

# Trends of Software Requirements Engineering Process in Pakistan and its Repercussion on Effort Estimation

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**Abstract:** Requirements Engineering (RE) is the most fundamental and crucial stage in software development, as it greatly decides success or failure for software projects. This research seeks to study present trends, challenges, and practices concerning software requirements engineering processes in Pakistan, particularly with respect to how these processes can be deficient in their estimation of effort—an important component of project planning, budgeting, and resource management. The damaging effects of inaccurate effort estimation surface in the form of cost overruns, delays in meeting deadlines, uncontrolled scope changes, and even project termination or failure. The study identifies some common problems pervading across Pakistani software companies that hamper the accuracy of effort estimation and these include unstandardized auditing procedures, poor or inconsistent documentation practices, and insufficient understanding of user requirements by both developers and stakeholders. Other than these, a major roadblock for estimating effort is inefficient project execution. The research methodology used involved the circulation of structured surveys and questionnaires among the professionals in the software industry to assemble qualitative and quantitative data. Findings point urgently for stronger RE process frameworks, improved communications between all stakeholders, and formal training programs for professionals involved in requirements gathering and analysis. The study recommends that improving RE practices through targeted training and process standardization and by engaging stakeholders could allow for a much more reliable effort estimation, better resource utilization, and improved rates of success for software development projects in Pakistan. Improvements of this nature will benefit individual companies but also serve to enhance maturity and competitiveness within the software industry of the nation.

**Keywords:** Requirement Engineering, Effort estimation, Software Development, Software project management, Pakistan software Industry.

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## I. INTRODUCTION

RE has an important beginning in software development, as the generic manner in which needs of all stakeholders are identified, elicited, analyzed, specified, validated, and managed comes under this head. This assures that the final product of software development meets the user need and expectations, consisting of these stages—feasibility study, a requirements elicitation specification verification, validation and management of requirements. Efficient RE development is vital to the success of a project because it avoids misunderstandings, lowering the cost of change late in the project and helping to ensure that the software created meets stakeholder expectations.

There is inconsistency in the adoption of standardized and comprehensive RE practices, especially in developing countries like Pakistan. Most software companies in Pakistan, especially those which fall under the category of small and medium-sized companies, do not follow the RE processes completely due to limited resources, lack of training, time, client and development teams being geographically distributed. Use of incompletely or incorrectly adapted requirements engineering sours poor documentation and inadequate communication to stakeholders, absent formal audits, causing misinterpretation and incompleteness in requirements.

These deficiencies affect effort estimation, an important part of project planning and management. Accurately estimating how much effort, time, and money are needed to complete a project becomes very difficult

when requirements are unclear or rapidly changing. Thus, there can be budget overruns and missed timelines, along with inefficient use of resources. The goal of the research is to analyze the current state of RE practices being followed in the software industry in Pakistan and their influence on effort estimation, thereby giving recommendations to improve the RE process and enhance project outcomes.

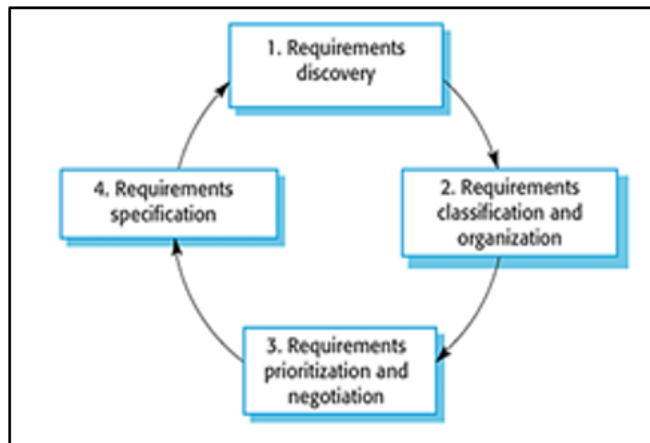


Fig1 Re Phases

## II. LITERATURE REVIEW

Requirements engineering and effort estimation predominate among the determinants of project success in software development. Their entire new practice introduces different levels of planning, namely release planning, sprint planning, and daily planning, which needs contribution from the managerial as well as non-managerial levels. The proportion in release planning is found to be 42 percent, while in daily planning and project bidding, it remained lower with 17 percent each, showing probably reduced input under these headings for effort estimation. Personal judgment seems much more relevant with the choice of estimation methods; high accuracy groups tend to use a mixture of techniques at a level of 66 percent whereas low accuracy tends to prefer single methods at a level of 61 percent, which suggests that a combination of techniques could enhance estimation reliability [1].

Requirements Engineering in South Asian countries is very inconsistent. Internal studies in Pakistan, India, Malaysia, and China have shown major differences in the adoption of the RE process due to organizational size, scope of project, and resource availability. Larger companies tend to have better implementation of structured RE methodologies, while smaller startups, particularly in Pakistan, struggle when they have less personnel and without formal models [2]. The potential of the IT industry in Pakistan is there, but significantly, it has fallen back in comparison to its regional competitors such as India because of poor compliance with RE standards and almost zero investment in quality processes [3].

The identification of risks and their validation during RE practically go unattended, especially in small-scale firms. In Pakistan, most organizations practice piecemeal

methods as opposed to comprehensive RE models [10]. The causes of difficulties regarding software maintenance are code inefficiencies, inadequate documentation, and inexperience of support teams. Effort estimation models such as COCOMO II and SLIM are cited in the literatures as being prominent enough to be mentioned in such instances [8]. Viewing this from a global perspective, it is clear that social rather than technical factors will influence the success or failure of distributed software environments [8]. Overall, an important issue facing developing economies is the lack of standardization and holistic treatment in the fashion of RE and effort estimation, making empirical studies an important tool to fill this gap.

