

Three Tier Unified Process Model for Requirement Negotiations and Stakeholder Collaborations

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ABSTRACT

This research paper is focused towards carrying out a pragmatic qualitative analysis of various models and approaches of requirements negotiations (a sub process of requirements management plan which is an output of scope management's collect requirements process) and studies stakeholder collaborations methodologies (i.e. from within communication management knowledge area). Experiential analysis encompass two tiers; first tier refers to the weighted scoring model while second tier focuses on development of SWOT matrices on the basis of findings of weighted scoring model for selecting an appropriate requirements negotiation model. Finally the results are simulated with the help of statistical pie charts. On the basis of simulated results of prevalent models and approaches of negotiations, a unified approach for requirements negotiations and stakeholder collaborations is proposed where the collaboration methodologies are embedded into selected requirements negotiation model as internal parameters of the proposed process alongside some external required parameters like MBTI, opportunity analysis etc.

Keywords : QoS i.e. Quality of Service, Requirement Negotiations, Stakeholder Collaborations, Distributed, KPI i.e. Key Process Indicators and Requirements Maturity.

1 INTRODUCTION

Project Management is surfacing rapidly; it encapsulates two broad line concepts attributed to software engineering i.e. software product development and software project management. To ensure overall effective project management and product development; there is another dimension, which needs to be addressed and i.e. project triple constraint management and specifically core functions of project management like scope, because scope identifies the estimates for other core functions like cost, time and quality. Scope management constitutes the concept of requirements engineering. [1] Studies, in the contemporary times have revealed that optimized outcome of software projects and operations can be obtained by means of incorporating a comprehensive and dynamic requirements engineering process. Requirements engineering evolved as an independent process addressing the two different dimensions i.e. Requirements Development & Requirements Management.[1] Requirements development constitutes elicitation, analysis, specification & validation while requirements management is a composite of negotiation, collaboration, change control, verification & stakeholder sets. Requirements negotiation and stakeholder collaboration both exist in two dimensions i.e. synchronous and asynchronous. [6][2] Once the stakeholders are working together and negotiating and collaborating in a real time it is inferred as synchronous and once they are not co-located and are spread over various time zones and performing negotiations and collaborations in a distributed environment of the sort, it can be inferred as asynchronous negotiation and communication process. [2] Both the dimensions are overlapping and iterative in nature. Hence the objectives of this research paper are articulated as under:

- 1) Literature review of various requirements negotiation and stakeholder collaboration models and methodologies.
- 2) Definition of KPIs and QoS attributes: QoS at abstract level and KPIs at specific levels.
- 3) Measurement of negotiation models on the basis of KPIs and QoS attributes.
- 4) Unification of Negotiations and Collaborations in a model to develop a unified process model.

Research methodology for achieving the identified objectives is likewise: Various negotiation models and collaboration methodologies are studied. KPIs and QoS attributes are identified on the basis of [10], [14] & [15]. Qualitative experiential analysis will be conducted on the basis of QoS KPI Yardstick and SWOT matrices will be developed to select a negotiation model as a base platform. After the model is selected collaboration methodologies will be embedded into base requirements negotiations model. As an end result, a unified process model for requirements negotiations and stakeholder collaborations to assist a state of the art requirements engineering activity at software projects will be presented. To validate, endorse and confirm the optimization of the proposed model that will surface as an outcome of this research will be comparatively analyzed with the previously selected best negotiation model. Furthermore, results of critical comparisons will be contrasted to highlight the ambiguities, inconsistencies and constraints annexed with researched and prescribed models, techniques, methodologies and approaches.

2 LITERATURE REVIEW

Requirements negotiations as described earlier is an iterative and continual process that spans over both the dimensions of requirements engineering process i.e. requirements management and development. [7] It goes alongside stakeholder collaborations. Literature pertaining to requirement negotiations and stakeholder collaborations was reviewed and then analyzed to comprehend and understand models related to both collaborations and negotiations for probable reasons of project failures and deficiencies. Analysis of the literature review at the abstract level revealed that there is no existence of a unified process model for collaborations and negotiations. Precise analysis as presented in the later parts of the paper reveal, requirements negotiations and stakeholder collaborations are synonymous to each other as negotiations only take place between the stakeholders. So, to increase the success rate of software projects there is a gap which needs to be filled? To bridge that gap following negotiation models were studied and explored:

- 1) Win-Win Model [4][3]
- 2) Spiral Model [7]
- 3) Multi Criteria Preference Analysis Negotiations [5]
- 4) Broker based Negotiations Framework [11][12]
- 5) Loren Model [13]

