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Software Requirements Negotiation: A Review on Challenges

Shamsu Abdullahi, Musa Ahmed Zayyad, Naziru Yusuf & Lawal Idris Bagiwa
Dept. of Computer Science, Hassan Usman Katsina, Polytechnic P.M.B 2052
Katsina State, Nigeria
Email: sasalihawa09@gmail.com

Amina Nura
Dept. of Mathematics and Computer Science,
Umaru Musa Yaradua University Katsina, Katsina State. Nigeria

Abubakar Zakari
Dept. of Computer Science,
Kano University of Science and Technology, Wudil, P.M.B 3244, Kano, Nigerias

Babangida Dansambo
Dept. of Computer Science,
Federal University Dutsinma,
Katsina State. Nigeria

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***Abstract*—Requirements negotiation involves discussion on the requirements conflict to have some compromise that will satisfy the participating stakeholders of a software project. The output of a requirement negotiation is a set of satisfied requirements of two or more parties. In this paper, we present a systematic review of requirements negotiation challenges. The study adopted 34 papers from the final study selection process which were analyzed based on the requirements negotiation challenges they addressed. The identified challenges are decision-making, communication, performance, managing requirement changes, and conflict resolution. The output of the study indicates that decision-making is addressed by 33% of the studies reviewed, followed by the performance with 22%, conflict resolution with 19%, while 16% focus on stakeholders' communication, and managing requirements changes has 10%.**

***Keywords*—Requirements, negotiation, conflict, communication, decision-making**

I. INTRODUCTION

In the software industry, software projects contain multiple sets of stakeholders with varying goals that need to be negotiated [1, 2]. Hence, requirements negotiation is normally conducted to have a compromise that will satisfy the needs of participating stakeholders [3]. Conducting requirements negotiation effectively saved a larger proportion of the time wasted to resolve conflicting requirements of the stakeholders during software development [4]. Furthermore, the negotiation result is set to satisfy two or more stakeholders in the presence of limited common knowledge and conflicting preferences [5, 6]. In recent years, process models, tools, and techniques were proposed by the researchers to enable the software development industry to address requirements negotiation challenges. Firstly, [7-9] proposed decision-making techniques to support stakeholders in decision-making during requirements negotiation. Similarly, the process models in [2, 4, 10-12] assist in resolving requirements conflict. The studies provide process models to aid conflict identification and resolution process. Secondly, [13-17] developed tools to improve the performance of requirements negotiation. For example, in [14] the performance of requirements negotiation tools was improved by extending an existing tool with novel concepts of sustainability. Furthermore, [8, 18] conducted an evaluation to enhance the requirements negotiation tool performance. Requirements negotiation is a human-centred activity that is dependent on the stakeholders' communication [19]. Similarly, [19-22] developed effective requirements negotiation techniques that address stakeholders communication challenges such as requirements identification, understanding, and collaboration. Additionally, managing requirements changes is another requirement negotiation

challenge reviewed by this study as presented in [23, 24]. During the software development process, 50% of the requirements are altered which leads to a need for a comprehensive process of managing changes in the stakeholders' decisions [25]. This is becauseconsistent changes in requirements results in failure in software projects [24]. Furthermore, managing requirement changes adequately not only minimizes the cost, time, resources of the software project but it makes the software project successful [23]. Many review studies have been conducted in software requirements negotiation as in[26] [27] [28]. However, these studies do not review requirements negotiation challenges as reviewed in this study. The remaining parts of the paper are organized as follows. In Sections 2, the related works are highlighted. The research methodology adopted is presented in Section 3. Section 4 gives the discussion. Section 5 presents the challenges. Section 6 describes the findings. Lastly, the study is concluded in the Section 7.