## III. RESEARCH QUESTIONS

- RQ 1: What techniques are followed by Requirement Engineers While Doing Requirement Engineering?
- RQ 2: What Consequences faced by Requirement Engineer in software project management?
- RQ 3: What is the Effect of following trends of Requirement Engineering for Effort Estimation?

## IV. METHODOLOGY

The aim of this study is to evaluate modern Software Engineering practices in Pakistan along critical lines laying emphasis on effort estimation. A mixed-method approach of the quantitative and qualitative data collection techniques was used to carry out this study, which involved thorough investigations through the surveys and questionnaires targeting software professionals from both academic and industrial realms.

Exploratory surveys first collected information on the existing Software Requirement Engineering (SRE) practices. Insights were subsequently used to create a structured questionnaire, which was then disseminated to the employees of the best-known software firms in Pakistan for completion. The questionnaire concerned itself with such information as to the concepts, practices, and methodologies currently used in those organizations about Software Requirement Engineering.

Researching into such critical areas as implementation of SDLC; depth and rigor of requirements elicitation; analysis specification and validation; such questions that were posed to respondents related to use of tools; techniques and frameworks during Requirement Elicitation phase and the perceived contribution towards overall project performance.

### A. RQ1: What Sort of Representation is followed by Most of the Organizations?

In Pakistan, maximum software companies usually follow a simple iterative model for their requirement engineering and software development processes. The below graph shows how different development models are distributed in various organizations.

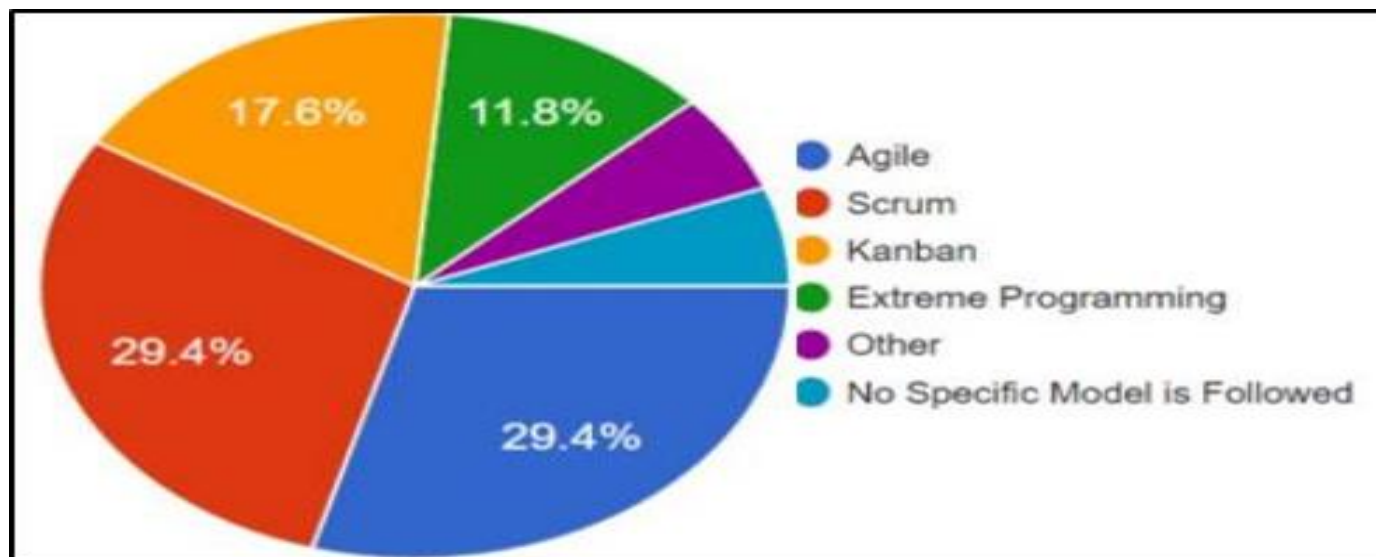


Fig 1 Methodology Graph

*B. RQ2: How many human Resources are there in the Group and how Several of them are Enthusiastic to Requirement Engineering Process?*

Include studies that show organizational sizes of 50-1000 employees. Only 2 out of 18 organizations had a specific requirement engineering (RE) team, while in the other organizations, there were no formal RE teams. Roles in requirements engineering were allocated to the persons like software engineers and system analysts that already work with the respective organizations. On this basis, the percentage of those involved in the RE involved team members in the requirements phase as shown in the

following chart. Thus, the study will measure the ability of organizations to perform conflict resolution during the RE process, which is significantly influenced by the skill sets of

the resources employed. Results indicate that an organization manages to resolve approximately 43.8 percent of the conflicts from 51 to 75 percent during the RE phase-involved conflicts. About 25 managed to sort out 26-50 percent of conflicts, while 18.8 states they resolved from 76-100 percent of conflicts; only 12.5 percent of the organizations remained with appropriate conflict resolution percentages of 76-100.

