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Impact of domain knowledge in phase of requirement engineering

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Abstract
Requirement engineering has received much attention in research and practices due to its importance for software project success. For a successful project, an accurate requirement is very important because projects are based on user's requirements. Domain knowledge is a key factor in gathering requirements and also understanding about software nature. In-depth knowing domain knowledge is best for understanding the problem and ease of project construction. In this paper, we discuss the different aspects which are important during the specification of requirements. Specification of requirement is a good practice with the help of domain knowledge. In requirement engineering, specification and management of requirements/knowledge is the main processes. It continues process throughout the project. Requirements are not complete and final. The purpose of this paper is to investigate the impact of domain knowledge on different requirements engineering activities.

Keywords: domain knowledge impact, effective requirements, domain knowledge impact on requirement engineering activities, domain engineering

1. Introduction
One of the challenges in Requirement Engineering is the huge gap between the customer demand and the analyst's perceived. To cover this gap, it has long been believed that requirements analysts need to be experienced in the customer's problem domain to be productive when performing a Requirement Engineering process. Deep knowledge of the problem domain is the very effective impact on exact requirement gathering. Brainstorming is another good approach to new ideas and requirement gathering. Different techniques proved useful in encouraging requirements analysts to become more creative in generating requirement ideas.

In requirement, engineering domain knowledge is a key factor and very important for gathering accurate requirements for the software application. A good system is full fill user needs and requirements. For good, system analysts have to need accurate requirements and for accurate requirements, have to need understanding about the domain of the system.

Most software engineering research studies results show that domain knowledge is essential to an effective software development. Domain Knowledge is the base for effective Requirements. We studied different phase of requirement engineering and the impact of domain knowledge on all phases. Domain knowledge is not only important for requirement gathering but also for requirement specification. The analyst knows about the domain of system give good result than the analyst not exact idea about system domain. Many types of research conduct in this scenario and give their finding in favor and also some against. We discussed in detail these case studies and surveys and after this, we give our suggestions.

2. Related work
Only little studies have explored the impact of domain knowledge on software engineering activities. Most software engineering research studies assume that domain knowledge is fundamental to an effective software development, and these studies do not evaluate whether this hypothesis holds. There is even no clear distinction between "knowledge" and "experience", as they are commonly used. Haruhiko Kaiya and Motoshi Saeki [1] they did research on requirement elicitation. For this purpose, they use domain ontology provides a semantic basis for requirements to be elicited. They create a method ORE (Ontology-based Requirements Elicitation). They define this process as a method and calculate it by an experimental case study of software music players. Actually, they want to overcome the problem of poor domain knowledge with the help of ontology. Daniela Damian *et al.* [2] in this research they examine communication and domain knowledge distribution between project members and different project members they examined how diverse roles working on requirements and their related artifacts coordinated along task dependencies. Domain knowledge is fundamental to effective software requirement. Alejandrina M. Aranda *et al.* [3] they don their research on requirement elicitation. They conduct an experimental survey and interviews to examining the impact of domain knowledge on requirement engineering. Customer and analyst both have a need for knowledge about application domain for good requirement gathering and elicitation. This is very necessary for a good software product. Walid Maalej and Smita Ghaisas [4] their research is for the business process. They interviews and studied in detail how does important domain knowledge for business rules in requirements engineering in the host

organization. Ali Niknafs [5] this is a complete thesis on domain knowledge effectiveness and impacts. They had done control experiment to check the impact of domain knowledge on different activities of requirement engineering. This study shows that the non-technical person in the team is a good impact on the effectiveness of the team and sometimes reason of novel ideas in system innovation.

3. Knowledge meaning and management in requirement engineering

All information about the product and its domain is called knowledge. Knowledge of Requirement engineering is a life cycle stage and high impact on the final product. For the success of any project need knowledge management. If our goal to improvement in software quality and widely accepted our product we need to manage past and current status information [6]. Software products are more complex than other products in the market. Knowledge management is very important not only for construction of software application and also for evaluation and maintains [7]. There is another important factor is an experience. Analysts have a little need to experience in the domain of application. Unambiguity is also very important in knowledge management and also in requirements. If all things are not clear there is rare chance to make a good product. Knowledge sharing is another important thing in knowledge management. Analysts share knowledge with other departments for a better understanding of the product, save time and reduce the chance of failure. Need a mechanism for sharing information in every department. Sometimes analysts have communication problem to collect requirements and cause the failure of the application [8].