II. Related Works

With regard to the related literature, few review works have been published in the field of study. These works include [27] where the authors conducted a review on electronic requirements negotiation. The study is limited to literature surveys on the state-of-the-art electronic software requirements negotiation. Similarly, [28] conducted a systematic mapping study in requirements negotiation, in which studies from 2007 to 2017 were utilized. The study investigates the requirement negotiation techniques, the environmental setting of conducting requirement negotiation studies, the evaluation techniques, and research facets in the field of study. However, the study did not examine the challenges in requirements negotiation. Additionally, [26] adopt the guidelines in [29] to conduct a systematic review in requirements negotiation from 2010 to 2015. The study has reviewed the requirement conflicts and requirements negotiation methods. In addition, the study adopted one database (Scopus) to search for relevant papers. Although the study partially investigates conflicts (issues) in requirements negotiation, the database used in the search process is insufficient to identify more relevant studies in the research domain. In general, the studies reviewed investigated software requirements negotiation from a different perspective. Hence, to our knowledge, no study conducted a review to investigate the challenges in software requirements negotiation. This research minimizes the research gap by critically analyzing 34 studies that addressed challenges in software requirements negotiation. The study adopts the guidelines in [29] for the review process.

III. RESEARCH METHODOLOGY

This section presents the methodology adopted in this research. The papers selected are based on challenges in software requirements negotiation. This study adheres to systematic guidelines given by [29]. These guidelines were also adopted by existing studies in software engineering research [30, 31] as a means of identifying, evaluating and interpreting all available research data relevant to a particular research question and interest in the studies.

A. Search Process

In this study, the search process was formulated and manipulated on the selected electronic databases to retrieve all the relevant studies. Seven electronic databases were selected in this study. These selected electronic databases are Google Scholar, Web of Science, ACM, Science Direct, Scopus, IEEEXplore, and dimensions. S

B. Inclusion and Exclusion Criteria

The study defines the inclusion and exclusion criteria which were later applied to the initial results of the search string used in the paper searching process. The criteria of inclusion are studies published from 2014 to 2019 and the papers that addressed challenges of software requirements negotiation. However, we adopted the recommendation by [29] to exclude non-English language studies. Hence, we include [21] that is written in Portuguese due to its relevance to this study as it focused on stakeholders' communication. Finally, the result of the search process based on the criteria of inclusion and exclusion resulted in 917 papers.

C. Paper Selection Strategy

This subsection presents the three phases of the study selection strategy. the phases are depicted in Figure 1.

- **Phase 1:** In the first phase, the 917 studies identified in the search process were thoroughly checked. The duplicate papers were identified and removed. However, we identified a few studies that focus on negotiation in automation engineering and artificial intelligence. Hence, these studies were eliminated. After the first phase, 325 papers were selected.
- **Phase 2:** In the second phase, the authors fully reviewed the abstracts of the 325 selected studies. During the abstract review, the authors classified the studies based on the type of requirements negotiation challenge that each of the papers addressed. At the end of this phase, 102 papers were selected.
- **Phase 3:** In the last phase, the researchers read the full text of the 102 papers. 34 papers were finally identified to address the scope of this research.