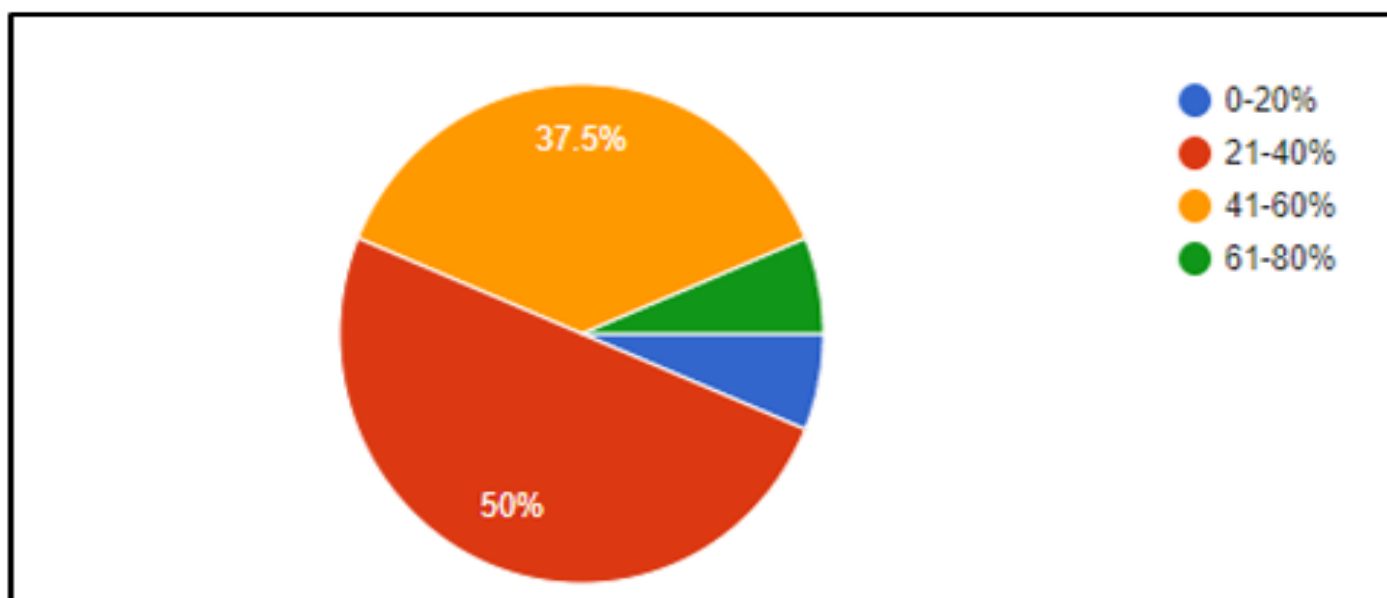


Fig 3 Resources Utilization

*C. RQ3: What is the usual time of developments in different administrations and how much percentage of it they apply on Requirement Engineering procedure?*

Based on the quadratic regression analysis of scatter plots, the relationship between average project duration and mean time assigned to the Requirement Engineering process is assessed.

Table 1 Research Questions

R #	Questions	Positive %	Negative %	Neutral %
R1	Do you prefer other organization to follow Requirement Engineering Process?	90%	2%	08%
R2	Does your organization take Requirement Engineering as an easy phase?	30%	60%	10%
R3	Do you think that the RE process provide awareness convey among project members?	80%	12%	08%
R4	Does your organization is comfortable with RE process (any framework)?	75%	20%	05%
R5	Do you think RE phase is just time-wasting part?	09%	84%	7%
R6	Does your company facing quite improvement economically after adopting any RE technique?	78%	10%	12%
R7	Are you satisfied with RE technique in your organization?	50%	28%	22%
R8	Is Effort Estimation process performed by Business Analyst team?	67%	21%	12%
R9	Does your team always go for only decided RE technique or it depends on project?	45%	36%	19%
R10	Have you ever faced any project failure due to poor RE process?	15%	48%	37%

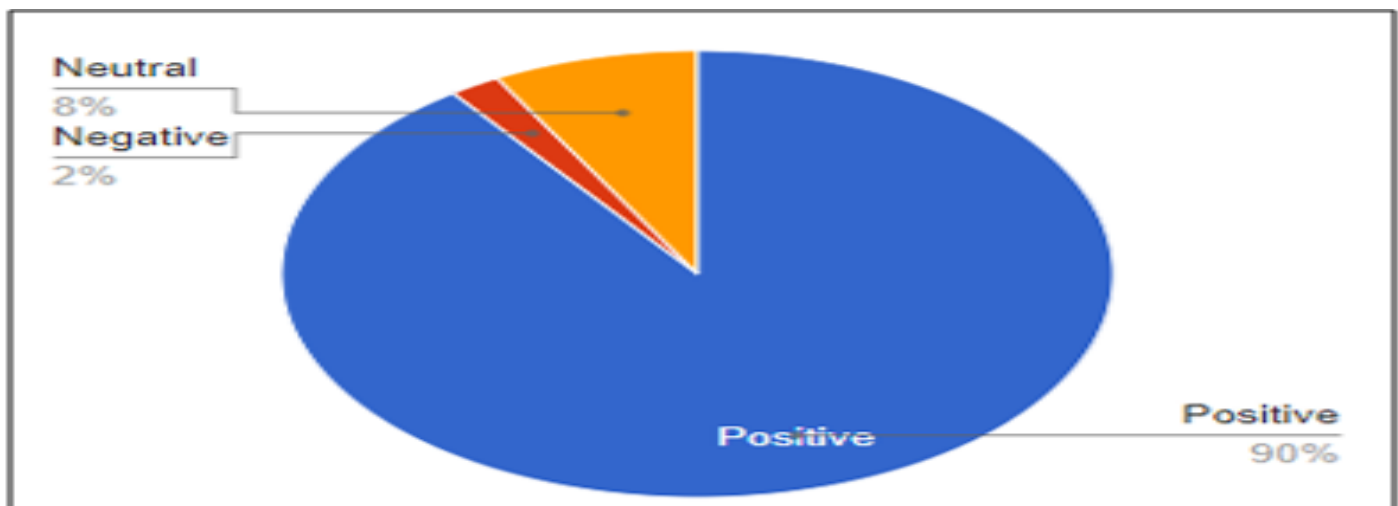


Fig 4 R1: Do you Prefer Other Organization to follow Requirement Engineering Process?