2.1 Win-Win Model

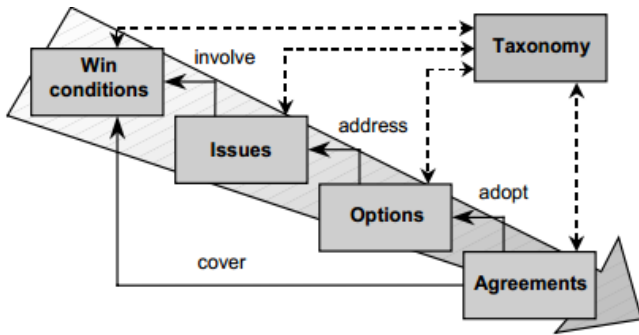


Fig. 1 Win-Win Negotiation Model

The model presented in figure 1 is for negotiations amongst the identified set of stakeholders. Initially the Win conditions are defined based on the taxonomy. Win conditions can be anything that can be termed as the objective or in other words anything required as an outcome of any prescribed effort. Once the win condition is defined only then it is exposed to a set of relevant stakeholders. If there exists a mutual agreement between the stakeholders with respect to the identified win conditions the agreement is made and the negotiations process is terminated else if a set of stakeholders have reservations regarding the win condition; those reservations are translated as issues and each identified issue is discussed, valued and resolved. The resolution of issues dictates formulation of various options to resolve those issues, in other words it can be said that resolution caters for contingency planning. The negotiation model presented above is an iterative model

encapsulating dual pathways for requirements negotiations.

2.2 Spiral Model

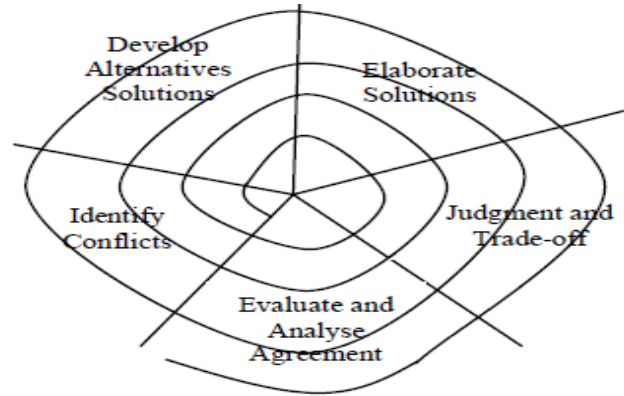


Fig. 2 Spiral Model for Negotiations

Figure 2 depicts the spiral model for requirements negotiations. It initiates the requirements negotiations process by analyzing the requirements with respect to conflicts i.e. identification of those requirements individually or compositionally which are conflicting or contradicting with other identified requirements and causing ambiguities with regards to requirements engineering process. [7] Once the conflicts are identified they are presented to the concerned stakeholders for analysis and evaluation to develop solutions. Solution development is reliant on the concept of contingencies i.e. the development of alternative possible solutions for the resolution of conflicts. Once the solutions are developed and pooled; possible optimum solutions are selected from the pool of alternative solutions on the basis of the problem domain and stakeholder discussions. The selected solutions are then expanded from abstract level to comprehensive level. After the solutions are comprehensively elaborated, judgmental trade-off is carried out i.e. decisions are made to follow which path as far as conflict and contradiction resolutions are concerned. After the identified conflicts, contradictions, inconsistencies and ambiguities are removed the newly established baseline requirements are evaluated and analyzed. If all the concerned stakeholders agree and no conflicts and contradictions prevail in the baseline requirements document, negotiation process is terminated else the requirements are re-negotiated and a new spiral for negotiation is invoked. This is again an iterative model which caters for dynamically arising risks, conflicts, inconsistencies and ambiguities associated with the identified and developed requirements baseline. [7]

2.3 Multi Criteria Preference Analysis Requirement Negotiation Model

Multi Criteria Preference Analysis Requirements Negotiation model also known as MPARN presented in [5] is an extension of Win-Win model for requirement negotiations. It incorporates preference analysis into the prevalent win-win requirement negotiations modeling methodology. Figure below presents a generic win-win requirement negotiations model incorporated with extended concepts of preference analysis.

Steps 1, 2, 3 and 8 depicted in the figure 3 are in conformance to figure 1 requirement negotiations model while steps 4, 5, 6 and 7 constitutes the extension proposed in [4] i.e. preference analysis. Negotiation for model below in figure 3 is presented as under [5]:

- 1) Identify develop the win conditions.
- 2) Look for any type of conflicts, contradictions, ambiguities and inconsistencies.
- 3) Develop elaborate and alternative resolution strategies.
- 4) Analyze and evaluate the core objective criteria for resolution.
- 5) Assess and select the resolution options based on the objective criteria setup earlier.
- 6) Allow each stakeholder to assign weights to different criteria and finally select the criteria with highest weight.
- 7) Finally rank the options based on their weighted analysis by all stakeholders.
- 8) Conduct post resolution analysis to achieve agreements.

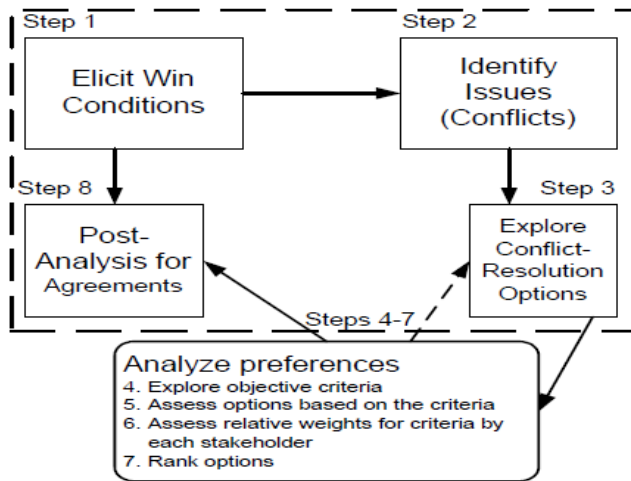


Fig. 3 MPARN Process for Requirement Negotiations

This is again an iterative model, providing extended capabilities and avoiding deadlock amongst stakeholders as far as decision making process is concerned because it provides preferential analysis to select and opt for the resolution strategies.

