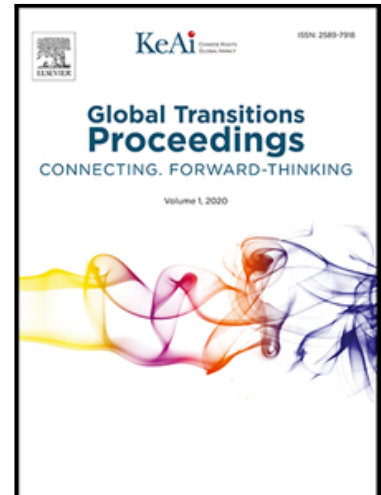# Journal Pre-proof

Team Conflict Dynamics & Conflict Management: Derivation of A Model for Software Organisations to Enhance Team Performance and Software Quality

Deepak Kumar Nunkoo , Roopesh Kevin Sungkur

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Team Conflict Dynamics & Conflict Management: Derivation of A Model for Software Organisations to Enhance Team Performance and Software Quality

Deepak Kumar Nunkoo[a] and Roopesh Kevin Sungkur[b*]

[a]*PricewaterhouseCoopers, Mauritius*
[b]*Department of Software and Information Systems, Faculty of Information, Communication and Digital Technologies, University of Mauritius, Reduit, Mauritius*

* Corresponding author. *E-mail address:* r.sungkur@uom.ac.mu

Abstract

Commercial Software Engineering is a team based activity and therefore success is hugely dependent on whether the team has succeeded in building a cooperative environment and how well the team members get along together. Over the past years, team conflict has increasingly been viewed as a major factor that can cause the failure of a software project. Conflict must be properly managed in the best interest of the project's stakeholders. This research uses team conflict dynamics model to analyse different conflict types and team conflict profiles to produce a framework that can improve project success in software development. An eight stage framework was devised and was tested. From the data gathered it was found that the framework was successful. This framework can be studied by individuals, taught or applied by a mediator and also another benefit is that individuals are encouraged to express themselves and integrate emotional intelligence.

1. Introduction

Today's business environment is dynamic and complex due to high levels of uncertainties in both local and international market forces such as global economic crisis and political tensions. In the midst of these challenges, it is essential to remain competitive and productive. Nowadays, firms have progressively adopted the use of teams for software development, services and processes to accomplish their vision as opposed to expecting people to follow the trends set by competitors [3], [7]. Studies have demonstrated that 82 percent of firms with at least 100 representatives want to allocate workers to different teams' activities and tasks as opposed to assigning one person per project. Around 70-75 percent of these teams are tasked to software development projects [8]. A group/team comprises of members with different roles. [12] define a team as "a small number of people with complementary skills who are committed to a common purpose, performance goals and approach for which they hold themselves mutually accountable." Managing teams can be considered as one of the biggest challenge faced in organisations. Teamwork helps achieving the different aims and objectives of a project [2]. When individuals with

diverging perspectives, skills, experience, and assessments are assigned a project, the consolidated effort can by far outperform what any group of similar people could achieve. However, within teams, there may have different conflicts and it is the role of the leader or Team lead to handle those conflicts. A leader can basically be defined as somebody who can have an influence on other people and the leader would also possess managerial authority in the workplace. A team functions as a coherent single unit which is well coordinated and aimed at solving a specific problem. It aligns individual strengths and competencies to achieve common team goals. A team can be formed for a long term duration or only for a few hours [19-21]. Team dynamics can be understood as how team member's distinct roles and behaviours impact other team members and the team as a whole [10], [11].

Many researches have showed that conflict is not necessarily a bad thing and that the form of conflict determines how much damaged can be caused. Therefore, conflict can be categorized as being constructive or destructive. Constructive conflicts emphasize on reaching a reasonable settlement that is acceptable to the struggling parties. On the other hand, destructive conflicts involve disputed and personal antagonisms. Conflict is common and