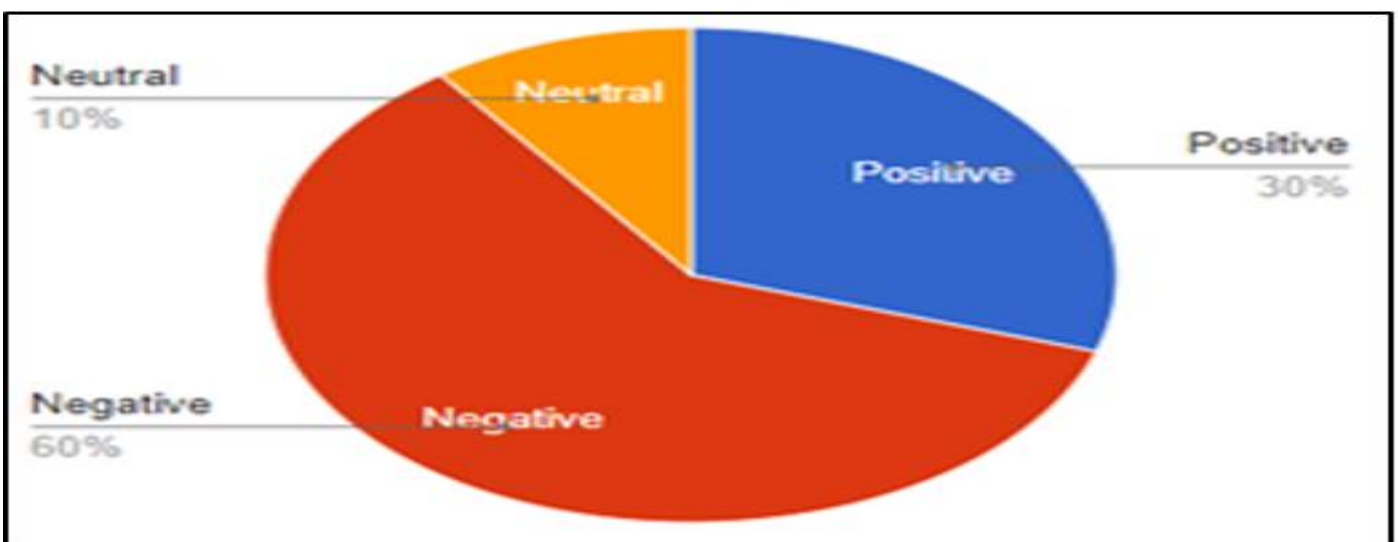


Fig 5 R2: Does your Organization take Requirement Engineering as an easy Phase?

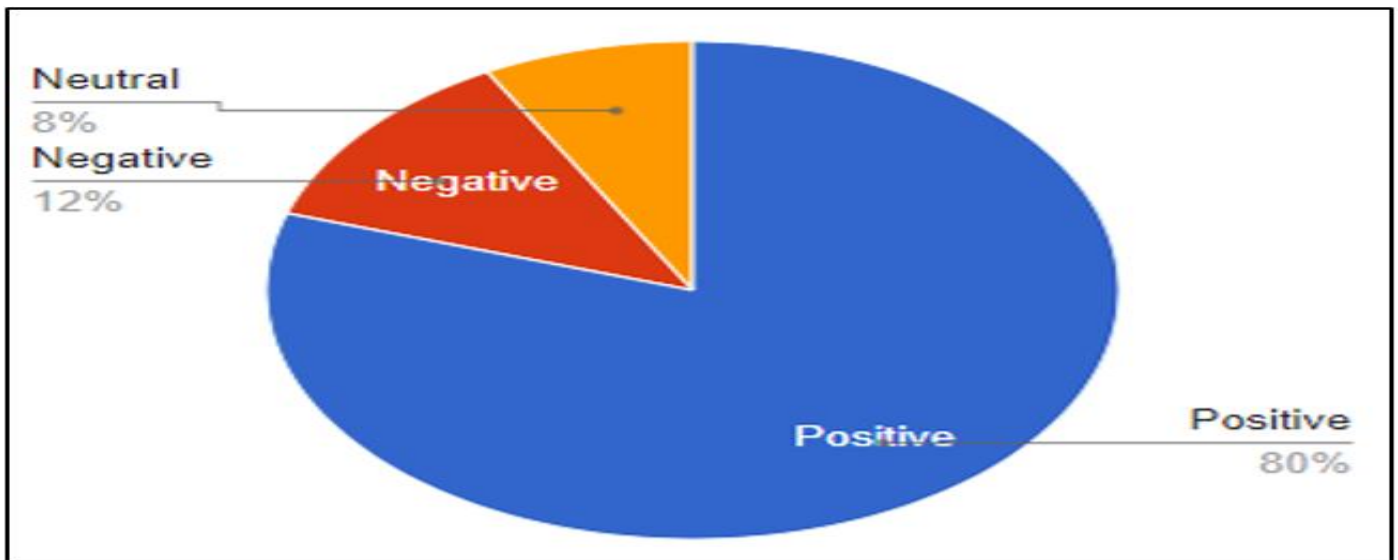


Fig 6 R 3: Do you think that the RE Process Provide Awareness Convey among Project Members?