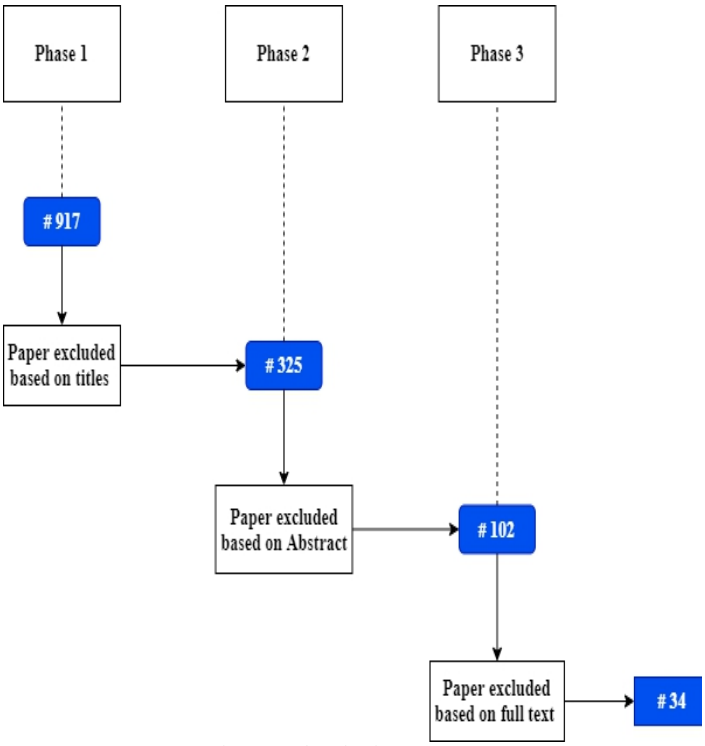

Fig. 1. Study selection process

IV. Discussion

In this section, the studies were classified based on the requirement negotiation challenges they addressed as described in Figure 2. Five requirement negotiation challenges were identified which are decision-making, conflict resolution, stakeholder's communication, performance, and managing requirement changes. The finding shows that from the selected studies, 33% address the stakeholders' decision-making challenges, followed by the performance of the requirements negotiation process with 22%r, conflict resolution with 19%, while 16% focus on stakeholders' communication and managing requirements changes has 10%.

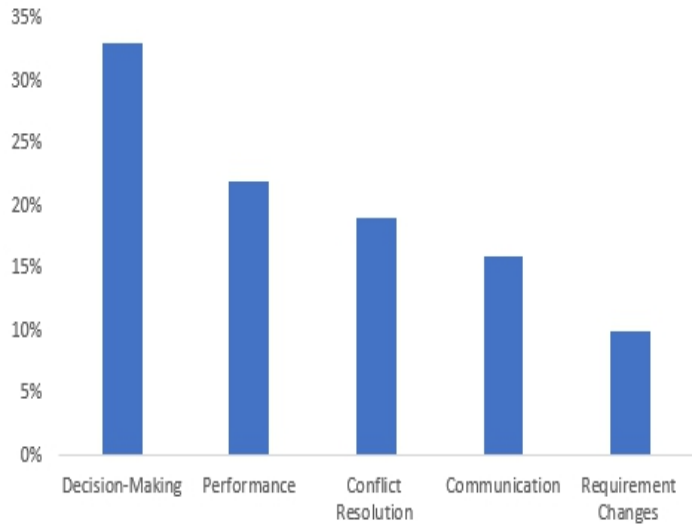

Fig. 2. Distribution of identified requirement negotiation challenges

A. Decision-making

Decision-making is the most challenging and difficult task in requirements negotiation [32]. Time, stress, and dynamic environment are factors that affect the decision-making process. In requirements negotiation, when making a decision, there are a number of challenges that existed and need careful attention before the commencement of negotiation. The first is problem identification and preference of decision-making which is addressed in [33] to enable stakeholders to effectively achieve agreements. Secondly, the interaction of software companies in the software ecosystem. The companies in ecosystem communication require interaction to survive the turbulent environment. Since software ecosystem products are for a wide market, requirements are often jointly defined by the suppliers of the ecosystem rather than brainstormed by the stakeholders [34]. However, actors can have mismatching goals that need careful negotiation. For instance, requirements must be converted into a set of complementary features [35]. Similarly, [36] stated the need for agile collaboration networks implementation between business organizations in the software ecosystem. This is to push software industries to grow beneath their geographical location in the present era of globalization.

Another challenge is the team member formation process, where the manager needs to choose the appropriate team members in the software project. However, the members' opinions have not been considered in the team formation process. To have a mutual decision between the manager and the members, there is a need to first define the negotiation team problem which addressed the misunderstanding of the manager and the members. Further, a negotiation model to implement the team formation process between the manager and the members was followed. [9] proposed an agent-based negotiation approach where the negotiation process is iterated until the benefit requirements of the manager and the members are all satisfied, or the deadline for the negotiation is reached. Similarly, [6] proposed a Groupware Requirements Negotiation System (GRNS) process model that incorporates a set of process models and Bayes to improve the effectiveness of decision-making in the requirement negotiation process. [36] use a dynamic multicriteria decision model provides techniques of improving decision-making in the software ecosystem. Finally, although there is a lot of decision making in requirements negotiation, there is little understanding about how stakeholders make decisions in requirement engineering.

B. Conflict Resolution

Requirements negotiation helps to resolve conflicts between stakeholders. Conflicts are negative undesired interactions that consume 80% of the stakeholders' time during requirements negotiation [4]. The causes of requirements conflict include goal conflict, resource contention, deployment and ownership, violation of assumptions, inadequate interface, policy conflict, and concurrency [1, 37, 38]. Negotiation is adopted in situations where interest conflicts are detected and cannot be ignored. Hence, it will help to make an effective decision in a negotiation process which is critical to the success of the

negotiation [1, 39]. The conflict resolution challenges identified in this research include multiple stakeholders with varying goals that need to resolve the mismatching goals [2]. This might be due to a lack of defined negotiation team problems thataddressed the misunderstanding of the stakeholders [9].