unavoidable in projects. Conflicts may yield successful or unsuccessful results, depending on the way the project is being supervised by the project manager [13]. When the actions of one person are interfering, obstructing, or in some other way making another's behaviour less effective, then people are said to be in conflict with each other. According to an assessment conducted by CPP Inc (publishers of the Myers Briggs Assessment and the Thomas Kilmann Conflict Mode Instrument) in 2008, it came to light that employees spent around 2.8 hours per week dealing with conflict, 25% of employees experience conflict situations that result into a personal attack and 10% announced that workplace conflict led to project failure. Also, one third said that conflict led to employees being fired or resigned. Over the past few decades, team conflict has received considerable attention as both a potential source of, and possible barrier to, team effectiveness. Conflict must be addressed to maximize project effectiveness and enhance project team members' satisfaction. Unresolved disputes hinder project management, leading team members to continually disagree over criteria, strategies, tactics and solutions. If conflicts are not resolved, this would damage the communication, coordination and control across the team and thus reducing the team performance level, the quality of the end product, the project deadline and costing. There exist two types of conflicts namely functional conflict and dysfunctional conflict [22-24]. Functional conflict is centred on improving team performance by implementing the goals set by the team, while dysfunctional conflict is encountered when one tries to exceed what is required by a group while trying to accomplish the goals set [25]. Possible outcomes of destructive conflict are cost overruns, communication drastically reduced between individual and groups, change resistance, increased tension and stress, project deadlines exceeded, lower performance, profit reduction, and unhealthy business relationships [26].

2. Related Works

2.1 Conflict Definition

[9] defines conflict as follows, "conflict is a process that begins when one party perceives that another party has negatively affected, or is about to negatively affect, something that the first party cares about." From a traditional point of view, it can be noted that conflicts are considered as bad and should be avoided whereas from a contemporary point of view, conflicts are inevitable, should be managed and are often useful. Conflicts may occur at several levels as categorized below:

- Intra individual conflict occurs when an individual has two sets of incompatible goals.
- Inter individual conflict occurs when two individuals strive to achieve their own goals, thus blocking the other's achievement.
- Intra group conflict arises when a person or group attempts to achieve a goal that interferes with the group's goal.
- Intergroup conflicts between two groups seeking to achieve their respective goals.

2.2 Types of conflict

Conflicts can have either a positive or a negative impact on teams. As mentioned earlier, conflicts can be generally broken down into two, namely functional conflict and dysfunctional conflict. Functional conflict is healthy, constructive disagreement between groups or individuals, while dysfunctional conflict is unhealthy disagreement that occurs between groups or individuals [17]. Past research papers have classified conflicts of being of three separate types namely task conflict, process conflict and relationship conflict [18]. Each of the mentioned conflict types have different consequences on team performance as shown in Table 1.

Table 1. Types of conflict

Task Conflict	Task conflict, also known as cognitive conflict can be defined as differences in ideas, attitude, and behaviour related to team tasks. For example, conflict over organizational policies and procedures is said to be a task conflict.
Process Conflict	Process conflicts are "disagreements among group members about the logistics of task accomplishment, such as the delegation of tasks and responsibilities" [6]. On the other hand, process conflict can be defined as differences of opinions and perspectives on how a task should be accomplished. For example, which person should be allocated with a specific task or how much work should a person be allocated? When team members disagree with the responsibility of completing a specific job, they experience process conflict.
Relationship Conflict	[6] defined relationship conflicts as "disagreements among group members about interpersonal issues, such as personality differences or differences in norms and values". Examples of relationship conflicts are conflict that arises due to personal issues, and differences over personality, values and attitudes.

2.3 Causes of conflicts

To avoid conflicts from arising, it is crucial to detect and understand their root cause. Table 2 shows the common causes of conflicts encountered by teams.

Table 2. Causes of conflict

Communication problems	Poor communication leads to misunderstandings within the team. It affects both team morale and performance. Type of communication channel being used has an impact on how effectively the message being communicated is received and interpreted. For example, using emails for a message that require a lot of feedback and interaction may not be effective. Project teams can be composed of people from different age groups, cultures, ethnicity and gender. Choice of words may mean different things to these groups. This may lead into potential conflicts if not adequately addressed.
Choice of power base to influence subordinates	Frequent use of coercive power may create a negative atmosphere at work. This may negatively affect team spirit and subsequently hinder team performance. On the other hand, using rewards power to motivate followers may require that the organization should be in good financial health otherwise it is not sustainable. Both coercive and reward power bases require continuous surveillance to ensure that the punishment or reward goes to deserving members. It is thus expensive to implement a continuous monitoring and surveillance system.
Organizational culture	When working with teams, it is essential for organization culture to support team performance. If the organizational reward system recognizes individual performance more than team performance, team spirit will be affected such that team members

	will find it difficult to share resources like information and task progress. Hierarchical structure of an organization may hinder team members from making innovative contributions to the team due to its less flexibility.
Lack of team coordination, cognition and cohesion	Lack of shared understanding among team members may lead to team working in isolation which may reduce effectiveness of the team in terms of performance output. Team spirit may get affected as well.