2.4 Broker Based Negotiations

Broker based model for requirement negotiations emphasizes that all type of negotiations and its associated functionalities shall be transferred from in-house responsibilities to external negotiation brokers i.e. third party. [11][12] Its claimed advantages are that it frees the resources consumed by the customer and the organization will keep running smoothly as it will not be exposed to the vulnerabilities imposed with regards to stakeholder management.[11] Generalized model depicting broker based requirements negotiations is presented in figure 4. It depicts a consumer side broker i.e. representative of the consumer or customer alongside provider side broker i.e. the representative of the third party that will provide services for requirements negotiation and all

its attributed functionalities.

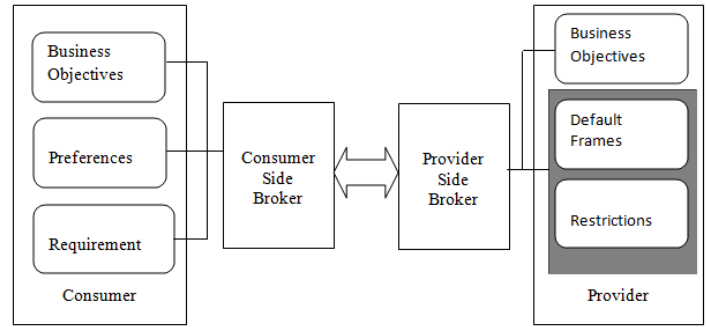


Fig. 4 Broker Based Requirements Negotiation

Now, what happens is that the consumer side broker provides the provider side broker with three documents and they are: business objectives, preferences as discussed and articulated by the relevant stakeholders and requirements documentation. [12] Provider i.e. third party service provider applies the negotiation process to the received set documents processes them with some default terms associated with requirements engineering while analyzing for its conformance with internationally defined and acclaimed standards. Finally, the revised and agreed upon baseline requirements are submitted back to the consumer. [12].

2.5 Loren Model

Loren Model setups the computer based collaborative requirements negotiation. It is based on the broad line concepts of requirements engineering depicted in fig. 5 below and presented by Loren in [13]:

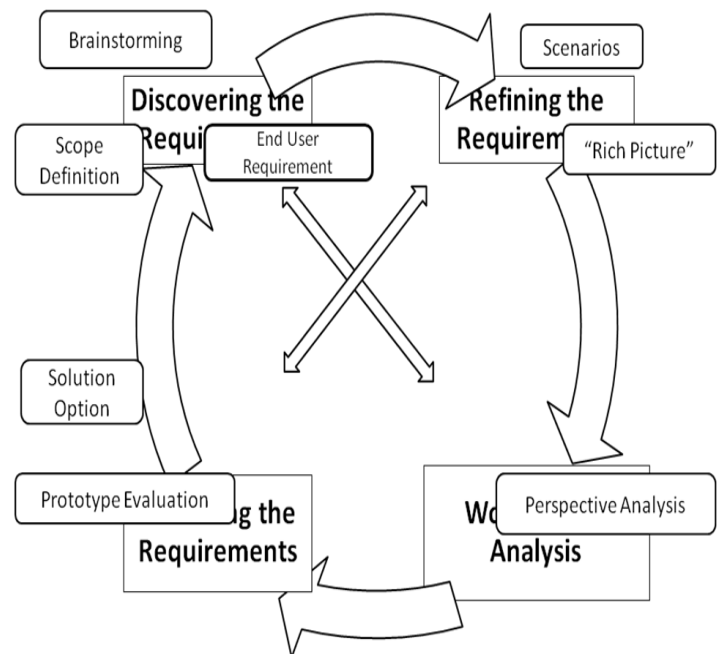


Fig. 5 Loren Model for Requirements Negotiations

Fig. 5, represents software requirements engineering broadly and provides software requirements negotiations at the granular level [13] i.e. it captures the requirements

alongside defining win conditions, it refines the discovered requirements by developing alternative solutions and scenarios to achieve the win conditions. Perspective analysis refers to endorsement of requirements while elaborating the alternative solutions and selecting the resolution strategies. Validation refers to the evaluation of prototype of requirements and it maps to negotiations post resolution analysis stage. Although it is a requirements engineering model it maps to the requirements negotiations adeptly as depicted in [13].

2.6 CIRCUS Methodology

CIRCUS means Collaboration and Intercultural issues on Requirements: Communication, Understanding and Soft Skills. It is workshop type of methodology to ensure stakeholder collaboration on projects and especially distributed development environments. These are certain aspect looked by CIRCUS to be successful as mentioned in [8] and are enlisted as under for collaboration in distributed environments:

- 1) For the collaboration to be successful Trust must prevail amongst the team members.
- 2) Delegation of responsibility is another critical aspect i.e. mutually agreed upon goals shall be articulated to clearly devise the responsibilities so as to avoid the derailment of the development team(s).
- 3) Communication process shall be open and performed at regular intervals.
- 4) Adeptly defined architecture, communication interfaces and work packages.
- 5) Properly defined and articulated requirements to have optimum outcome of the negotiation process.
- 6) Usage of standardized terminologies to avoid differences that may originate on the basis of using lingo.
- 7) Avoidance of cultural collisions and discussion.

