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Stakeholder's Evaluation Process for GSD Based Requirements Elicitation Frameworks

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***Abstract*: The stakeholder's evaluation for requirements elicitation tasks is considered as one of the key aspects of any software development project to meet right scope of anticipated product. The requirements elicitation stakeholder's list is traditionally comprised of all those roles, which may affect the requirements elicitation task in any way. The stakeholder's evaluation process becomes more complicated when the stakeholders are belonging to different geological parts of world during requirements elicitation process just like in case of global software development contexts. This article proposed a stakeholder's evaluation process for GSD based requirements elicitation frameworks. The proposed stakeholder's evaluation process has been applied on industrial projects in a controlled experiment performed using undergraduate level students of software engineering program. A positive contribution has been found in the overall improvement of the whole requirements elicitation process for GSD-based projects. It has been observed that an improvement of 12.0% was achieved in system understandability aspect, an improvement of 16.2% was achieved in functional requirements understandability aspect, an improvement of 9.5% was achieved in user interfaces understanding aspect and an improvement of 13.5% was achieved in non-functional requirements understandability aspect. An overall improvement factor was observed in the quality of requirements document prepared using the proposed stakeholder's evaluation process, which justified the applicability of the proposed stakeholder's evaluation process for GSD based requirements elicitation frameworks.**

***Keywords*: Stakeholder's Evaluation, Stakeholder's Analysis, Requirements Elicitation, Requirements Elicitation in GSD, Requirements Elicitation Frameworks.**

I. INTRODUCTION

The requirements engineering task is performed as the frontline activity to formalize the real needs of product users during the whole process of software development. The requirements engineering stage is considered as the most crucial stage in the software development activities [1]. The nature of requirements engineering process defines it as one of the most human centered activity performed during software development life cycle. The human centered nature of the requirements engineering process defines its fundamental dependency on the human factors. The human factors may include attitudes, work preferences, styles, skills and personality aspects. Hence, the human resource management becomes most important task during whole process of the requirements engineering [2]. The requirements engineering is considered to be more social process than engineering task performed during software development life cycle [2].

Mostly the software development companies focus human factors during the whole process of requirements engineering and consider the technical engineering aspects as the secondary aspects of the development. The requirements engineering is considered as the most important frontline activity during any software development project [1, 2]. The traditionally the software developers have been investing less in the process of requirements engineering as compared to other phases of software development. Over the time, the software engineers realized the big mistake of less investment in requirements engineering which has been resulting in the formalization of poor product requirements. The poor requirements have been becoming the major source of project failures in different domains of software development [3]. Therefore, now software developers invest more in the requirements engineering process to make it as much rigorous as possible to minimize the chances of defects injected in the whole development process from the requirements engineering phase. This phase shift in the traditional approaches of software development has benefit to the software development industry.

Requirements Engineering: The requirements engineering is broadly divided into two main phases including requirements development (RD) phase and requirements management (RM) phase as is shown in figure-1. The requirements development phase is iteratively executed to elicit and document the product requirements while the requirements management phase is concerned with the requirements change management and requirements traceability aspects. The requirements development stage is taken as a pre-process stage for requirements management phase as is shown in the given figure-1.

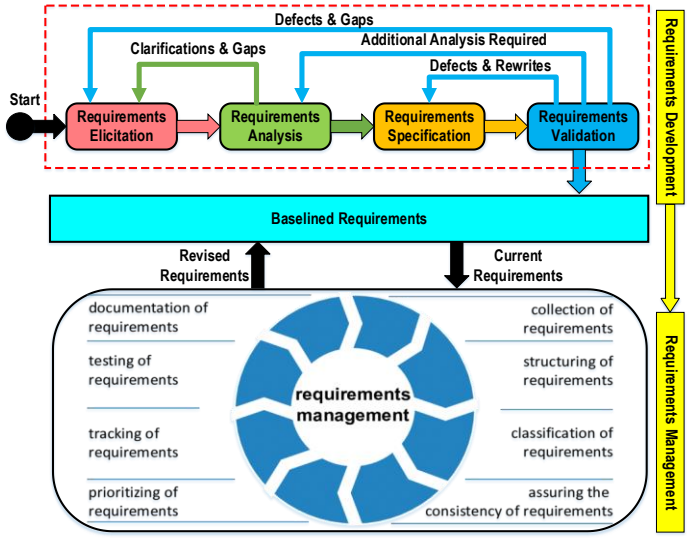

FIGURE 1. Requirements Engineering Tasks

The requirements development phase is concerned with the development of initial requirements baseline document using iterative or non-iterative approaches [3]. The requirements baseline document acts as reference document for all requirements changes emerged due to different reasons. The requirements management phase is primarily concerned with the management of all changes occurring in the requirements of the product in contrast with requirements baseline document. The requirements baseline document acts as a reference document for all activities of requirements management phase. The main tasks performed during the requirements management are shown in given figure-1, which is a self-exploratory figure.

Requirements Elicitation: The requirements elicitation is primarily concerned with the gathering of the product requirements from its stakeholders [4]. The requirements elicitation frameworks define the systematic ways to perform the whole process of elicitation by using multiple iterative elicitation sessions. The requirements elicitation process/task is a process/task, which is full of cross-sectional interactions and cross-sectional conversations between the developer's teams and user's teams [5, 6]. The requirements elicitation process is mostly based on frequent conversations between these two types of participants to finalize the product requirements according to its real conception. The requirements elicitation process becomes more complex and challenging in global software development projects where the product users as well as product development teams are distributed across the different parts of world [7, 8].