[15] performed extensive research and came up with 8 key contributing factors to project conflicts. These factors have been listed in the table 3 below.

Table 3. Contributing factors to project conflicts [15]

1	High Stress Environment
2	Ambiguous roles / responsibilities
3	Multiple boss situation
4	Advance technology complexities
5	Unrealistic deadlines
6	Lack of resources
7	Insufficient funding
8	Inept leadership

2.4 Effective Team dynamics

Teams have become common units for managing hyper competition, especially in knowledge intensive industries [7]. The basic explanation is that teams can handle tension faster, react appropriately to emerging circumstances, make better choices, and be more efficient than individuals [4]. In particular, high tech firms have begun to utilize teams in order to optimize the use of expertise, reduce workload impact, take advantage of advanced technologies and achieve higher levels of organizational learning.

2.5 Conflict Resolution Techniques - Thomas and Kilmann model

[16] developed a two dimensional model with the following conflict resolution techniques as shown in Table 4.

Table 4. Conflict Resolution Techniques [16]

Competing	Seeking to accomplish the goal in an assertive and uncooperative way at the detriment of the other person.
Collaborating	All potential options and solutions are considered when resolving disputes and seeking results that satisfy both parties. The parties rely on common interests, not different views.
Compromising	Solutions that are acceptable by both parties are considered. Both sides tend to give up something to gain partly what they want. Compromising people do not normally dismiss the issues, but they also do not dwell on them.
Accommodating	The parties agree that differences in views and beliefs are not insurmountable. One party is willing to ignore its own desires, relying on the other party's interests and opinions. It can take the form of selfless generosity or charity.
Avoiding	The conflict is simply ignored and no solutions are considered. The conflict may no longer matter after a certain period of time. Both parties are indifferent about their own and others' problems.

2.6   Existing Team Conflicts Dynamic

After analysing the existing Team Conflict Dynamics Models, the authors feel that there is a need to propose a newer one since the ones present have been existent since too long and that they are practically outdated for this modern era. A critical appraisal of existing Team Conflicts Dynamic Model can however be helpful in highlighting the inherent strengths and weaknesses as shown in Table 5.

Table 5. Comparative study of existing Team Conflict Dynamics Models

Existing Team Conflicts Dynamic Model	Strengths	Weaknesses
Açıkgöz et.al (2015) [1]	- This research revealed the essential role of problem solving capability on team learning, and the impact it has on the quality of new software products. The problem solving capability offers an ongoing framework for information processing that allows the team to achieve higher learning. - It also provides important implications for understanding the impact of team climate on team problem solving, as well as the impact of team problem solving on team learning.	- This study is prone to a common method bias, as the same individuals responded cross-sectionally to both the dependent variable and the independent variable. - A cross sectional design using questionnaires was another drawback of this research. While surveying is a broad and growing field of social science, the questionnaire approach does not provide objective results about software product quality, which is naturally dynamic. - This study is limited in terms of methodological aspects.
Robbins (2020) [14]	- The model is the most embraced conflict mechanism used. - This model explains how conflict progress through the different stages, helping the person to understand whether or not the conflict can be resolved and which conflict resolution techniques can be applied. - The model makes use of the most used effective conflict resolution techniques.	- The model does not ensure that the conflict is actually resolved. Stage IV is about the outcomes of the conflict and it can be either increase group performance or decrease group performance.
Davidson (2004). [5]	- Several longitudinal studies carried out by the University of Tasmania with students and school age children found substantially improved results in conflict resolution after training in listening, assertiveness, and problem solving skills described in the model. - Although no hypothesis was proven in the model, it was a very practical model. - This models thoroughly details the conflict resolution process and provides alternatives for example the BATNA, and loops to resolve any conflicts that may arise while dealing with the both parties emotions. - Compared to other models, this model focus on win-win resolution techniques and ensures that both parties are satisfied with the solution implemented, thus reducing the chances of conflict arising between the two parties again.	- The presence of structural and cultural influences that establish the social context under which conflict resolution occurs, and that predispose participants to cooperate, is not discussed. - No hypothesis was proven in this model. - The model does not apply any team dynamics concept and focuses mainly on managing conflicts effectively.

