the multitude of requirements.

3 PRACTICAL FRAMEWORKS

Practical framework is not informed by the normal theory but through practice or experience knowledge gained, the findings of research results to support, extend or revise the practice. From review of research papers on RE, practical framework is unpopular but have been developed through experience from overwhelming the problems like non-functional requirements [2]. Since this framework could be used to suggest the type of verification or quantitative measurement towards the software process phased. The usefulness of the framework is validated through terminological and conceptual discrepancies. The framework can be investigated further with non-RE phases such as property or characteristic, attribute, quality, constraint, and performance [2,4]. Furthermore the entity requirements are divided into geographical location, time and pre-condition to understand the result obtained from research framework implementation in real projects, both in lab situations as well as on industry projects in order to improve current results obtained on dealing with quality issues early on.

4 CONCEPTUAL FRAMEWORKS

Though several type of model can be developed in RE, there are three basic levels of models that are suitable according to REBOK (Requirement Engineering Book of Knowledge) which are requirement model, solution model and conceptual model. Requirement model specification the problem and requirement gathering aspects while solution model describes the shape of implementation for solution perspectives on problems highlighted or research gaps investigated [1]. Conceptual model in RE provides technological software or hardware specification that can be taken into account of user view, logical view, process view, implementation view and installation view [8].

Conceptual framework is known for argument of concepts chosen for investigation and the relationship exist. Conceptual framework is based on previous research where the frameworks are constructed from far ranging sources. The framework also will consist of different theories and contribution of knowledge towards the study [1]. Familiar conceptual framework in RE is to coordinate the RE activities in obtaining a high level of
concurrency in development with purpose of obtaining efficient development the future targeted applications in the businesses [3,6].

Conceptual model framework is also suitable in integrating non-functional requirement into entity relationship and object oriented model. Past papers have present strategies to deal with non-functional requirement and integrating the requirement into conceptual models [5]. Recently, system development practice has indicated that changing requirements, lack of trained manpower and inadequate methods are responsible for system failures.

Thus, solution to his problems is through conceptual framework in addressing the non-functional requirement entities. However, this is still a pressing need for further investigation on industrial RE problems where RE research has tended to be dominated by large customer-driven systems, typically in the defense sector [5].

5 DISCUSSIONS

Based from the types of framework discussed above, the five distinct phases that are requirement elicitation, requirement analysis & negotiation, requirement documentation, requirements verification & validation and requirements management suitability with the distinct framework is important strategy for further research and selecting the right framework. The theoretical framework mainly discussed more on the analysis and the negotiation phase in determining the right requirement for the selected industry with the type of business. Besides that, managing the requirement obtained through changes in requirements obtained that is popular in theoretical frameworks entities. Then the qualities are questioned with providing sustainable framework for measuring the quality of requirements.

Developers are able to support a certain software quality when the community enables it to. For example security requirement protect the users account and the requirements engineer is aware that this is technologically feasible and that there is an actual method to protect the account. Besides this, goal modeling purpose to handle requirements elicitation and negotiation. Furthermore, the process modeling is the activity through which the requirements specification is applied for requirements validation. Conceptual framework RE phase, usually to coordinate requirements activities in obtaining a high level of concurrency in development and to ensure efficient development of both the future targeted applications and the relevant business process.

This also relates to the management of requirements through documentation process. Industries usually use the written documentation for RE process activities. Also validation is the key to ensure the changes in system components and conform to the external requirements. For practical framework the representation that determines the verification of the framework is determined through operational phase where review, test or formal verification are determined. Then the framework is investigated through the quantitative measurement and qualitative where no direct verification is confirmed. This is usually handled by subjective stakeholder which will review the RE stated in the RE documentation.

6 CONCLUSIONS

To conclude, each framework as its own suggestive advantages with the supporting RE phases those are suitable to determine the activities of the framework. Future research on the practical framework is suggested for further development in RE for defense use as practical framework consist of validation and verification of RE phase that suggest results after implementation of the framework in real industries. Nevertheless the conceptual framework though not popular in RE it is important for future development perspectives as it measures previous work and extends the framework for good cause to the society.

REFERENCES