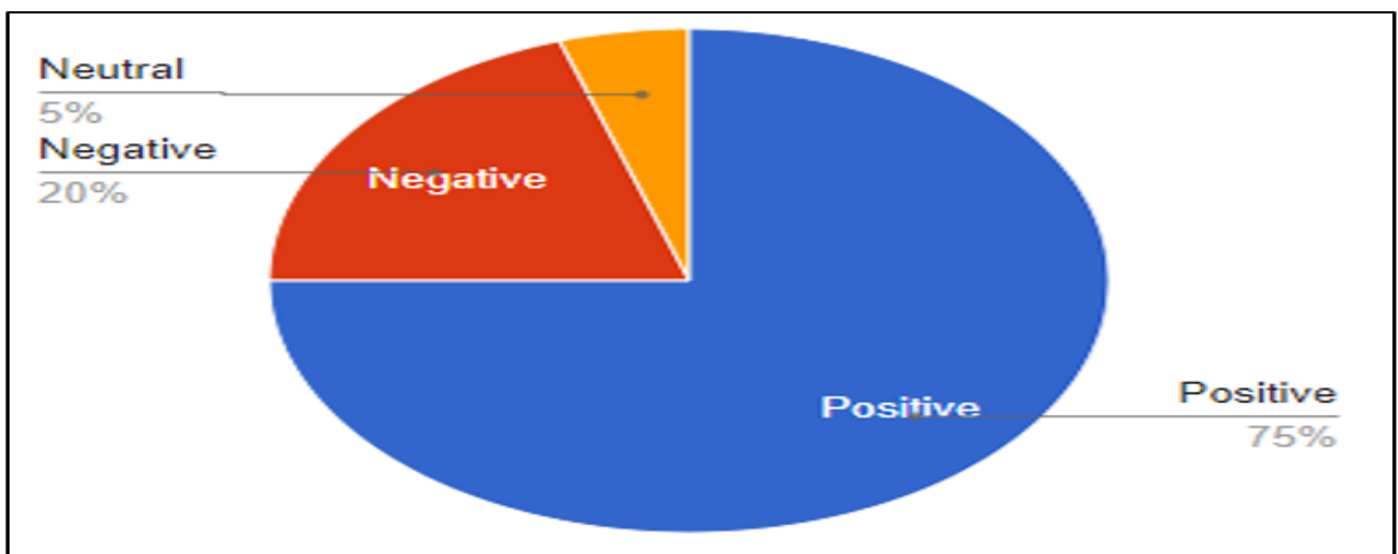


Fig 7 R4: Does your Organization is Comfortable with RE Process (Any Framework)?

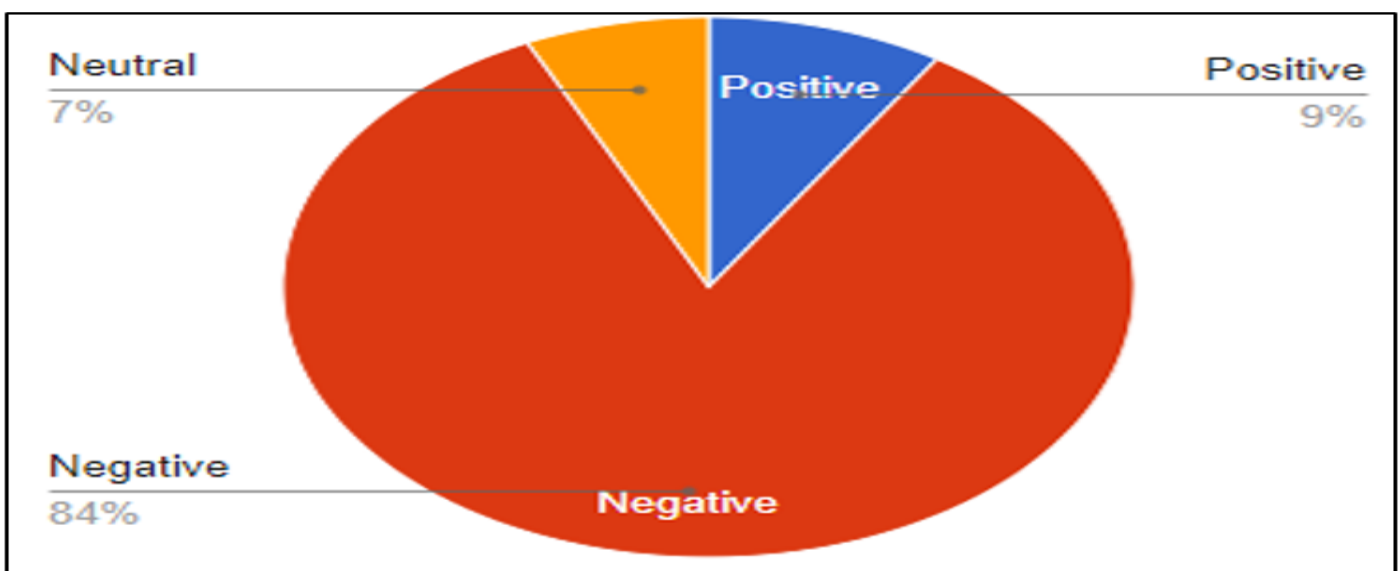


Fig 8 R5: Do you think RE phase is just time-wasting part?