2.7 FLOW Methodology

FLOW methodology emphasizes for efficient and timely feedbacks. It relies on the information theory and concepts of information flow. It categorizes the information to be communicated in the following two categories:

- 1) Solid Information (It refers to the information that is understandable by third parties; available for most of the time, implicitly i.e. completely auto-nomic).[9]
- 2) Fluid Information (All remaining type of information

is known as fluid information; in other words information that does not satisfies the fore narrated criteria; requires explicit direction and control partially auto-nomic).[9]

FLOW methodology captures information for two particular aspects as mentioned the back bone for emphatic communication in [9] i.e. Project Analysis and Project Optimization.

Literature review identifies that collaborations and negotiations are cohesive and there must be a process model for managing them cohesively. Success rate of projects can be maximized if a negotiations and collaborations as part of project scope and communications management is taken and managed cohesively i.e. in a unified manner to minimize content deficiencies [17], which in turn are root cause of failure.

3 EXPERIENTIAL ANALYSIS OF NEGOTIATION MODELS

Two tier analysis is performed. Analysis is on the basis of QoS attributes and key process indicators, as identified on the basis of [14] and [16]. First tier constitutes development of weighted analysis on the basis of identified KPI's while the second tier is focused towards translation of weighted matrix into specific SWOT matrices for each of the negotiations models. Finally, the SWOT is simulated through pie chart to select the best negotiation model available.

3.1 KPI based Weight Matrix

Weighted analysis of software requirements negotiation process is conducted on the basis of yardstick, which is developed by looking into the following parameters, generally accepted as criteria for the evaluation of negotiation processes [14], [16]; also known as feature base indicators to measure how well organized a negotiation process is; feature based analysis for earlier discussed requirements negotiation models is presented in table 1 below; it also encapsulates the degree of persistence of a particular feature in a particular model; persistence refers to the outcome of negotiation model i.e. maturity and conformity level of each defined KPI is measured according to class ranges as (2: Comprehensive Support; 1: Partial Support; 0: No Support):

Table 1: KPI based Weighted Analysis

Serial	KPIs	Win Win Model	Spiral Model	Preference Based Model	Broker Based Model	Loren Model
01	Stakeholder Identification	0	1	0	1	1
02	Cohesive Team Development	2	1	2	1	2
03	Planned Collaborations	2	2	2	1	2
04	Autonomic Process Support	0	0	0	0	0
05	Guided Stakeholder Communication	0	0	1	0	0
06	Uniform Linguistics	1	1	1	0	1

07	Uniform Templates	2	1	2	0	2
08	Dynamic Decision Making	1	1	1	1	1
09	Requirements Maturity	2	0	2	0	1
10	Leveraged Triple Constraint	0	0	0	0	0
11	Alternatives & Contingencies	2	2	2	0	1
12	Iterative	2	2	2	0	2
13	Preferential Decisions	0	0	2	0	0
14	Views Requirements, Architecture and Production Processes Cohesively	0	0	1	0	0
15	Requirements Prioritization (Individual / Combined)	2	0	2	0	0
16	Personality Depiction	0	0	0	0	0
17	Attitudinal Monitoring and Evaluation	0	0	1	0	0
18	Asynchronous Communication	2	2	2	2	2
19	Heterogeneity and Interoperability	1	1	2	2	0
20	Tiered Process	0	1	2	1	0

3.2 SWOT Analysis of Negotiation Models

Based on the results and findings from the weighted tabulated matrix in the previous section, SWOT for each of the earlier discussed models is conducted. The analysis depicts covers and articulates the resultant matrix for each of the negotiation

model based on the weighted values for each of the identified and devised evaluation attribute with regards to distributed environment. SWOT prescribes which requirements negotiation model is competent enough for distributed environment. SWOT for each of the model is presented independently as under:

Table 2: SWOT Matrix for Win-Win Model 1

SWOT Matrix: Win-Win Negotiations Model	
Strengths	<ol style="list-style-type: none"> 1) It assures formation of synchronized and agreed upon team; there by facilitating interoperability at the administrative level. 2) Supports information distribution comprehensively keeping maturity focused. 3) Provide proper documentation templates that are standardized all across. 4) Provides adequate risk management facility. 5) Plans alternatives and provides contingency based remedies. 6) Process is iterative in nature and supports asynchronous communication in a limited manner.
Weaknesses	<ol style="list-style-type: none"> 1) Provides asynchronous communication platform but still is not recommended for distributed environments for its lack of evolution and academic orientation. 2) Supports dynamicity with respect to decision making but fails when the architecture is n-tier
Opportunities	<ol style="list-style-type: none"> 1) Extend its decision making capabilities for n-tier architectures and ensure interoperability alongside asynchronous communication.
Threats	<ol style="list-style-type: none"> 1) Lacks support for N-tier and conflict resolution approach is not comprehensive enough; can cause its alienation. 2) Unable to depict and ascertain personalities alongside direct attitudes; hence lacks autonomic ability required of the negotiations at the distributed levels and environments. 3) Supports prioritization but lacks concept of preference based valuations; obsolete.