Another challenge is the major risk of unresolved conflicts because not all stakeholders are committed to the successful realization of the system to be built which could compromise its success. This may have detrimental consequences and the project may fail. Conflicts could be a creative source of new and innovative ideas and not necessarily a negative outcome. Thus, it is important to identify and analyze conflicts and resolving them along with documenting the corresponding resolutions [3].

C. Communication

The comprehensive communication processes in requirement negotiation promote structured negotiation among geographically distributed stakeholders [40]. The challenges in stakeholders' communication include large and distributed stakeholders in the software projects as in the ecosystem. In this case, the elicited requirements of the stakeholders are supported by tools such as agents and online tools [21]. Requirements are brainstormed from initial ideas, through clarification, to the implementation of the requirement. However, negotiation results may indicate that requirements were poorly understood due to a lack of proper communication. Hence, a re-negotiation to conform to the project objectives is required. Moreover, failure to address such issues in time might lead to negative consequences on the project. These issues are re-work, missed schedules, and budget overrun [19]. On the other hand, another challenge is the stakeholders' communication assistant. The software project team needs to have tools that can assist communication between stakeholders in requirements negotiation. This is because the agent used has information and its different language that can harm the process of communication between the development team and stakeholders[21]. [22] proposed a model that incorporates the trust management process with the requirements definition process to address the requirements definition process challenge in requirement negotiation. The success or failure of a software project is determined by a proper requirements definition. The lack of an effective requirement definition draws an ambiguous conclusion and leads directly to the failure of the software project.

D. Managing Requirement Changes

According to [23], during software development, 50% of the requirements are altered which makes it immune to changes inherently throughout the software development process. The requirement changes often lead to failure in projects developed [24]. This poses the need for a comprehensive requirements negotiation process that allows negotiated requirements to accommodate new changes from the stakeholders in requirement negotiation [25]. [24, 41] proposes a technique to manage requirements changes at the converging win-conditions stage of requirements negotiation. This is to mitigate the difficulty in managing requirements changes experienced in the later stages of the software development lifecycle. In requirement negotiation, managing requirement changes adequately not only minimizes the cost, time, resources of the software project but make the software project successful [23].

E. Performance

Performance refers to the use of negotiation tools to aid stakeholders' cooperation during requirements negotiation. An agent is an automated negotiation tool used to improve negotiation by providing means for stakeholders to organize behavior and achieve agreement [21]. The agent has a utility function of the stakeholders represented in the negotiation that allow geographically separated stakeholders to achieve agreement [16]. [18] improve the performance requirement negotiation process by proposing a method that provides the means for stakeholders to organize their behaviour to achieve agreement.s

V. STUDY CLASSIFICATION BASED ON REQUIREMENTS NEGOTIATION CHALLENGES

In this section, challenges addressed by the selected requirement negotiation studies are elaborated. Table 1 present the references along with the requirements negotiation challenges that the studies addressed.

TABLE 1. Author wise addressed challenges of the papers

ID	Challenges
[4]	Conflict resolution
[12]	Conflict resolution
[10]	Conflict resolution
[42]	Communication
[6]	Decision making
[35]	Decision making
[9]	Decision making and conflict resolution
[17]	Performance of RN tool
[16]	Performance
[24]	Managing requirement changes
[18]	Performance
[43]	Communication
[20]	Communication
[22]	Communication
[19]	Communication
[44]	Requirement analysis
[41]	Managing requirement changes
[11]	Conflict resolution
[1]	Decision making
[45]	Decision making and conflict resolution
[36]	Decision making
[46]	Decision making
[47]	Performance
[33]	Decision Making
[15]	Performance
[2]	Conflict resolution
[38]	Decision-making
[48]	Decision-making
[49]	Performance and Decision making
[13]	Performance
[14]	Performance
[8]	Decision-making and performance
[21]	Communication
[50]	Decision-making