3. Methods

The aim of this research is to analyse different conflict types and team conflict profiles, in order to produce resolutions that can improve project success in software development. A model will be proposed with resolutions and conflict management techniques that make use of effective team dynamics and effectiveness and enable the team to resolve conflicts swiftly as they occur so that better team performance can be achieved. The methodological approach for this study will be a mixed quantitative and qualitative approach. It would be mostly quantitative research whereby data collection will be done mostly through a survey. Employees working in the software development industry and those working in teams will be surveyed. The data collected will be analysed and conclusion will be drawn as to what are actual causes of conflicts, how these are being resolved and the consequences that this have on the team performance and the final product delivered. The data from the survey will be analysed to test relationships between variables affecting team performance and software quality. This analysis will help in the derivation of a model that can be used in software development teams in Mauritius.

3.1 Research Method

A hybrid (mixed) research method has been used for this study. A mixed methods research design is a procedure for collecting, analysing, and "mixing" both quantitative and qualitative research and methods in a single study to understand a research problem. However, more emphasis is laid upon the qualitative method than the quantitative method.

Qualitative method - In such case, data is not recorded in numerical form. It includes short written responses on surveys, interviews and other approaches that are characterized by non-numerical format. The research strategies used generally feature sustained contact with people in settings where those people normally spend their time. The focus is on human experience and contexts of human behaviour. A structured interview will also be carried out with the managers/team leads in order to test and evaluate the proposed framework. Several team members and the team leads and/or managers will be interviewed and conclusions would be drawn accordingly. Finally, an evaluation survey will be done with the members of the teams in which the proposed framework was applied in order to obtain their views.

Quantitative method - It is designed to address issues that require projectable data that can be analysed and segmented in a statistically reliable manner. That is, it attempts to explain phenomena by collecting and analysing numerical data. For this study, survey will be used to collect information and this information will be thoroughly analysed and conclusions will be drawn.

Sampling - The basic sampling theory is that researchers can draw conclusions about the entire population by systematically selecting representative elements of a population. Therefore, sampling is necessary when a broad population size requires budget, time and resource constraints.

Sample Size- From the National Computer Board (NCB) list of ICT Directory of companies, it was found that there were 167 companies which had Software development listed as being their main activity. It has been assumed that there are approximately 3000 people working in software development teams in Mauritius and the average number of person in a team is 5. Hence, the required sample size is 165 for this study.

Questionnaire Design - The 18 questions set in the survey were prepared and are represented in the table below. As the table is shows, these questions were chosen precisely to help cover the objectives listed in the section of Literature Review.

4. Results

This section describes the major finding and an interpretation of the research. Well managed conflict will increase chances of success, but if dysfunctional conflict is not managed, this will only worsen the situation, decreasing chances of success. Thus all conflicts should be well assessed and should not be avoided. A win-win approach is always desired so that both parties are equally happy with the result of the conflict. Therefore, techniques like accommodating and competition should be used at a minimum. Techniques that encourage the win-win approach are confrontation, compromising and CCT.

Analysis of factors affecting team dynamics

Table 6: factors that create conflicts in teams

Factors		
High stress environment	Shared/ Common Resources	Insufficient funding
Ambiguous roles/responsibilities	Differences in project goal/objectives	Inept leadership
Multiple boss situation	Cultural differences	Differences in project goal/objectives
Advance technology complexities	Value differences	Schedules
Unrealistic deadlines	Personality Issues	Shared/ Common Resources
Lack of resources	Difference in technical opinions	

A reliability test was done using PSPP, with all the 15 factors shown in Table 6 and Figure 2. As shown in Figure 1, The Cronbach's Alpha yielded a value of 0.9 which is acceptable as it is greater than the acceptable value 0.7. The factors that were listed in the survey can be see below and the participants have rated them according to the order of the importance, with five being the highest. The most influential factors that cause conflicts have been listed below and ordered according to the number of votes received by the participants.