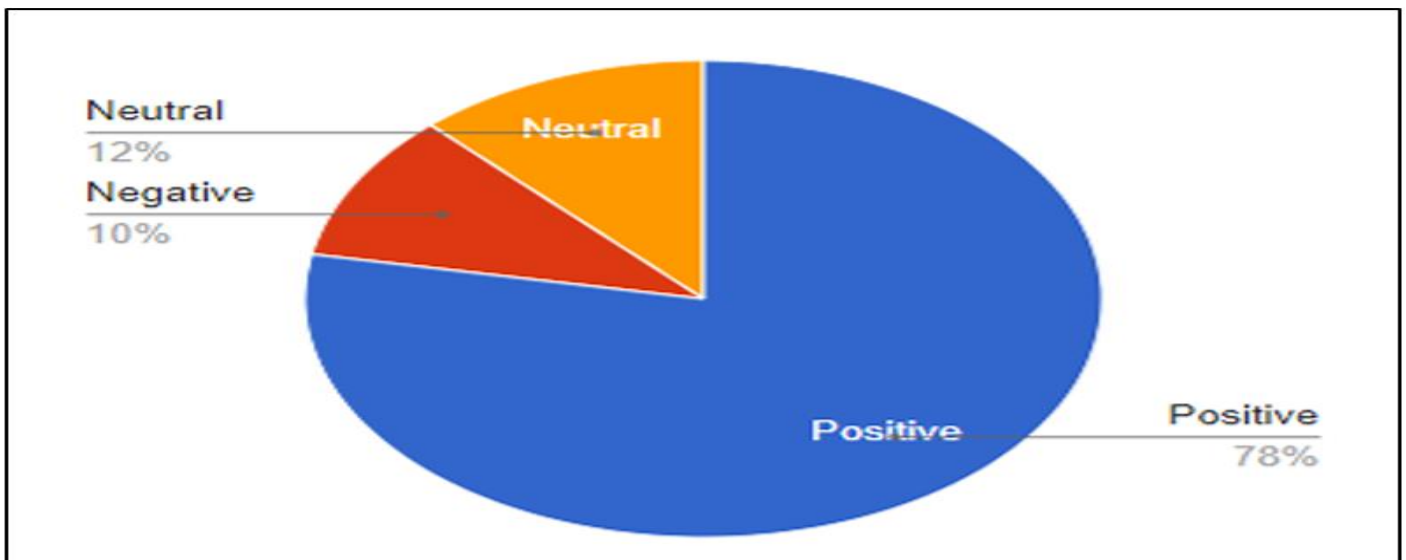


Fig 9 R6: Does your company facing quite improvement economically after adopting any RE Technique

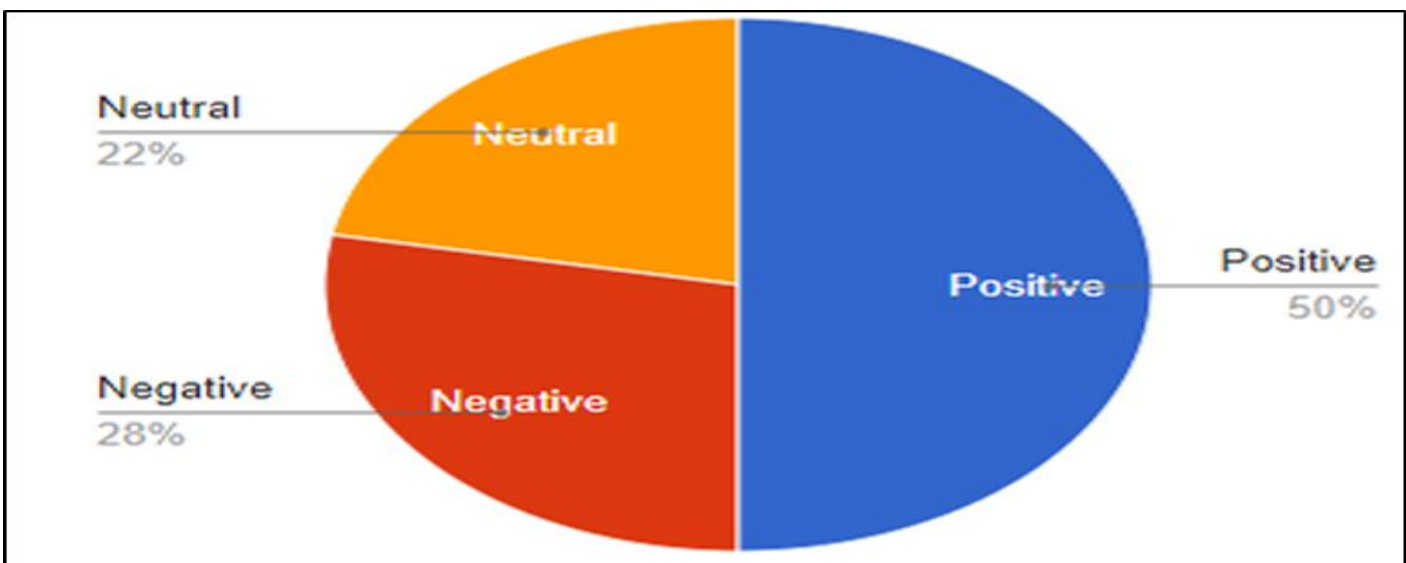


Fig 10 R7: Are you satisfied with RE technique in your organization?

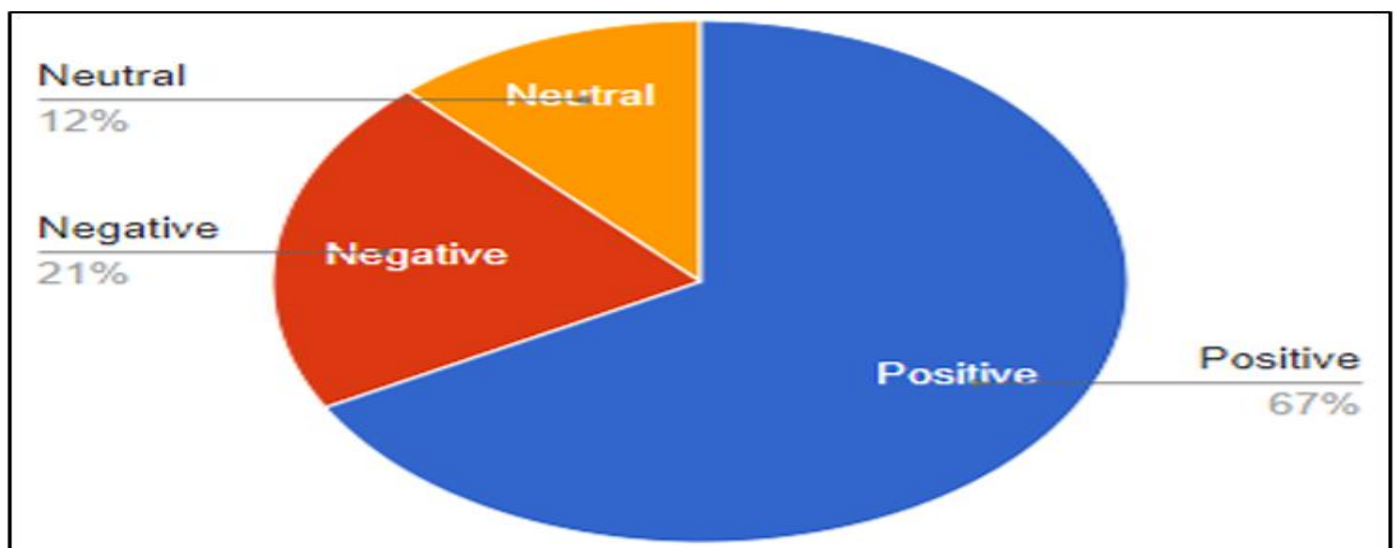


Fig 11 R8: Is Effort Estimation process performed by Business Analyst team?