The stakeholder's management becomes more challenging in global software development projects where stakeholders are geographically located apart from each other and cannot perform informal communications and interactions like traditional software development [9, 10]. The stakeholders of the product may include a long list of personalities that affect directly or indirectly the development of the product. The management of such a long list of stakeholders becomes a serious problem during requirements elicitation process in global software development-based requirements elicitation frameworks [11]. The problem of stakeholder's management is solved by classifying the list of stakeholders into different classes depending upon the stakeholder's interests and stakeholder's influence. The stakeholder's prioritization can be performed using these two factors to categorize all stakeholders into four major classes as is shown in the given figure-2. The overall stakeholder's groups can be divided into four major classes depending upon their interests and influence as is shown in given figure-2.

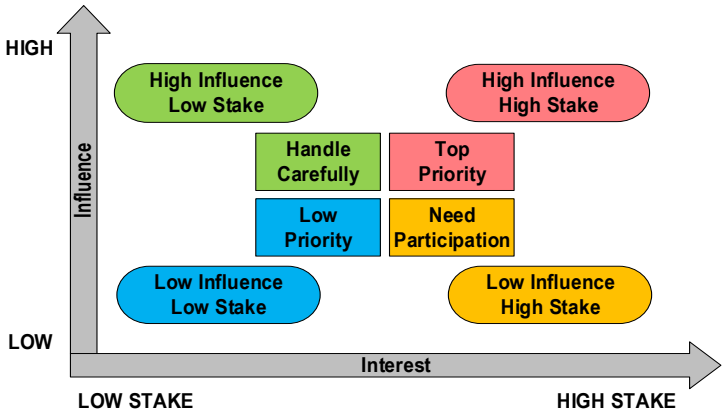

FIGURE 2. Stakeholders Priority Analysis

The four classes of stakeholders may include those who have low-stake and high-influence, those who have high-stake and high-influence, those who have low-stake and low-influence and those who have high-stake and low-influence. The stakeholders with high influence and low stake should be handled with care. The stakeholders with high influence and high stake should be given top priority. The stakeholders with low influence and low stake should be given low priority. The stakeholders with low influence and high stake should be interacted and coordinated to engage them for active participation in requirements elicitation process. The stakeholders understanding process becomes more complicated due to such kind of diversities in the groups with different interests and influences in global software development contexts. The requirements elicitation process itself becomes very

challenging in global software development contexts due to the diversities in the characteristics of stakeholders. There is a serious need to devise a stakeholder's evaluation process for global software development-based requirements elicitation frameworks.

Contributions: The proposed stakeholder's evaluation process for requirements elicitation task for global software development context serves as an asset for software development companies. The proposed evaluation process can be used to select the most appropriate stakeholders for requirements elicitation frameworks used in global software development projects. The proposed stakeholder's evaluation process can also be integrated in project management tools to automatically classifying the different types of stakeholders and their profiles can be maintained and used for more appropriately recruiting of development team for requirements elicitation work. The stakeholder's identification criteria, stakeholder's prioritization criteria and stakeholder's selection criteria will systematically help the requirements engineering teams to identify, prioritize and finally select the most productive requirements elicitation stakeholders for global software development projects.

II. STAKEHOLDER'S EVALUATION PROCESS

The requirements elicitation process stage of software development can be divided into three major types of processes, which execute systematically to furnish the requirements engineering deliverables like software requirements documents. The three types of processes include pre-elicitation processes, elicitation processes and post-elicitation processes [12]. The pre-elicitation processes are those processes, which should be completed before the start of the requirements elicitation process in traditional requirements engineering works. The elicitation processes are those processes, which are completed during the elicitation process executed in form of multiple elicitation sessions in traditional requirements engineering works. The post-elicitation processes are those processes, which are completed after the completion of the requirements elicitation process in form of multiple requirements elicitation sessions in traditional requirements engineering works.

The pre-elicitation processes play a vital role in the improvement of the whole requirements elicitation process [13]. The health of whole requirements elicitation process is critically dependent on health of pre-elicitation processes. The main concern of the pre-elicitation processes is to prepare and plane the information required for requirements elicitation process. The pre-elicitation processes may include different types of processes ranging from background understanding process to requirements elicitation tools and techniques selection processes. The given figure-3 shows a detailed list of pre-elicitation processes that may include in the pre-elicitation stage of requirements elicitation task. The preliminary data collection phase should be completed before the start of the elicitation resource-planning phase to successfully establish the goals of elicitation process.

The preliminary data collection phase is primarily concerned with the preparation and collection of base information about system requirements sources, organizational real needs and product stakeholder's priorities about product features. The maturity and quality of the preliminary data collection phase defines the maturity and quality of the whole requirements elicitation process executed in form of multiple elicitation sessions. After the completion of the preliminary data collection phase, the requirements resource-planning phase is executed. The preliminary data collection phase includes different processes like organization understanding, background understanding, stakeholders understanding, project understanding and sources understanding. The project understanding processes further include different processes like project-context analysis, project-resources familiarization, project-milestones understanding, project-deliverables understanding and project-status understanding. The stakeholder's understanding processes further include processes like stakeholder's training and stakeholder's evaluation. The requirements elicitation resources planning further includes processes like RE team-planning, RE approach-planning, RE technology-planning and RE session-planning. The RE approach-planning processes further include processes like technique selection and customization process. The elicitation technique customization is an optional process, which can be opted in case of real-need; otherwise, this process can be skipped/ignored. The elicitation technique selection process can be implemented in the form of a software project management tool in which the technique customization will be provided as an additional attribute, which can be used in those scenarios where customization is desired. The elicitation technique selection processes re primarily implemented in the requirements elicitation tools which are commonly used as groupware tools during online elicitation sessions.