Table 3: SWOT Matrix for Spiral Model

SWOT Matrix: Spiral Negotiations Model	
Strengths	<ol style="list-style-type: none"> 1) Supports information distribution comprehensively as planned. 2) Plans alternatives and provides contingency based remedies. 3) Process is iterative in nature and supports asynchronous communication in a limited manner.

Weaknesses	<ol style="list-style-type: none"> 1) Lacks Risk handling mechanism even at a minute level. 2) Provides asynchronous communication platform but still is not recommended for distributed environments for its lack of evolution and academic orientation. 3) Lacks major evaluation indicators like dynamicity, heterogeneity etc.
Opportunities	<ol style="list-style-type: none"> 1) Extend its decision making capabilities for n-tier architectures and ensure interoperability alongside asynchronous communication. 2) Extend its team development processes thereby formulating and ameliorating its lingo orientations if at it is aimed to be used in distributed negotiation environments.
Threats	<ol style="list-style-type: none"> 1) Lacks support for N-tier and conflict resolution approach is not comprehensive enough; can cause its alienation. 2) Unable to depict and ascertain personalities alongside direct attitudes; hence lacks autonomic ability required of the negotiations at the distributed levels and environments. 3) Lacks core negotiation competencies like prioritization, hence not recommended for distributed environments.

Table 4: SWOT Matrix for MPARN

SWOT Matrix: Multi Criteria Preferential Analysis Requirements Negotiations Model	
Strengths	<ol style="list-style-type: none"> 1) Provides tier instantiation of the process for conflict resolution in an organization iteratively. 2) It assures formation of synchronized and agreed upon team; there by facilitating interoperability at the administrative level. 3) Supports information distribution comprehensively. 4) Provide proper documentation templates that are standardized all across. 5) Provides adequate risk management facility and requirements maturity. 6) Plans alternatives and provides contingency based remedies. 7) Process is iterative in nature and supports asynchronous communication in a limited manner.
Weaknesses	<ol style="list-style-type: none"> 1) Provides asynchronous communication platform but still is not recommended for distributed environments for its lack of evolution and academic orientation. 2) Monitors attitude only minimally by means of preferential analysis
Opportunities	<ol style="list-style-type: none"> 1) Extend its decision making capabilities for n-tier architectures and ensure interoperability alongside asynchronous communication. 2) Extend monitoring of attitudes so as to avoid deadlocks in the decision process
Threats	<ol style="list-style-type: none"> 1) Incapable of depicting personalities; hence lacks autonomic ability required of the negotiations at the distributed levels and environments which may cause hindrance in the decision making process.

Table 5: SWOT Matrix for Broker Based Negotiations

SWOT Matrix: Broker Based Requirements Negotiation Model	
Strengths	<ol style="list-style-type: none"> 1) Provides Asynchronous communication thereby facilitating heterogeneity and interoperability. 2) Leverages the triple constraints for software processes at a broader level; encapsulating requirements engineering.
Weaknesses	<ol style="list-style-type: none"> 1) Lacks Risk handling mechanism even at a minute level. 2) Provides asynchronous communication platform but still is not recommended for distributed environments for its lack of evolution and academic orientation. 3) Lacks major evaluation indicators like dynamicity, standardization and uniformity of lingo etc.
Opportunities	<ol style="list-style-type: none"> 1) Provides partial support for stakeholder collaborations, team development and identification of stakeholder relevance. 2) Supports N-tier architecture partially i.e. only for SOA based environments.
Threats	<ol style="list-style-type: none"> 1) Leverages the project triple constraint in extreme manner i.e. the negotiations and collaboration are managed and performed actually by third party contracted and delegated for the purpose. Hence, is not applicable for all types of distributed environments such as confidential and security prone.

Table 6: SWOT Matrix for Loren Model

SWOT Matrix: Loren Negotiation Model	
Strengths	1) It assures formation of synchronized and agreed upon team; there by facilitating interoperability at the administrative level. 2) Supports information distribution comprehensively. 3) Provide proper documentation templates that are standardized all across. 4) Provides adequate risk management facility. 5) Plans alternatives and provides contingency based remedies. 6) Process is iterative in nature and supports asynchronous communication in a limited manner.
Weaknesses	1) Provides asynchronous communication platform but still is not recommended for distributed environments for its lack of evolution 2) Supports dynamicity with respect to decision making but fails when the architecture is n-tier or the environment demands heterogeneity.
Opportunities	1) Extend support for risk handling, team development and identification of stakeholder relevance.
Threats	1) Mainline orientation is mirror image of the acclaimed requirements engineering process. 2) Similarity in orientation causes ambiguities.