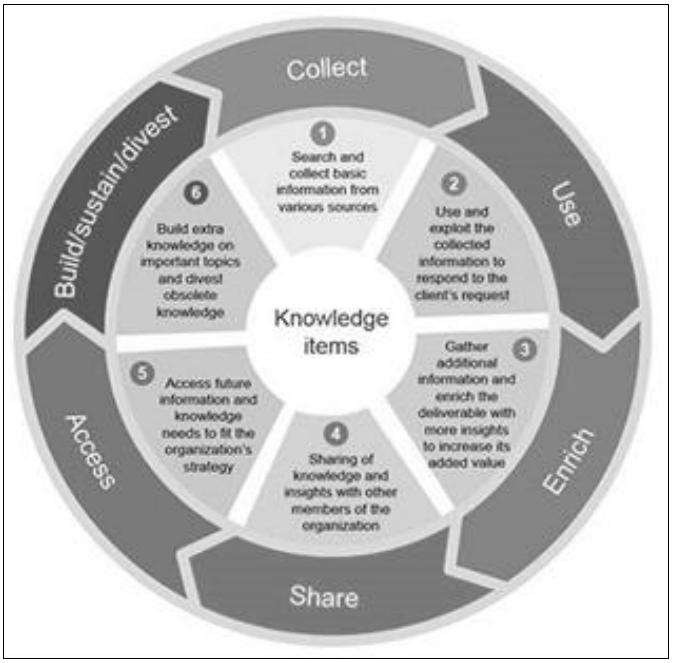

Fig 1: Knowledge management strategy

4. Domain Knowledge

Application area and related information about application and area are called domain knowledge. If analyst does not understand the domain of the application he is unable to get good and complete requirements. Analyst failure to collect requirements, product fail to fulfill customer needs. Domain knowledge is important for searching data [9]. Application area defines the nature of the application. Like shops, application do not work like institutes application. Even searching any information on internet or system, there is need domain knowledge [10]. Without known domain of the application analyst unable to collect correct requirements and the reason for failure. IEEE says with a good application needs exact, accurate, complete and unambiguous requirements. For this purpose, analyst needs ample information about domain of application. Sometime analysts have communication problem to collect requirements and cause the failure of application. User is also need domain knowledge for use of the system [11]. Without this knowledge, analytics solutions are built which do not entirely address the real problem.

5. Importance of domain knowledge

In high-quality requirement need domain knowledge. "Requirements analysts having much knowledge of software technology, they don't know or understand their problem domain where software to be developed will be operated. Lack of domain knowledge allows the analysts to perform poor requirements and as a result, they come to produce requirements activities of low quality. Requirements gathering from stakeholders are actually one of the most crucial steps in requirements analysis processes." And without domain information, it is a more difficult task to be performed [1].

6. Domain engineering

The importance of domain knowledge is that today a new subject to learn is 'domain engineering'. Domain engineering is concerned with the activity of collecting, organizing and storing past experience in building system in a particular domain. Domain engineering focuses on three major phases, domain analysis, and domain design and domain implementation, for defining reusable requirements, common architecture and to implements the reusable assets. Domain engineering is a continuous process. [12]

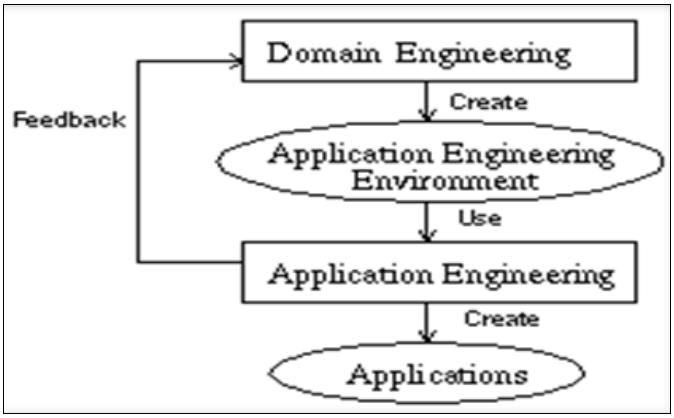

Fig 2: Domain engineering architecture

7. The relationship between Software Development Activities and Domain Knowledge

The relationship between Software Development Activities and Domain Knowledge is a very important relation for a

good product development. Luck of domain knowledge cause of incorrect and ambiguous requirements. Analyst unable to collect exact and correct requirements and this is the reason of system is not fulfilling user requirements. Requirements specifications is important to structure in requirements engineering [13]. One issue in RE is the gap between what the customer needs and what the analyst thinks the customer requirements. To bridge this gap, many consider that an analyst needs to know the customer's problem domain well to do RE well for a system in the domain [14]. Software development activities start on requirements gathering and if this phase is incomplete and in the wrong direction, there is no any application development which compensates customer expectations. This is the reason for time and cost increase and out of the budget.