The stakeholder's evaluation process is further composed of four activities including stakeholder's analysis process, stakeholder's data collection process, stakeholder's conflict logging process and stakeholder's personality assessment process [14, 15]. The stakeholder's analysis process is further composed of three tasks including stakeholder's identification, stakeholder's prioritization and stakeholder's selection. Consider the given figure-4, which shows the details of stakeholder's analysis process proposed for requirements elicitation process running in traditional as well as in global software development projects.

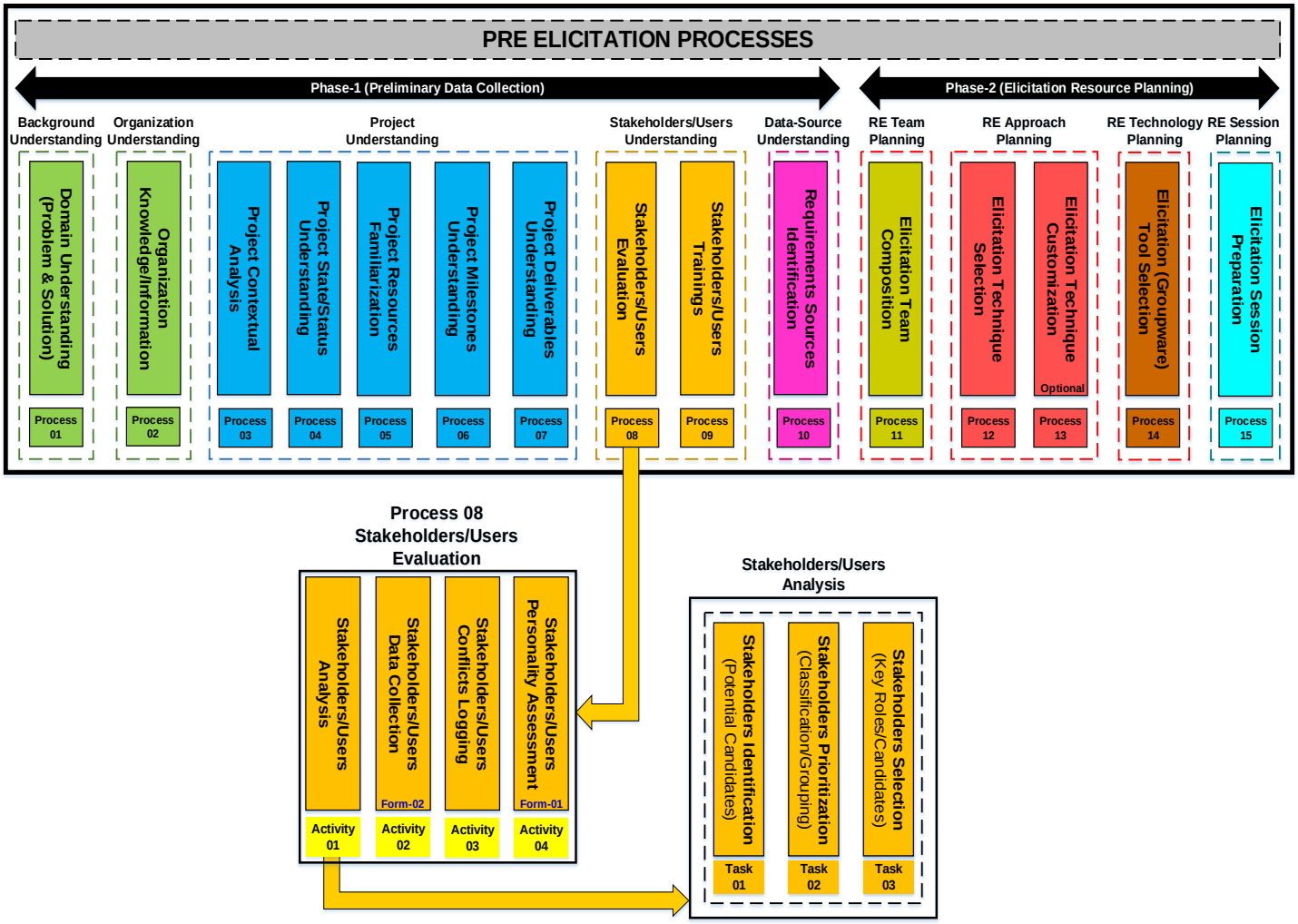

FIGURE 3. Pre-Elicitation Processes for GSD Based RE Frameworks

The proposed stakeholder's analysis process is composed of different tasks including stakeholders profiling, stakeholder's identification, stakeholder's prioritization, stakeholder's repository and stakeholder's selection. All these tasks performed during the stakeholder's analysis process are executed systematically to finally contribute in the stakeholder's selection process for requirements elicitation frameworks for GSD based software development projects.

The stakeholder's evaluation process enables the software development companies to identify the right stakeholders for their right projects. The selection of most appropriate stakeholders for any software development project contribute a lot in the overall success of that project. The stakeholder's selection processes can also be integrated in software development team composition and selection tools, which are mostly used by software project management teams.

The stakeholder's profiling stage shows that there are four major sources of stakeholder's definition including the source-1 as application domain, the source-2 as solution domain, the source-3 as project characteristics and the source-4 as client organization. The different stakeholders of requirements elicitation process would be belonging to one of these four types of stakeholders. The stakeholder's identification stage is used to identify the potential stakeholders of the whole requirements elicitation process. The stakeholder's identification is performed using different stakeholder's identification criteria including role, knowledge, influence/power, interests, hierarchical level, interpersonal skills, relationships, geological positions, responsibilities and abilities. The stakeholder's prioritization stage is used perform the classification/grouping of potential stakeholders. The stakeholder's prioritization is performed using prioritization criteria including stakeholder's roles and roles importance.