VI. RESEARCH FINDINGS

During searching and data extraction from the selected papers, many challenges were identified in software requirements negotiation. However, in this section, we highlight these challenges found in the research domain. Firstly, requirement changes while already negotiated is a factor leading to software project failure. Findings show that 10% of the studies reviewed provide solutions to requirements changes. Managing the changes in requirements effectively help reduce the time, resources, cost, and make the project developed successfully [24]. Secondly, a lot of time is wasted to resolve the differences in heterogeneous stakeholders[4]. However, various studies indicated a lack of conflict identification and resolution techniques [10, 12]. Although conflict techniques have been developed recently to address conflict as in [11], better conflict resolution mechanisms are needed that will provide proper detection and resolution of conflict. Decision-making gained a lot of attention from the selected studies with 33% of the selected papers. Various studies have hinted at the lack of communication approach for software companies to interact in the software ecosystem [1, 35, 36]. However, in order to improve communication between software companies in the ecosystem interactions novel synchronous and asynchronous techniques are needed to be incorporated in requirement negotiation tools.

As presented in Figure 2, most of the studies examined the performance(22%), automated tools such as agent was used to improve the performance of the requirements negotiation process[13, 49]. The study by [14] integrates the sustainability concept and extends the requirements negotiation model. Although many techniques were used to improve the requirement negotiation process, there is a need for integrating the novel concepts of machine learning and data mining approaches to improve the performance. Lastly, the highlighted requirements negotiation challenges need to be resolved with novel techniques.

VII. CONCLUSION

The software requirements negotiation process enables the software industries to negotiate varying goals of multiple stakeholders during the software development process. However, stakeholders' needs have become larger and complex which results in many challenges. This paper attempted to identify various challenges addressed by software requirements negotiation studies. The research conducted a systematic review from 2014 to 2019 to achieve the study objectives. Furthermore, 34 papers were adopted for this study and they are analyzed based on requirement negotiation challenges that they addressed. The identified challenges include decision-making, conflict resolution, stakeholders' communication, managing requirements changes, and requirements negotiation tools performance. The finding shows that decision-making and performance challenges were addressed by the majority of the studies with 33% and 22% respectively. Finally, novel techniques, process models, and tools of requirements negotiation are needed in the software industry to enable heterogeneous stakeholders to achieve agreements.

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REFERENCES

[1] Jamoussi, Y. J. J. o. S. E. (2015). Enhancing Satisfaction of Actors' Requirements in Web Service Composition: A Guided Negotiation based Approach. *Journal of Software Engineering*, 9(3), 1819-4311.

[2] Ahmad, S., *et al.* (2016). An Enhancement of Software Requirements Negotiation with Rule-based Reasoning: A Conceptual Model. *Journal of Telecommunication, Electronic and Computer Engineering,* 8(10), 193-198.

[3] Kukreja, N. (2015). *Using Social Networking Technology to Improve Collaborative Requirements Elicitation, Negotiation, Prioritization and Evolution*. University of Southern California.

[4] Kushiro, N., T. Shimizu, and T. J. P. C. S. Ehira. (2016). Requirements Elicitation with Extended Goal Graph. *Procedia Computer Science*, 96, 1691-1700.

[5] Braun, P., *et al.* (2006). E-negotiation Systems and Software Agents: Methods, Models, and Applications. In *Intelligent Decision-Making Support Systems*. Springer. 271-300.

[6] Sofian, H. B., *et al.* (2014). A Requirements Negotiation Process Model that Integrates Easywinwin with Quality Assurance and Multi-criteria Preference Techniques. *Computer Engineering and Computer Science*. 39(6), 4667-4681.

[7] Reiser, A. (2012). *Entscheidungsunterstützung in elektronischen Verhandlungen: Eine Analyse unter besonderer Berücksichtigung von unvollständigen Informationen*. Springer-Verlag.

[8] Zhu, X., *et al*. (2018). *Criteria Making in Role Negotiation.* IEEE Transactions on Systems, Man, and Cybernetics: Systems, 50(10), 3731-3740.

[9] Wang, J. and J. J. E. A. o. A. I. Zhang. (2015). A Win–Win Team Formation Problem based on the Negotiation. *Engineering Applications of Artificial Intelligence,* 44, 137-152.