3.3 Selected Negotiation Model

Hence the model selected on the basis of SWOT analysis and its simulation (presented below) is Multi Criteria Preference Analysis Requirement Negotiations Model. The simulation of the SWOT and weighted analysis is given in the figure below:

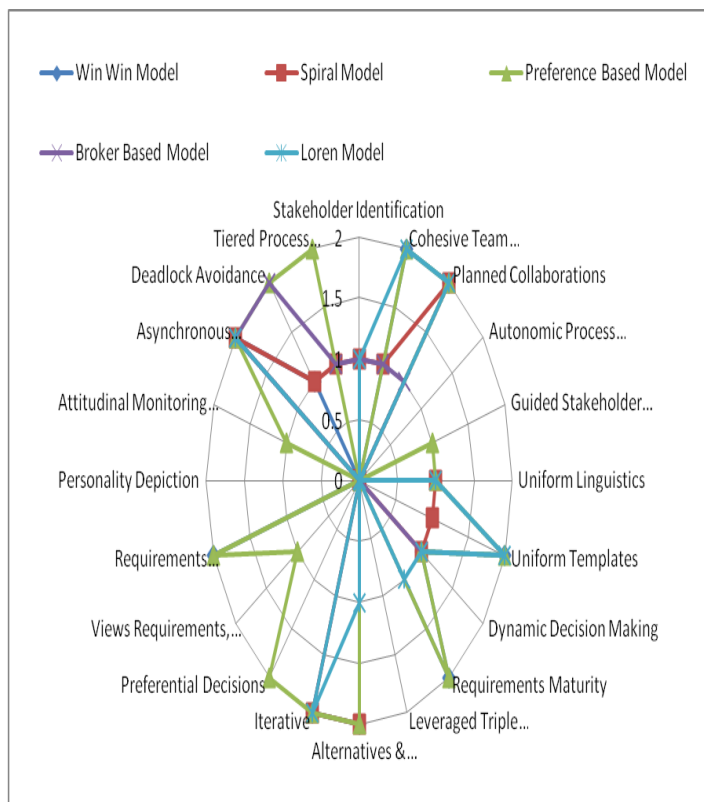


Fig. 6 SWOT Simulations

As depicted in the figure 6 above, Multi Criteria Prefer-

ence Analysis Requirements Negotiation Model (MPARN) satisfies the most part of evaluation indicators / attributes required of a sound, adept and proficient negotiation process for distributed as well as co-located environments. Although there are some QoS attributes like Personality Depiction, Autonomic Process Support and Leveraged Triple Constraints are not supported by any of the processes. There are some attributes like Guided Stakeholder Communication, Standardized Linguistics, Dynamic Decision Making, Simultaneous View of Requirements and Attitudinal Monitoring which are extended and incorporated into MPARN.

4 UNIFIED PROCESS MODEL FOR STAKEHOLDER COLLABORATIONS AND REQUIREMENT NEGOTIATIONS (UPMNC)

The proposed unified process model for requirements negotiation and stakeholder collaborations in a distributed environment implicitly addresses the personality depiction (by means of MBTI i.e. Myer Briggs Type Indicators [15]) and dynamic decision making (by means of incorporating prioritization strategies earlier in the requirements negotiation process) indicators. It addresses the collaboration challenges interfaced in the distributed environment as discussed earlier by means of providing autonomic and computer aided assistance (by incorporating FLOW and CIRCUS methodologies parallel to negotiations in a process). Proposed model is shown in figure 7:

The model encapsulates three tiers, Pre-Process Invocation Tier, Process Invocation Tier & Facilitation Tier. The first tier i.e. pre-process invocation is focused towards priorities identification, agenda setting and content definition on the basis of opportunity analysis and definition of engagement strategy, personalities of the stakeholders, team constituents and role assignments on the basis involved personality types identified with the help of MBTI model. Requirements are prioritized either individually or in combination. It articulates all the attributes of stakeholders using MBTI i.e. Myer Briggs Type in-

dicators; a personality comprehension methodology. [15]