Using these prioritization criteria, overall stakeholders are categorized as primary stakeholders having most important role and secondary stakeholders having medium important roles. The secondary stakeholders are further classified as mandatory

secondary stakeholders having more important roles and optional secondary stakeholders having less important role. The complete information about these three types of stakeholders is maintained as identified stakeholder's repository. The stakeholder's selection process is used to select the key stakeholders of the anticipated project using stakeholder's selection criteria based on stakeholder's knowledge (the domain knowledge and the technical knowledge) and the stakeholder's interpersonal skills (communication skills and collaboration skills). At the end of this stage, we get a list of key stakeholders of the anticipated software development product/project, which becomes the ultimate outcome of the whole stakeholder's analysis process.

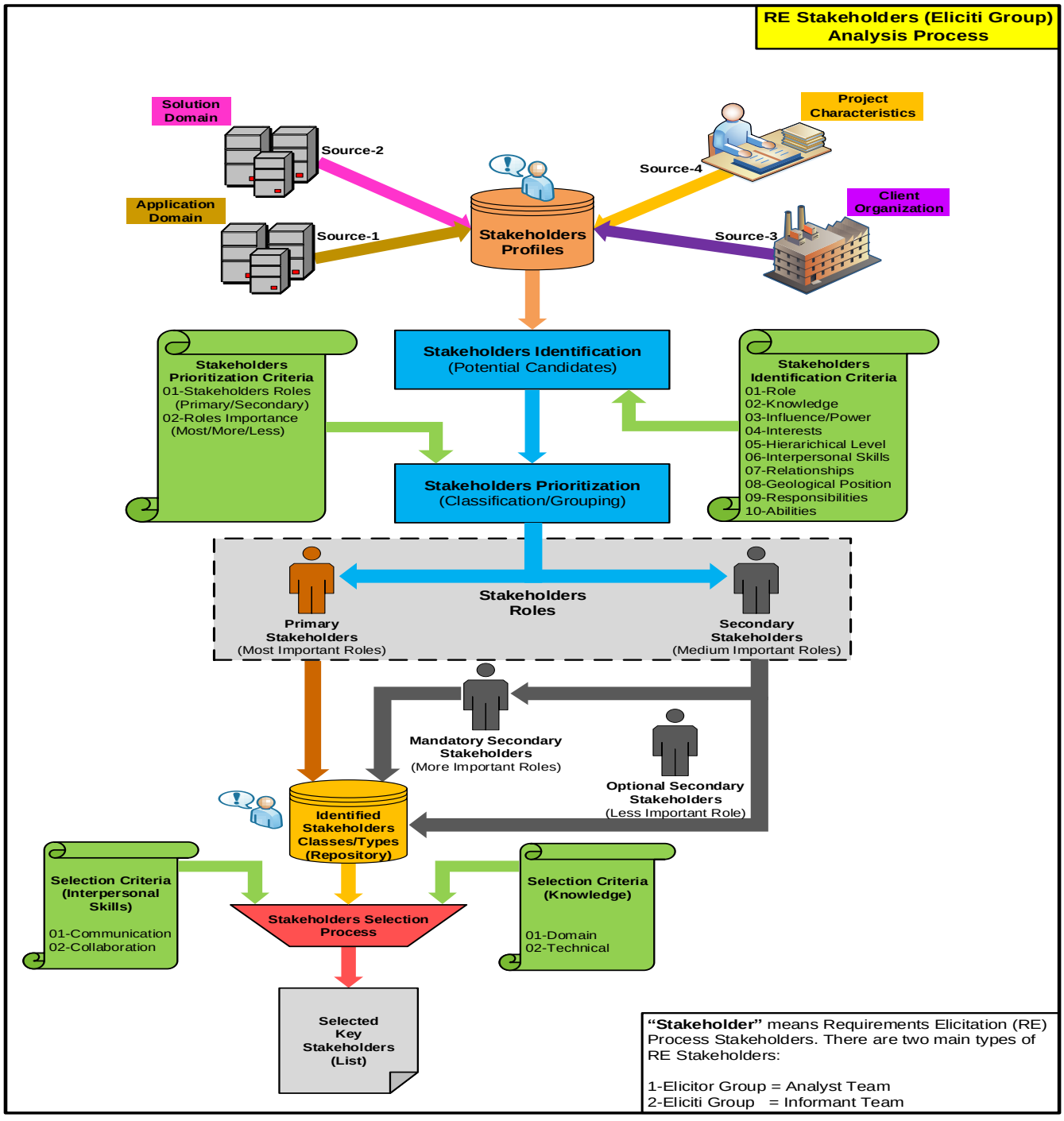

FIGURE 4. RE Stakeholder's Analysis Process

III. CONTROLLED EXPERIMENT RESULTS

A controlled experiment was performed as a pilot study for the evaluation of the impact of proposed stakeholder's evaluation process during requirements elicitation in GSD-based software development projects. The proposed stakeholder's evaluation process has been applied on two different projects using a set of 100 (one hundred) undergraduate level students as participants. The selected projects were based on the development of two

different software requirements specifications documents according to IEEE guidelines for web-based students-teacher interaction portals (student-portal and teacher-portal) for a university in Pakistan. The both selected projects were taken of the approximately same complexity and nature. Also the same project deadlines were allocated to working teams for both projects during requirements engineering tasks.

There were ten different teams of undergraduate level program with team IDs as Team-0, Team-1, Team-2, …, Team-9. Each team was comprised of two groups of students entitled as *Group-1 (Requirements Analyst Team)* and *Group-2 (Product Users Team)*. Each group was comprised of five students which were selected randomly from a class of undergraduate level program of software engineering. The group-1 working as requirements analyst-team was asked to work as requirements analyst for the assigned projects while group-2 was asked to work as product-users for the assigned projects. The role of both groups was reversed during the second project to remove the biasness created due to the working experience of the team members. Each group was comprised of one group head and remaining four group members. The analyst team was assigned a moderate distribution scenario while the user team was assigned a worst distribution scenario.