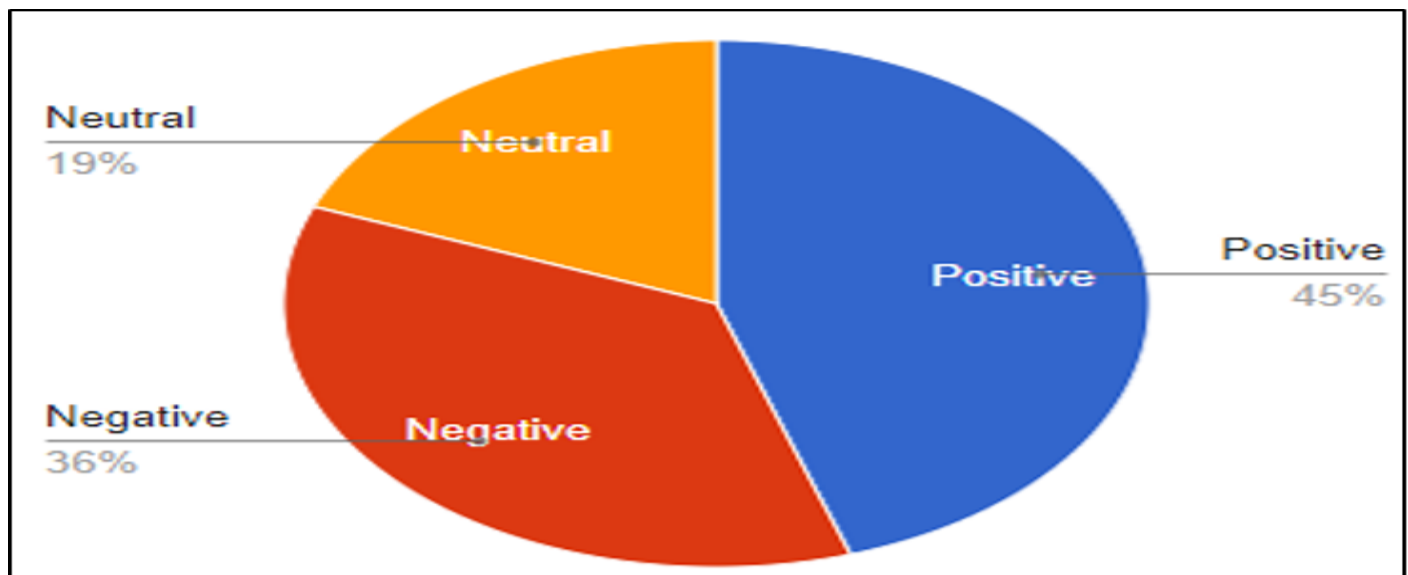


Fig 12 R9: Does your team always go for only decided RE technique or it depends on Project?

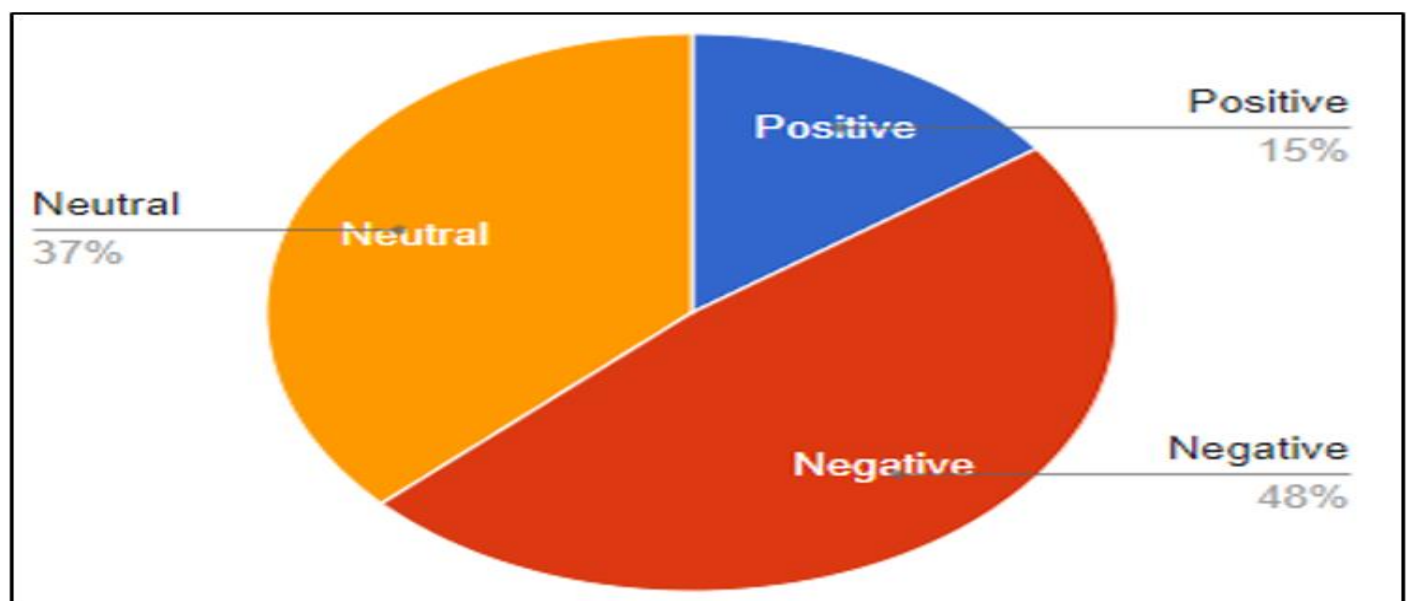


Fig 13 R10: Have you ever faced any project failure due to poor RE process?