[10] Amroune, M., *et al.* (2014). Composition of Aspectual Requirements: A Multi-Criteria Process for Conflict Resolution. *Journal of Software Engineering,* 8(2), 75-88.

[11] Thew, S. and A. J. R. e. Sutcliffe. (2018). Value-based Requirements Engineering: Method and Experience. *Requirements Engineering.* 23(4), 443-464.

[12] Oster, Z. J., G. R. Santhanam, and S. Basu. (2015). Scalable Modeling and Analysis of Requirements Preferences: A Qualitative Approach Using CI-Nets. In *2015 IEEE 23rd International Requirements Engineering Conference (RE)*. IEEE.

[13] Patrikar, M., S. Vij, and D. J. P. C. S. Mukhopadhyay. (2015). An Approach on Multilateral Automated Negotiation. *Procedia Computer Science,* 49, 298-305.

[14] Seyff, N., *et al*. (2018). Tailoring Requirements Negotiation to Sustainability. In *2018 IEEE 26th International Requirements Engineering Conference (RE)*. IEEE.

[15] Monteserin, A., *et al*. (2017). Agent Negotiation Techniques for Improving Quality-attribute Architectural Tradeoffs. In *International Conference on Practical Applications of Agents and Multi-Agent Systems*. Springer.

[16] Vahidov, R., R. Saade, and B. Yu. (2016). Effects of Negotiation Tactics and Task Complexity in Software Agent:

Human Negotiations. In *Proceedings of the 18th Annual International Conference on Electronic Commerce: e-Commerce in Smart connected World*.

[17] Hussain, A., *et al.* (2016). Requirements Engineering Practices in UUMIT Centre: An Assessment Based on the Perceptions of In-House Software Developers. *Journal of Telecommunication, Electronic and Computer Engineering.* 8(8), 27-32.

[18] Mohammad, Y. and S. Nakadai. (2019). Optimal Value of Information Based Elicitation During Negotiation. In *Proceedings of the 18th International Conference on Autonomous Agents and MultiAgent Systems*. International Foundation for Autonomous Agents and Multiagent Systems.

[19] Knauss, E., *et al.* (2015). Patterns of Continuous Requirements Clarification. *Requirements Engineering,* 20(4), 383-403.

[20] Jia, J. and L. F. J. R. E. Capretz. (2018). Direct and Mediating Influences of User-Developer Perception Gaps in Requirements Understanding on User Participation. *Requirements Engineering*, 23(2), 277-290.

[21] Aguiar, L. G. F., *et al.* (2016). Conceptual Mapping as a Communication Tool of Legal Requirements. In *2016 11th Iberian Conference on Information Systems and Technologies (CISTI)*. IEEE.

[22] Kiritani, K. and M. J. P. c. s. Ohashi. (2015). The Success or Failure of the Requirements Definition and study of the Causation of the Quantity of Trust Existence between Stakeholders. *Procedia Computer Science.* 64, 153-160.

[23] Bhatti, M. W., *et al*. (2010). A Methodology to Manage the Changing Requirements of a Software Project. In *2010 International Conference on Computer Information Systems and Industrial Management Applications (CISIM)*. IEEE.

[24] Ahmad, Z., *et al.* (2015). Impact Minimization of Requirements Change in Software Project through Requirements Classification. In *Proceedings of the 9th International Conference on Ubiquitous Information Management and Communication*.

[25] Fricker, S., *et al.* (2010). Handshaking with Implementation Proposals: Negotiating Requirements Understanding. *IEEE Software,* 27(2),. 72-80.

[26] Terpstra, E. J. S. U. R. E.-j. (2015). A Systematic Literature Review of Requirements Negotiation Methods from 2010 till 2015. *Student Research Conference 2015,* 1.

[27] Lenz, A., M. Schoop, and G. Herzwurm. (2016). Electronic Requirements Negotiation–A Literature Survey on the State-of-the-Art. In *UK Academy for Information Systems Conference, Proceedings of UKAIS*.

[28] Tito, L., *et al.* (2017). A Systematic Mapping of Software Requirements Negotiation Techniques. In *ICEIS (2)*.

[29] Kitchenham, B., *et al.* (2009). Systematic Literature Reviews in Software Engineering–A Systematic Literature Review. Information and Software Technology. 51(1), 7-15.