The responsibility of the analyst team was to elicit and document the product requirements from the product user's team in two iterations. In first iteration of work, the both teams used traditional stakeholder's evaluation method during requirements elicitation process and furnished SRS (i.e. SRS1) for project-1 (student-portal) using IEEE standard for developing software requirements specifications document. In the second iteration of work, the both teams used proposed stakeholder's evaluation method during requirements elicitation process and furnished SRS (i.e. SRS2) for project-2 (teacher-portal) using IEEE standard for developing software requirements specifications document. Consider the given table-1, which shows details of the working attributes of the executed controlled experiment. The table shows details of team composition to team geological distributions for both groups of analyst-team and user-team. Also, the analyst-team and user-team geological distributions are shown in the given Fig. 5 which is also a self-explanatory.

TABLE 1
PILOT STUDY TEAMS CHARACTERISTICS

Sample Size	100 (Hundred) UG Students
Teams	10 Teams (Team-0, …, Team-9)
Team Size	10 UG Members in Each Team
Team Split	Two Working Groups (G1, G2)
Group Split	**G1:** 5 Students (1 Head + 4 Members) **G2:** 5 Students (1 Head + 4 Members)
Group Work Roles	**R1:** Analyst-Team Work **R2:** User-Team Work
Teams Work Structures	**Analyst Team:** 1 Ana, 2 Mem, 2 Rec **User Team:** 1 Head User, 4 Mem Users
Teams Work Struct-1	Doing RE-GSD Without Proposed Framework **G1** (Analyst-Team), **G2** (User-Team)
Teams Work Struct-2	Doing RE-GSD With Proposed Framework **G1** (User-Team), **G2** (Analyst-Team)
Analyst-Team Distribution	**Moderate-Scenario** considered, where all members belong to three different countries.
User-Team Distribution	**Worst-Scenario** considered, where all members belong to different countries.
Analyst-Team Geo Positions	Ctry-1 (Syria): Rec-2 Ctry-3 (Pakistan): Ana, Mem-1, Rec-1 Ctry-5 (Malaysia): Mem-2
User-Team Geo Positions	Ctry-1 (Syria): Usr-1 Ctry-2 (Saudi Arabia): Usr-2 Ctry-3 (Pakistan): Usr-3 Ctry-4 (Indonesia): Usr-4 Ctry-5 (Malaysia): Usr-5
Team Cultural Patterns	Ctry-1 (Syria): Culture-1 Ctry-2 (Saudi Arabia): Culture-2 Ctry-3 (Pakistan): Culture-3 Ctry-4 (Indonesia): Culture-4 Ctry-5 (Malaysia): Culture-5
Ref Country	Ctry-3 (Pakistan): Base Country with GMT+5
GMT Shift	1-6 Hours (GMT+2 to GMT+8)

Consider the given table-2 which shows the results of the executed pilot study for the evaluation and analysis of the proposed stakeholder's evaluation process. All engaged software development teams documented two SRS by considering the SRS development standard of IEEE. The SRS1 and SRS2 were sent to two different subject experts (evaluator-1 and evaluator-2) for expert judgment based on SRS numerical grading to transform qualitative results into quantitative forms by considering the quality of documented requirements in accordance with IEEE standard for SRS development.

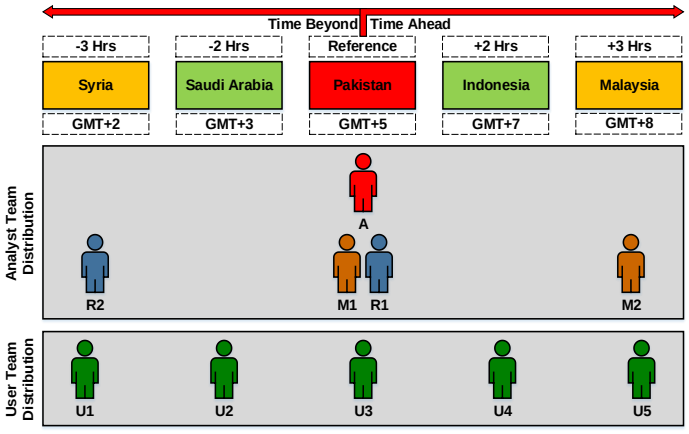

FIGURE 5. Assigned GSD Context for Pilot Study

The results obtained from the external evaluators using expert judgment are shown in the given table-2 and displayed in form of a graph in given figure-6. It has been observed that there was a quality improvement in the SRS development of project-2 in which analyst teams were using the proposed stakeholder's evaluation process as compared to the SRS development project-1 in which the proposed stakeholder's evaluation process was not used. The majority of the applicant teams demonstrated an overall improvement in the outcomes of the requirements elicitation works by using the proposed stakeholder's evaluation process as can be seen from the given table-2 data. This table shows the overall results obtained at team level. The team-0 demonstrated an improvement factor of 15.5%, the team-1 demonstrated an improvement factor of 13.5%, similarly the team-2 demonstrated an improvement factor of 15.75%, similarly the team-3 demonstrated an improvement factor of 20.0%, similarly the team-4 demonstrated an improvement factor of 18.25%, similarly the team-5 demonstrated an improvement factor of 01.75%, similarly the team-6 demonstrated an

improvement factor of 15.75%, similarly the team-7 demonstrated an improvement factor of 16.5%, similarly the team-8 demonstrated an improvement factor of 00.5% and similarly the team-9 demonstrated an improvement factor of 15.75%. An overall improvement of 13.4% has been observed in the quality of the developed SRS by all teams in accordance with the IEEE standard for SRS development. The overall 13.4% improvements in the quality of the developed SRS by the application of proposed stakeholder's evaluation process, demonstrates its impact on the whole requirements elicitation process for global software development-based projects. Hence, the proposed stakeholder's evaluation process is expected to serve as an asset for software development industry working on global software development projects.