## V. RESULTS AND FINDINGS

This research paper examines the role of Requirements Engineering (RE) in software development with a focus on estimating efforts and outcomes of projects. The results reveal significant insights into how RE practices influence the success or failure of projects, how practitioners tackle RE challenges, and the consequences of poor RE implementation.

### D. Impact of Requirement Engineering on Project outcomes (RQ1)

Requirement Engineering plays a crucial role in the success or failure of a software project. When it works, Requirement Engineering closes the software product on time and on budget. It is said to be the main ingredient that aligns people's expectations from the product. When executed contrary to that, it may result in any or all of the

following: huge rework, overspending, mismatches in what requirements are understood to be, and delays in schedule. All these failures stem from inter-organizational structures, ineffective communication among members of a team, and poor stakeholder involvement. Avoiding such obstacles through systematic elicitation, structured communication, and proper change management will facilitate a much better effort estimation process.

### E. Counting RE Challenges (RQ2)

Domain-specific strategies and methodological approaches are being employed by researchers and practitioners against RE challenges. The main areas of countermeasures include the following:

➤ *Communication:*

Better interdepartmental collaboration and normalization of communication flows in order to control and eliminate misunderstanding.

➤ *Knowledge Management:*

Addressing the knowledge gaps of the global context and the domain, and managing shared understanding between the team members.

➤ *Stakeholder Integration:*

To ensure a common platform for active involvement and communication among users, developers, and project teams.

These challenges in effort estimation can very much be solved by proper application of RE techniques, which must be gauged with regard to the complexity and nature of the software being worked on.

*F. Consequences of poor Requirements Engineering(RQ3)*

One of the worst outcomes is that poor implementation of RE affects effort estimation accuracy and project performance directly. Problems arise from issues like excessive changes, miscommunication, ambiguity in scope, and stakeholder discontent. Such issues often stem from the use of inappropriate RE techniques or the omission of critical RE steps. If the RE process is poorly managed, projects will undergo high risks of failure, which can merely stem from misunderstanding requirements or failure to define deliverables and clear communication between parties involved.

*G. Frame work and Techniques in Literature (RQ4)*

Moreover, the study also examined different frameworks and techniques used in RE, exhibiting a trend in the practitioner selection of proper methods. In most cases, the selection of RE techniques became dependent on domain-specific necessities, past experiences, and considerations of how effective the technique would be.

➤ *The following Techniques are Included, which are well Established in Literature and Practice:*

- Interviews: Close direct interaction with the stakeholders for an in-depth understanding of the requirements.
- Questionnaires: Measurement in a structured way from a large range of representatives.
- Use Cases/Scenarios: The visualization of functional requirements in terms of interaction with the system.
- Brainstorming: To stimulate the collaborative generation of ideas with the intent of uncovering hidden requirements.
- Data Gathering from Existing Systems: Making some assumptions of requirements based on what the existing system does.
- Surveys: For larger-scale data collection.

These methods demonstrate the heuristic nature of the work whereby the practitioners fall back on methods with which they are familiar or that they last applied successfully. It then gets observed that the right technique to match the domain of the project can significantly improve the accuracy of effort estimation and reduce the risk between software requirements engineering.

Table 2 Techniques Reason

Technique	Reason	Percentage
Focus group	Comfortable to all involved.	100
Use case	Suitable with time frame allocated.	100
Prototyping	An efficient and effective technique.	100
Observation	It is the practice in their organization.	95.8
Interview	It helps to understand user's domain model.	95.8
Workshop	It generates as many requirements as it can.	91.7
Role-playing	It generates only complete and accurate requirements.	91.7

**VI. DISCUSSION**

The role of Requirement Engineering (RE) is prominently highlighted as the pillar of success for software projects in Pakistan. Often, the absence of standardization in RE processes leads to poorly defined processes, resulting in incomplete or incorrect effort estimations affecting budget, scheduling, and resource management. Such inefficiency manifests itself further in project delays, cost overruns, and ultimately failure to meet stakeholder expectations. The findings portray a stricter RE process, improved with RE audits and the evaluation of RE processes. Thus, the enhancement of interaction between the development team and stakeholders is necessary to minimize misunderstandings in requirement definitions. Improvement in the training and capacity-building programs for RE practitioners is also suggested for better process maturity

and enhanced project-based outcomes. If these gaps are filled, organizations will greatly enhance the accuracy of effort estimation and improve the chances of successful software delivery.

**VII. CONCLUSION**

The research's main objective is to integrate issues, challenges, best practices, and criteria concerning the effects of Requirement Engineering (RE) from researchers' and practitioners' viewpoints. The determination of success or failure of any software product is dependent on Requirements Engineering. This particular research work has identified the key issues and challenges that exist in various techniques of RE. It also studies the effect of RE on software project management; incomplete or improper requirements collected from customers during elicitation



usually lead to high complexity in such projects and can cause costly errors in development as well as inaccurate estimates of effort required for an effective project. This research considers both what makes projects successful and what causes them to fail while looking into RE. Communication gaps between end-users typically express need in natural language and misunderstandings between developers, who date interpretation of requirements through a conceptual and technical lens reason for these failures. Therefore, a structured and well-defined RE process should be implemented.

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