8. Application environment

Most of the time a system is not working alone. A system work in a specific environment with interact other systems. So need is information about these systems in which the system interlinks or communicates. There is also integration problems arise if application not compatible. Analyst need not only information about application domain also need the information about environments of application and related systems working in the environment. Because the system is failing to the relation with environmental systems, the system is useless [15].

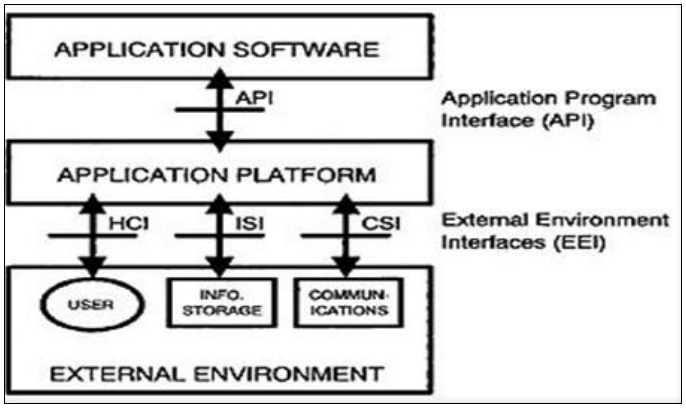

Fig 3: Application platform architecture

9. Discussion

The main point that can be drawn from the findings of this paper is that the presence in a requirements engineering team of a domain expert with a computer science or software engineering background improves the effectiveness of the team. Requirements Engineering (RE) aims at the elicitation, analysis, and specification of requirements that unambiguously reflect the intended purpose of a software system considering and aligning the viewpoints of all relevant stakeholders. Precise and consistent requirements directly contribute to appropriateness and cost effectiveness in the development of a system [16]. All these activities are not possible incorrect way without domain knowledge. Domain knowledge is a key factor in requirement gathering and requirements are a key factor for good product. So without domain knowledge, it is almost impossible to make an application. We investigate different studies, surveys and case studies which prove to be the importance of domain knowledge. Domain engineering is another subject in the sense of domain knowledge. Domain knowledge study is the part of requirement engineering but domain engineering is a separate subject for development a good software application and reuse/share all type of information.

Table 1

S. No.	Methodology	Purpose	Findings
1	Domain ontology	Requirements Elicitation	Ontology for requirements
2	Socio-technical	Check the role of domain knowledge	Explains the importance of domain knowledge and communication
3	Conduct a Controlled experiment	Domain knowledge impact on elicitation	Positive effect of domain knowledge
4	Research study	Rules for global software's	Sharing of domain knowledge is important for global software vendor
5	Research study	Find the importance of domain knowledge in activities of requirement engineering	Importance of domain knowledge in activities of requirement engineering

10. Search Strategy

We have done a systematic search for our paper on renowned digital libraries for our review paper. We also use many review papers to enhance our results and find. We match our main quires for selecting any paper also check the paper worth and used latest papers for the betterment of our review.

i) Google scholar

https://scholar.google.com.pk/

This is a most common digital library for searching data. We used some research papers from this library for our review and results.

ii) Science direct
https://www.sciencedirect.com/
This is a well-known digital library for searching scientific papers. We used most of the time science direct articles for our research work. Our most of the search question selected from this library.

iii) Ieee xplore
http://ieeexplore.ieee.org/Xplore/home.jsp
We also used this library for our research work. Most of the papers we used, not only search papers but also follow the paper pattern for our work from there.

iv) Springer
http://www.springer.com/in/
We search many articles from this database. We find some unique information from this digital library for our search. This library is very useful for us.

v) Acm
https://www.acm.org/
This is the last library we used for our work. This is also a big online library for different research work.

11. Future work / Conclusion

There are many activities other than requirement idea generation that could benefit from a domain expert. Some studies focus that ignorant person in the team give novel ideas and a good addition to the team but there is more need to study on this argument.

1. Here is needed to combine the study of domain knowledge and domain engineering.
2. Possibilities are that some domain ignorant person in the team gives novel ideas and enhancement of team performance.

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