Consider the given table-3 which shows the detailed results of the executed pilot study giving the detailed view of SRS documents evaluation at chapter level using IEEE defined quality criteria. The results of all teams have been shown in the given table along with average results of all teams for each chapter. The same results have also been shown in the figure-7 as a graph to better understand the representation. It can be seen from the table-3, that that an overall improvement of 12.0% was achieved in chapter-2 of SRS. Similarly, an overall improvement of 16.2% was achieved in chapter-3 of SRS. Similarly, an overall improvement of 9.5% was achieved in chapter-4 of SRS. Similarly, an overall improvement of 13.5% was achieved in chapter-5 of SRS. For all teams, both SRS were graded by two independent evaluators E1 and E2. The evaluator E1 was a PhD doctor from academics while the evaluator E2 was a software engineer from software development industry.

TABLE 2
CONTROLLED EXPERIMENT (PILOT STUDY) RESULTS

SRS	Evaluation Team	Team 0	Team 1	Team 2	Team 3	Team 4	Team 5	Team 6	Team 7	Team 8	Team 9
SRS 1	First Evaluator (FE)	59.0	55.0	67.0	55.0	58.0	60.5	66.0	57.0	78.0	49.0
	Second Evaluator (SE)	65.5	73.0	58.5	62.5	62.5	67.0	70.0	44.5	62.0	64.5
	Average (FE+SE)/2	**62.25**	**64.00**	**62.75**	**58.75**	**60.25**	**63.75**	**68.00**	**50.75**	**70.00**	**56.75**
SRS 2	First Evaluator (FE)	72.5	67.0	84.0	77.5	72.5	55.5	78.0	69.5	70.5	69.5
	Second Evaluator (SE)	83.0	88.0	73.0	80.0	84.5	75.5	89.5	65.0	70.5	75.5
	Average (FE+SE)/2	**77.75**	**77.50**	**78.50**	**78.75**	**78.50**	**65.50**	**83.75**	**67.25**	**70.50**	**72.50**
Teams Individual Improvement		**15.50**	**13.50**	**15.75**	**20.00**	**18.25**	**01.75**	**15.75**	**16.50**	**00.50**	**15.75**
Overall Improvement (Avg2-Avg1)		**+13.4%**									