1. High stress environment
2. Ambiguous roles and responsibilities
3. Multiple boss situation
4. Unrealistic deadlines
5. Differences in project goals and objectives
6. Difference in technical opinions
7. Personality issue

Case Processing Summary

		N	%
Cases	Valid	112	99.12
	Excluded	1	.88
	Total	113	100.00

Reliability Statistics

Cronbach's Alpha	N of Items
.90	15

Fig. 1. Cronbach's alpha for the above factors

The factors that were listed in the survey can be see below and the participants have rated them according to the order of the importance, with five being the highest.
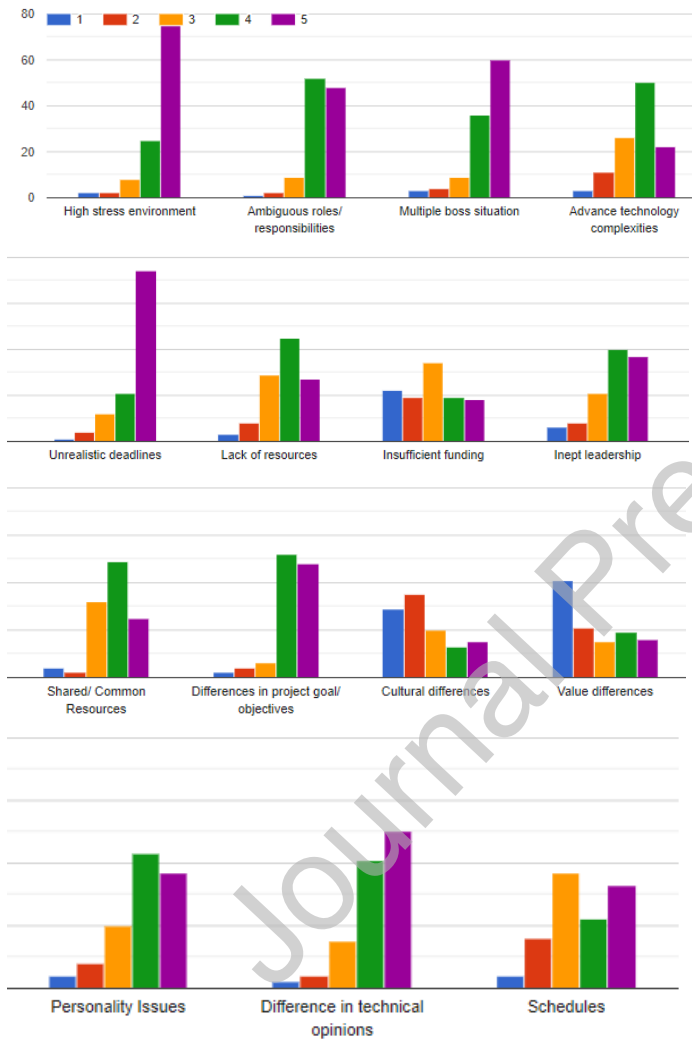

Fig. 2. Statistics of the factors that cause conflicts

Following the literature on existing models, it was found that there are lots of factors that affect team conflict dynamics. The table below summarizes all the hypothesis that were supported throughout the models discussed initially. Moreover, the survey revealed some helpful insights. Conflicts occur once in a while within teams and the top 3 causes of conflicts are poor planning, project priorities not well defined and prior unresolved conflicts. While not all conflicts are constructive, all destructive conflicts should be handled. The two most used conflict resolution techniques are collaborating and confronting. The following can also be noted:

- Task conflicts occur more than relationship conflicts followed by process conflicts.
- 69.6 % of teams are physical teams working with each other under the same geological place.
- It was found that on average there are 9 people in a team.

5. Discussion

The design phase is one of the key chapters of the project. Based on the models analysed in the previous chapter and the analysis of the survey data, a blueprint of the proposed system is depicted in this section and diagrammatically represented in Figure 3.

Stage 1: Team Formation

First and foremost, the team lead or manager responsible for handling the project should be a good leader. Leadership is complex and dynamic. It is not a matter of one size fits all approach when managing people. People have different personalities and react differently to situations. As a leader, understanding people's emotions, perspectives, motives and concerns increases satisfaction of team members.

- **Team member competencies**

Team leader must strive to utilize diverse expertise of team members, coordinating their efforts to work as a single unit in order to deliver organizational goals.