[30] Zakari, A., *et al.* (2020). Spectrum-based Fault Localization Techniques Application on Multiple-Fault Programs: A Review. *Global Journal of Computer Science and Technology: G Interdisciplinary*, 20(2).

[31] Abdullahi, S., *et al.* (2020). *Software Testing: Review on Tools, Techniques and Challenges. International Journal of Advanced Research in Technology and Innovation,* 2(2), 11-18.

[32] Orasanu, J. and E. Salas. (1993). *Team Decision Making in Complex Environments.*

[33] Lenz, A. and M. Schoop. (2017). Decision Problems in Requirements Negotiations–Identifying the Underlying Structures. In *International Conference on Group Decision and Negotiation*. Springer.

[34] Jansen, S., A. Finkelstein, and S. Brinkkemper. (2009). A Sense of Community: A Research Agenda for Software Ecosystems. In *2009 31st International Conference on Software Engineering-Companion Volume*. IEEE.

[35] Valença, G., *et al*. (2014). Competition and Collaboration in Requirements Engineering: A Case Study of an Emerging Software Ecosystem. In *2014 IEEE 22nd International Requirements Engineering Conference (RE)*. IEEE.

[36] Arrais-Castro, A., *et al.* (2015). Collaborative Negotiation Platform Using a Dynamic Multi-Criteria Decision Model. *International Journal of Decision Support System Technology,* **7**(1), 1-14.

[37] Weiss, M., B. Esfandiari, and Y. J. C. n. Luo. (2007). Towards a Classification of Web Service Feature Interactions. *Computer Networks*, 51(2), 359-381.

[38] Alharthi, M., J. Campbell, and C. McDonald. (2014). *An Ontological Win-Win Model for Requirements Negotiation: Visual Decision-Making Aid for Software Development Teams*. ACIS.

[39] Yan, J., *et al.* (2007). Autonomous Service Level Agreement Negotiation for Service Composition Provision. *Future Generation Computer Systems*, 23(6), 748-759.

[40] Damian, D.E. and D. Zowghi. (2002). The Impact of Stakeholders' Geographical Distribution on Managing Requirements in a Multi-Site Organization. In *Proceedings IEEE Joint International Conference on Requirements Engineering*. IEEE.

[41] Frischbier, S., P. Pietzuch, and A. Buchmann. (2014). Managing Expectations: Runtime Negotiation of Information Quality Requirements in Event-based Systems. In *International Conference on Service-Oriented Computing*. Springer.

[42] Schneider, K., *et al.* (2017). Reframing Societal Discourse as Requirements Negotiation: Vision Statement. In *2017 IEEE 25th International Requirements Engineering Conference Workshops (REW)*. IEEE.

[43] Knauss, E., *et al*. (2018). Continuous Clarification and Emergent Requirements Flows in Open-Commercial Software Ecosystems. *Requirements Engineering*, 23(1), 97-117.

[44] Brace, W. and K. J. R. E. Ekman. (2014). CORAMOD: A Checklist-oriented Model-based Requirements Analysis Approach. *Requirements Engineering*, 19(1), 1-26.

[45] Mairiza, D., D. Zowghi, and V. Gervasi. (2014). Utilizing TOPSIS: A Multi Criteria Decision Analysis Technique for Non-functional Requirements Conflicts. In *Requirements Engineering*. Springer. 31-44.

[46] Farshidi, S., *et al.* (2018). *Multiple Criteria Decision Support in Requirements Negotiation*. in *REFSQ Workshops*.

[47] Seyff, N., *et al.* (2015). Using Popular Social Network Sites to Support Requirements Elicitation, Prioritization and Negotiation. *Journal of Internet Services and Applications*. 6(1), 7.

[48] Liu, T., *et al.* (2019). *Understanding the Decision-Making of Students in Requirements Engineering Course Projects.*

[49] Mahmoud, M. A., M. S. Ahmad, and A .J. P. C. S. Idrus. (2019). Value Management-based Alternatives Ranking Approach for Automated Negotiation. *Procedia Computer Science,* 161, 607-614.S

[50] Abdullahi, S., *et al.* (2020). Criteria for Accepting Software Requirements Negotiation Tools in the Software Industry. *4th Asiainternational Multidisciplinary Conference*, 2(1), 39-45.