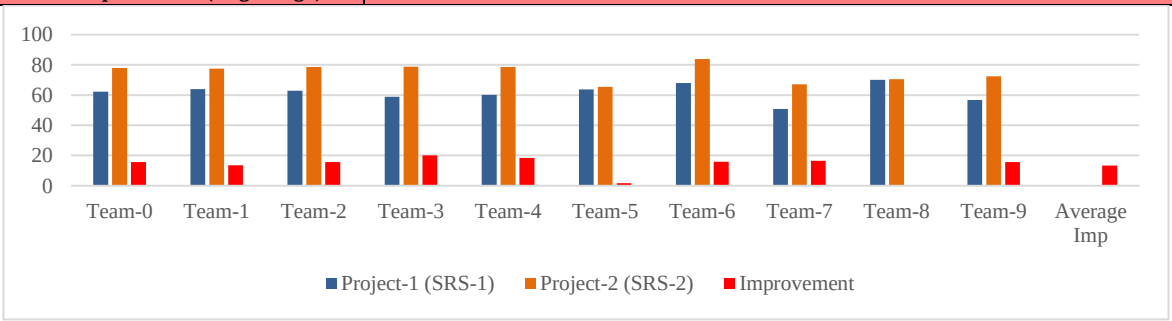

FIGURE 6. Controlled Experiment (Pilot Study) Results

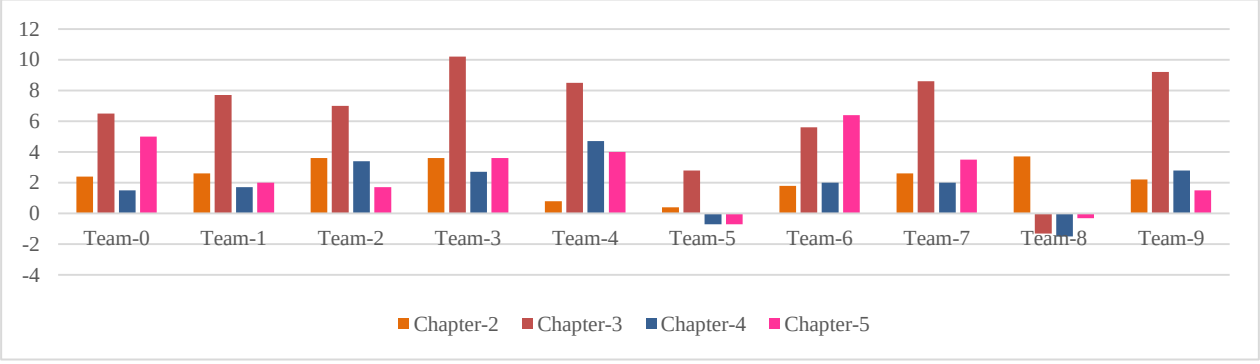

FIGURE 7. Pilot Study, Chapter-wise SRS Results

TABLE 3
PILOT STUDY, CHAPTER-WISE SRS RESULTS

SRS Chapter	Evaluator (Eval-1, Eval-2)		Team 0	Team 1	Team 2	Team 3	Team 4	Team 5	Team 6	Team 7	Team 8	Team 9
Ch-2	SRS 1	Eval-1	12.5	12.5	12.0	11.0	15.0	12.5	13.0	12.5	15.5	12.5
		Eval-2	17.0	14.0	14.5	13.5	15.0	13.0	15.0	10.0	10.0	15.5
		Avg-1	**14.8**	**13.2**	**13.2**	**12.2**	**15.0**	**12.8**	**14.0**	**11.2**	**12.8**	**14.0**
	SRS 2	Eval-1	17.0	14.0	17.0	14.5	15.5	10.5	14.5	12.5	17.5	16.5
		Eval-2	17.5	17.5	16.5	17.0	16.0	16.0	17.0	15.0	15.5	16.0
		Avg-2	**17.2**	**15.8**	**16.8**	**15.8**	**15.8**	**13.2**	**15.8**	**13.8**	**16.5**	**16.2**
Improve (Avg-2 – Avg-1)			**+2.4**	**+2.6**	**+3.6**	**+3.6**	**+0.8**	**+0.4**	**+1.8**	**+2.6**	**+3.7**	**+2.2**
Teams Net Avg Improvement (Team-0 To Team-9)			**+2.4 ➔ (2.4/20) x100 = +12.0%**									
Ch-3	SRS 1	Eval-1	25.5	23.0	28.5	21.5	23.0	23.0	27.5	22.5	33.0	16.0
		Eval-2	23.5	32.0	22.0	24.0	25.5	27.5	31.0	16.0	24.5	25.5
		Avg-1	**24.5**	**27.5**	**25.2**	**22.8**	**24.5**	**25.2**	**29.2**	**19.2**	**28.8**	**20.8**
	SRS 2	Eval-1	29.5	32.0	36.0	33.0	31.5	26.0	32.0	30.5	26.5	27.0
		Eval-2	32.5	38.5	28.5	33.0	34.5	30.0	37.5	25.0	28.5	33.0
		Avg-2	**31.0**	**35.2**	**32.2**	**33.0**	**33.0**	**28.0**	**34.8**	**27.8**	**27.5**	**30.0**
Improve (Avg-2 – Avg-1)			**+6.5**	**+7.7**	**+7.0**	**+10.2**	**+8.5**	**+2.8**	**+5.6**	**+8.6**	**-1.3**	**+9.2**
Teams Net Avg Improvement (Team-0 To Team-9)			**+6.5 ➔ (6.5/40) x100 = +16.2%**									
Ch-4	SRS 1	Eval-1	08.5	09.5	13.0	10.0	09.5	11.5	13.0	14.0	15.5	09.0
		Eval-2	11.5	13.5	10.5	13.0	12.0	13.5	13.0	09.5	13.5	11.0
		Avg-1	**10.0**	**11.5**	**11.8**	**11.5**	**10.8**	**12.5**	**13.0**	**11.8**	**14.5**	**10.0**
	SRS 2	Eval-1	09.5	11.0	16.5	15.0	13.5	09.0	13.5	15.0	14.5	12.5
		Eval-2	13.5	15.5	14.0	13.5	17.5	14.5	16.5	12.5	11.5	13.0
		Avg-2	**11.5**	**13.2**	**15.2**	**14.2**	**15.5**	**11.8**	**15.0**	**13.8**	**13.0**	**12.8**
Improve (Avg-2 – Avg-1)			**+1.5**	**+1.7**	**+3.4**	**+2.7**	**+4.7**	**-0.7**	**+2.0**	**+2.0**	**-1.5**	**+2.8**
Teams Net Avg Improvement (Team-0 To Team-9)			**+1.9 ➔ (1.9/20) x100 = +09.5%**									
Ch-5	SRS 1	Eval-1	12.5	10.0	13.5	12.5	10.5	13.5	12.5	08.0	14.0	11.5
		Eval-2	13.5	13.0	11.5	12.0	10.0	13.0	11.0	09.0	13.5	12.5
		Avg-1	**13.0**	**11.5**	**12.5**	**12.2**	**10.2**	**13.2**	**11.8**	**08.5**	**13.8**	**12.0**
	SRS 2	Eval-1	16.5	10.0	14.5	15.0	12.0	10.0	18.0	11.5	12.0	13.5
		Eval-2	19.5	17.0	14.0	16.5	16.5	15.0	18.5	12.5	15.0	13.5
		Avg-2	**18.0**	**13.5**	**14.2**	**15.8**	**14.2**	**12.5**	**18.2**	**12.0**	**13.5**	**13.5**
Improve (Avg-2 – Avg-1)			**+5.0**	**+2.0**	**+1.7**	**+3.6**	**+4.0**	**-0.7**	**+6.4**	**+3.5**	**-0.3**	**+1.5**
Teams Net Avg Improvement (Team-0 To Team-9)			**+2.7 ➔ (2.7/20) x100 = +13.5%**									

IV. CONCLUSION

The requirements elicitation is considered as the frontline activity performed during the requirements engineering process. The requirements elicitation frameworks define the systematic way of carrying requirements elicitation process to gather product requirements to understand the real needs of its stakeholders. The quality of the requirements elicitation process is vitally dependent on identification and involvement of the right stakeholders in the product conception stage of project. The stakeholder's evaluation process is defined to identify important stakeholders of the anticipated product for better involvement in the project development process. This article presented a stakeholder's evaluation process, which provides a rigorous way to perform stakeholder's analysis for global software development-based requirements elicitation tasks. The proposed stakeholder's evaluation process has been used in industrial projects and an encouraging feedback has been found through requirements elicitation outcomes.