- **Team Goal Setting**

When the team is formed, team goals should be defined by the team leader and the expectations should be communicated to all team members at the start of the project. Having a clear goal in mind help the employees to stay focused and prioritize on their work over personal issues. Once the team is formed, Tuckman's team development process is engaged.

- **Team Problem Solving**

Team problem solving is related to team members' ability to solve problems together to provide solutions during product development or improve current products. As and when the team encounters problems or issues, resolving them together will help enhance team cohesion and the team can grow together.

Recommendations to implement throughout the process

- **Team oriented culture**

Team oriented culture must be adopted by the organization in order to cultivate team spirit.

- **Maintaining effective communication**

Critical tasks that need to be clearly understood by team members should use face to face as a communication medium. The use of non-offensive words should be adopted to prevent emotionally triggering anger in some team members. Tailoring communication message to suit type of audience improves effectiveness of communication. The use of feedback ensures that the message is being interpreted as intended.

- **Expansion of resources**

The leader should ensure that all required resources are available for its team members to avoid conflicts. Resource constraints need to be thoroughly explained to avoid conflicts.

- **Trust**

Project team leader must demonstrate a great degree of accountability in order for him to earn team members

trust. Principles of transparency, openness and fairness need to be adhered to when leading project team. Task allocation and resource sharing should be based on team's agreed shared norms.

Stage 2: Conflict detection and confirmation

By incorporating and framing the concept that a workplace dispute can often be healthy for a company, a change in mind-set can begin. Since many people view conflict as a bad thing to stop at all costs, knowing the importance and meaning of conflict as part of a healthy organization can be a powerful first step. Therefore, it is important to differentiate between functional and dysfunctional conflict. Below are the steps that needs to be followed in order to confirm whether conflict resolution ire required or not.

● Meet stakeholders and provide opportunities to discuss their project problems, grievances and perceptions.
● Pose suitable questions to further investigate the established causes.
● Then, the project team can use this knowledge to create a basic diagram to visualize how the dispute developed and evolved.
● Decide if a conflict management mechanism is required (if so, continue the next step).

Stage 3: Issue Analysis and advocate governing variables of conflict

Conflict Assessment steps

● Arrange stakeholders or chat face to face with individual stakeholders.
● Separate conflict, describe the type of conflict / issue and what caused it.
● Allowing stakeholders to share their thoughts and feelings with minimal intervention, it may be necessary to ask 'Why' questions at times to explain unanswered points.
● Once all issues were addressed, grouping issues of similar nature according to the five core issues: conflicting beliefs, institutional issues, conflicting interests, knowledge issues, and complicated relationships.

● Identify what causes the problem to arise: a perceived or actual difference; a perceived or actual threat; a lack of information;
● Advise team members to overlap problems and use these umbrella definitions to direct systematic evaluation of conflict causes. It is important to communicate win win.
● Determine conflict level
● Decide which issues are most relevant and need immediate action

Stage 4: Evaluation of possibilities

In this stage, the team lead should choose which conflict management technique would be more appropriate. One main principle of conflict resolution is win-win. Optimal solutions can only be sought by going beyond the participants' initial negotiating positions to discuss these fundamental needs and concerns with the expectation of creating innovative alternatives that resolve them more adequately.

Stage 5: Agreement on solution

Once a conflict resolution technique is decided, the two parties are made aware of the course of action and they are agreeable to this, then we can move to the next stage.

Stage 6: Implementation of chosen solution (Initiate course of action)

If both parties agree, the course of action is initiated. If not, the areas of disagreement are revisited and possibilities are re-evaluated as per stage 4 and the process continues.

Stage 7: Conflict feedback and Team learning

Once the conflict has been resolved, the conflict should be documented so that this can be provided to other teams as well, thus enabling other team leaders to better deal with a similar situation. When the conflicts are resolved the team should learn from what happened and it should be exemplary.