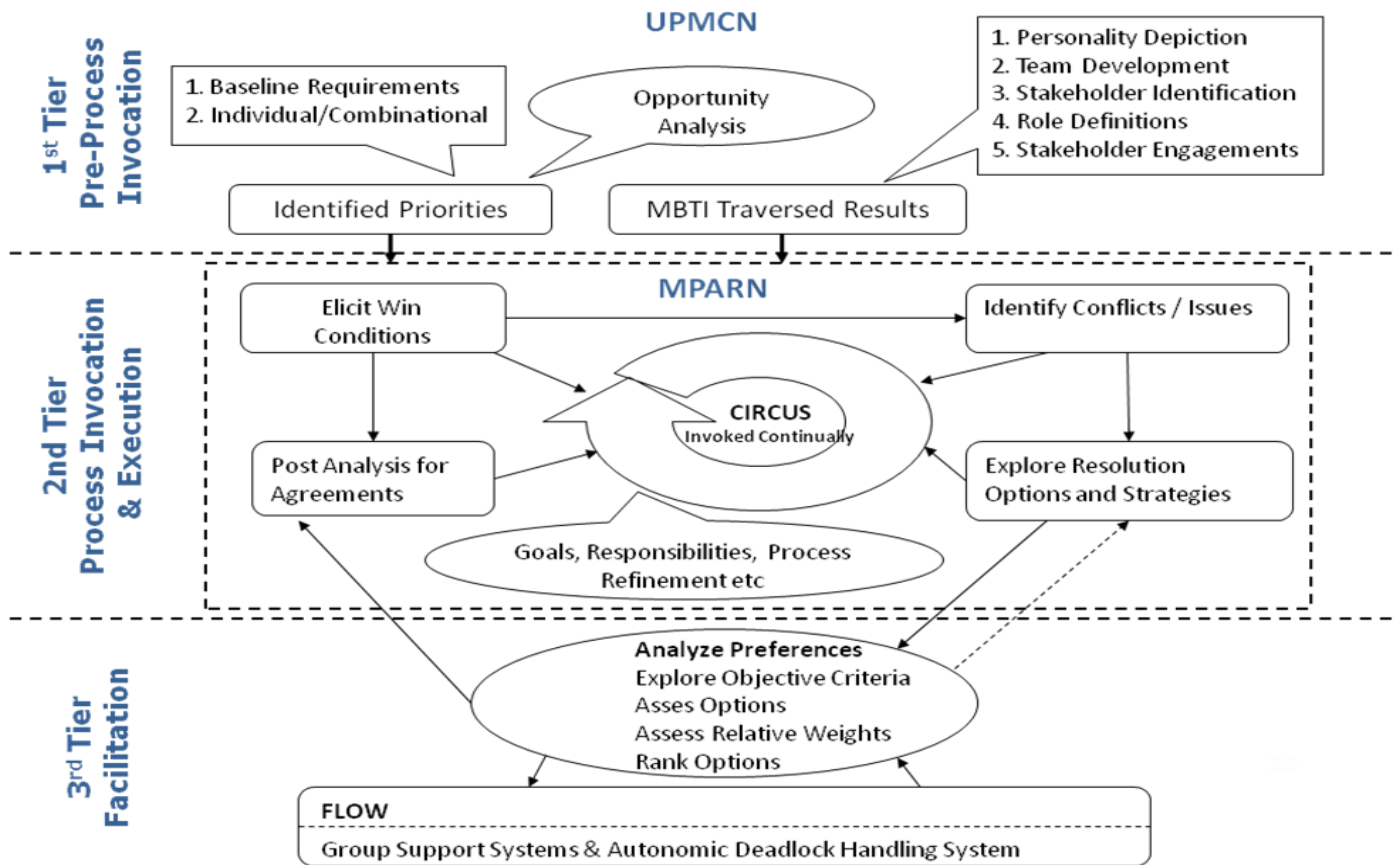


Fig. 7 Three Tier - Unified Process Model for Collaboration & Negotiation

Succeeding tier i.e. Process Invocation and Execution Tier is dependent on pre-process invocation tier; it seeks information from the preceding tier for identification and definition of the win condition; analyzes the win condition, if there are conflicts or issues diagnosed it explores and develops certain resolution strategies and solutions. If no conflicts or issues exists the win condition is achieved by mutual agreement. Mutual agreement still would be on the basis of preferential analysis. CIRCUS methodology [8] for stakeholder goals, responsibilities and communication definitions and delegations is invoked alongside the invocation of the process implicitly. It can be altered with respect to goals and responsibilities at any intermediary stage of the process execution.

Last tier of the proposed model facilitates smooth execution of the second tier. Third tier is known as Facilitation Tier. Here in this tier preferential analysis of the possible resolutions is conducted. To avoid the deadlocks with respect to preferential analysis causing considerable delays in the decision making process FLOW methodology [9] of information distribution equipped with group support system to eliminate the hurdles surfacing in the agreement process by means of autonomic support system i.e. it caters for all types of deadlocks in a preventive and anticipatory manner while logging the situation and scenarios interfaced in the process. Logging is done to enhance persistence, reliability and efficacy.

Statistical comparison of proposed model with the selected

model for requirements negotiations is presented as under:

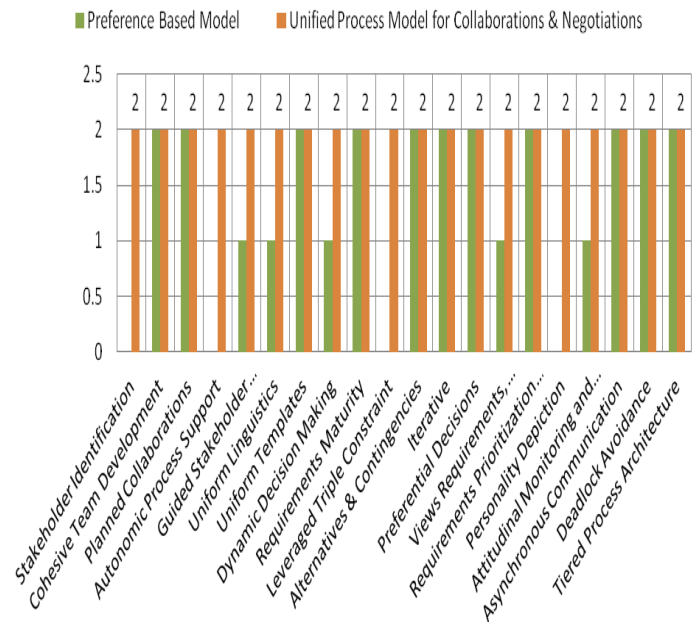


Fig. 8 UPMCN vs MPARN

UPMCN almost resolves all the issues adeptly as it completely conforms to the identified indicators (for it was developed after the indicators were evolved in a yardstick measured and rated comparatively for each of the discussed model), required of a process, as shown in the figure 8 comparing the proposed model with the best i.e. selected requirements negotiations model. Research has presented a unified process model as claimed for the resolution of issues, as identified in the list of indicators needed to address the set of collaboration issues rising in a distributed environment. It also makes the process efficient by assuring dynamic decision making free of deadlocks and hindrances. Deadlocks are resolved as an autonomic group support system is placed in the domain based on FLOW that works as a contingency to the process flow while assuring resolution and agreement by means of conflicts and contraindications.

5 CONCLUSION AND FUTURE WORK

Hence, the research objectives are comprehensively met and the gaps identified in the literature review are addressed as a result. Proposed model addresses issues like content deficiencies and isolated negotiation and collaboration processes which were of the root causes of project failure. UPMNC, presented provides and facilitates project managers to manage a project adeptly while assisting project management organizations with regards to key knowledge areas like scope management and communications management.

Futuristically, it is intended to extend the present research to the following articulated areas for optimization and industry utilization of the presented model:

- 1) Development of a requirements negotiations tool to assist the proposed unified process for requirements negotiations and stakeholder collaborations in a distributed environment.
- 2) Refine and ameliorate the evaluation indicators for requirements negotiation model's evaluation taxonomically for fields other than software and IT projects.
- 3) Extend the autonomic requirements negotiations to overall requirement engineering processes by means of development of an independent artificially intelligent component for controlling the negotiation and collaboration processes.

REFERENCES

- [1] Betty H.C. Cheng, Joanne M. Atlee. Research Directions in Requirements Engineering. IEEE Computer Society Washington, FOSE, pages 285-303, 2007.
- [2] Brandon Rydell, Sean D Eby, Carl Seaton. A distributed Requirements Collaboration Process. In IGI Global: Distributed Team Collaboration in Organizations, pages 169-181, 2011.
- [3] Daniela E Herlea. User Participation in Requirements Negotiations. In ACM SIGGROUP, pages 30-35, 1999.
- [4] Barry Boehm, Alexander Egyed. Software Requirements Negotiations: Some Lessons Learned. In ICSE 98 proceedings of the 20th International Conference on Software Engineering, pages 503-506, 1998.

- [5] Hoh Peter In, David Olson. Requirements Negotiations using Multi-Criteria Preference Analysis. Journal of Universal Computer Science, pages 306-325, 2004.
- [6] Daniela E. Damian, Didar Zowghi. The Impact of Stakeholders' Geographical Distribution on Managing Requirements in a Multi-Site Organization. RE '02 Proceedings of the 10th Anniversary IEEE Joint International Conference on Requirements Engineering, pages 319-330, 2002
- [7] Sabrina Ahmed. Negotiations in the Requirements Elicitation and Analysis Process. ASWEC '08 Proceedings of the 19th Australian Conference on Software Engineering, IEEE Computer Society, pages 683-689, 2008.
- [8] Anne Hoffmann, Christian Lescher. Collaboration and Intercultural Issues on Requirements: Communication, Understanding and Softskills (CIRCUS). CIRCUS '09 Proceedings of the 2009 Collaboration and Intercultural Issues on Requirements: Communication, Understanding and Softskills, IEEE Computer Society, pages 1-4, 2009.
- [9] Kai Stapel, Eric Knauss and Kurt Shneider. Using FLOW to Improve Communications of Requirements in Globally Distributed Software Projects. CIRCUS '09 Proceedings of the 2009 Collaboration and Intercultural Issues on Requirements: Communication, Understanding and Softskills, IEEE Computer Society, pages 5-14, 2009.
- [10] Friedrich Stallinger, Paul Grunbaucher. System Dynamics Modelling and Simulation of Collaborative Requirements Engineering. Journal Software and Systems, pages 311-321, 2001.
- [11] Dubios E, Kritikos A, Kubiki S. An Automatic Requirements Negotiation Approach for Business Services. IEEE European Conference, pages 133-140, 2011.
- [12] Peer Hassel Meyer, Chang Tao Qu, Lutz Schubert, Bastian Koller, Philip Weider. Towards Autonomous Brokered SLA Negotiation.
- [13] Daniela Herlea. Computer Supported Collaborative Requirements Negotiations. Proceedings of KAW'98 Banf, Alberta, Canada, 1998.
- [14] Software Acquisition Gold Practice. Requirements Trade-Offs and Negotiations. <http://www.goldpractice.thedacs.com>, 2006.
- [15] Myer Briggs. MBTI: Myer Briggs Team Identification Type Indicators. <http://www.myersbriggs.org/my-mbti-personality-type>, 2009.
- [16] Rong Peng. A Requirements Maturity Measurement Approach Based on SKLSEWiki. Computer Software and Applications Conference Workshos, pages 251-254, 2010
- [17] The Standish Group. Why Projects and Products Fail? http://www.spinroot.com/spin/Doc/course/Standish_Survey.html, 1995.