Two SRS of different projects were prepared by the stakeholders selected using the proposed evaluation process. It has been observed that that an overall improvement of 12.0% was achieved in chapter-2 of SRS. Similarly, an overall improvement of 16.2% was achieved in chapter-3 of SRS. Similarly, an overall improvement of 9.5% was achieved in chapter-4 of SRS. Similarly, an overall improvement of 13.5% was achieved in chapter-5 of SRS. An overall improvement factor was observed in the quality of SRS that was prepared using the proposed stakeholder's evaluation process. The improvement in the quality of SRS is a clear indicator of fact that proposed stakeholder's evaluation process is applicable for software industries working in GSD modes. Therefore, the proposed stakeholder's evaluation process is expected to serve as an asset for the whole software development industry working in global software development context to better understand the right stakeholders of the anticipated product.

REFERENCES

[1]. E. C. Groen, N. Seyff, R. Ali, F. Dalpiaz, J. Doerr, E. Guzman, M. Stade, "The Crowd in Requirements Engineering: The Landscape and Challenges," *IEEE Software.*, vol 34, pp 44–52, 2017.

[2]. M. A. Akbar, A. Alsanad, S. Mahmood, A. A. Alsanad, A. Gumaei, "A Systematic Study to Improve the Requirements Engineering Process in the Domain of Global Software Development," *IEEE Access.*, vol 8, pp 53374–53393, 2020.

[3]. A. Aldave, J. M. Vara, D. Granada, E. Marcos, "Leveraging creativity in requirements elicitation within agile software development: A systematic literature review," *Journal of Systems and Software.*, vol 157, 110396, 2019.

[4]. W. Wang, W. Liu, J. Mingers, "A systemic method for organisational stakeholder identification and analysis using Soft Systems Methodology (SSM)," *European Journal of Operational Research.*, vol 246, pp 562-574, 2015.

[5]. M. Rajablu, G. Marthandan, W. F. Yusoff, "Managing for stakeholders: the role of stakeholder-based management in project success," *Asian Social Science.*, vol 11, pp 111, 2015.

[6]. P. Aragonés-Beltrán, M. García-Melón, J. Montesinos-Valera, "How to assess stakeholders' influence in project management? A proposal based on the Analytic Network Process," *International journal of project management.*, vol 35, pp 451-462, 2017.

[7]. V. D. Gooyert, E. Rouwette, H. V. Kranenburg, E. Freeman, "Reviewing the role of stakeholders in operational research: A stakeholder theory perspective," *European Journal of Operational Research.*, vol 262, pp 402-410, 2017.

[8]. M. Sadiq, "A fuzzy set-based approach for the prioritization of stakeholders on the basis of the importance of software requirements," *IETE Journal of Research.*, vol 63, pp 616-629, 2017.

[9]. K. Aaltonen, J. Kujala, "Towards an improved understanding of project stakeholder landscapes," *International Journal of Project Management.*, vol 34, pp 1537-1552, 2016.

[10]. K. Davis, "A method to measure success dimensions relating to individual stakeholder groups," *International Journal of Project Management.*, vol 34, pp 480-493, 2016.

[11]. I. M. Herremans, J. A. Nazari, F. Mahmoudian, "Stakeholder relationships, engagement, and sustainability reporting," *Journal of Business Ethics.*, vol 138, pp 417-435, 2016.

[12]. M. A. Iqbal, A. Shah, T. K. Khan, "Predicting Most Productive Requirements Elicitation Teams using MBTI Personality Traits Model," *International Journal of Engineering and Advanced Technology.*, vol 9, pp 3809-3814, 2019. doi:10.35940/ijeat.a9833.109119

[13]. M. A. Iqbal, A. R. Aldaihani, A. Shah, "Big-Five Personality Traits Mapped with Software Development Tasks to Find Most Productive Software Development Teams," *International Journal of Innovative Technology and Exploring Engineering.*, vol 8, pp 965-971, 2019. doi:10.35940/ijitee.j9755.1081219

[14]. M. A. Iqbal, F. A. Ammar, A. R. Aldaihani, T. K. Khan, A. Shah, "Building Most Effective Requirements Engineering Teams by Evaluating Their Personality Traits Using Big-Five Assessment Model," in *Proc. 2019 IEEE 6th International Conference on Engineering Technologies and Applied Sciences (ICETAS), Kuala Lumpur, Malaysia* doi:10.1109/icetas48360.2019.9117561

[15]. M. A. Iqbal, F. A. Ammar, A. R. Aldaihani, T. K. Khan, A. Shah, "Predicting Most Effective Software Development Teams by Mapping MBTI Personality Traits with Software Lifecycle Activities," in *Proc. 2019 IEEE 6th International Conference on Engineering Technologies and Applied Sciences (ICETAS), Kuala Lumpur, Malaysia* doi:10.1109/icetas48360.2019.9117370

[16]. E. M. Agwu, "Impact of Stakeholders' Analysis on Organizational Performance: A Study of Nigerian Financial Organizations," *International Journal of Strategic Decision Sciences (IJSDS)*, vol 10, pp 64-80, 2019.

[17]. X. Gan, R. Chang, T. Wen, "Overcoming barriers to off-site construction through engaging stakeholders: A two-mode social network analysis," *Journal of Cleaner Production.*, vol 201, pp 735-747, 2018.

[18]. J. Rześny-Cieplińska, A. Szmelter-Jarosz, "Assessment of the crowd logistics solutions-The stakeholders' analysis approach," *Sustainability.*, vol 11, pp 53-61, 2019.

[19]. C. W. Mohammad, M. Shahid, S. Z. Hussain, "Fuzzy attributed goal-oriented software requirements analysis with multiple stakeholders," *International Journal of Information Technology.*, pp 1-9, 2018.

[20]. J. Dick, F. Turkelboom, H. Woods, I. Iniesta-Arandia, E. Primmer, S. R. Saarela, G. Zulian, "Stakeholders' perspectives on the operationalisation of the ecosystem service concept: Results from 27 case studies," *Ecosystem services.*, vol 29, pp 552-565, 2018.