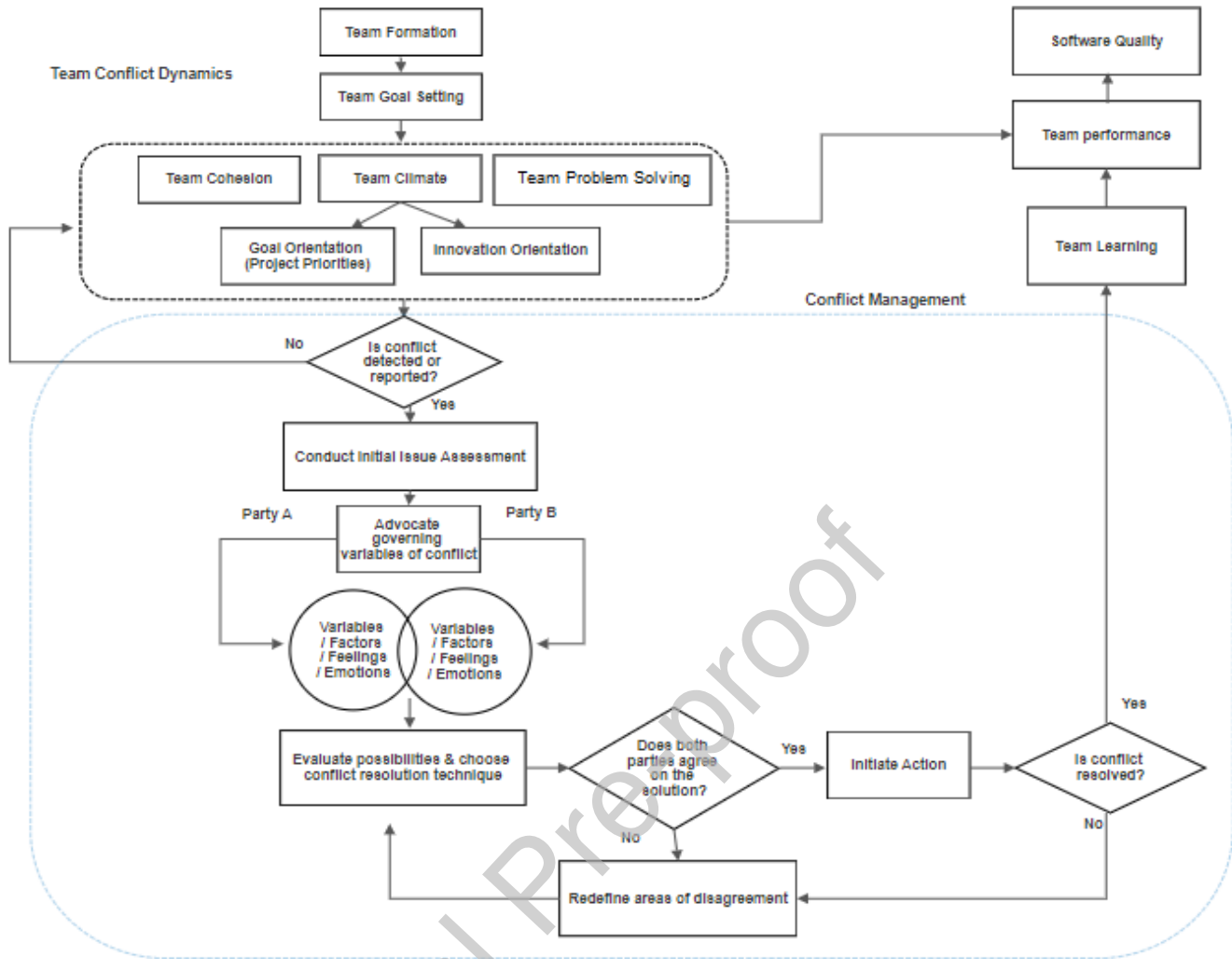per project and project A had 8 members while project B had

Fig. 3. Proposed Framework   12

Stage 8: Team performance and Software Quality
Three output assessment constructs are presented to measure team performance namely quality of product, team efficiency and team effectiveness.

- After the project is completed, the team performance is evaluated by comparing the quality of the new software with a similar project.
- Customer feedback is collected to evaluate the quality of the delivered product.
- 360-degree feedback method is used to evaluate each team members and eventually the team as a whole.

Evaluation of Proposed Framework

The proposed framework was implemented in two projects in a particular software development organization. Project A is a new software development that was initiated at the start of August with an expected completion date of October 2020.

Project B had already started in July 2020 with an expected completion date October 2020. One manager was allocated

people. The efficiency and validity of the system will be evaluated via an empirical analysis, which is questionnaire. There will also be a data collection excise, via a questionnaire, from 2 different projects, where for three months (August 2020 to October 2020). While team members were presented with an evaluation questionnaire to fill, a structured interview was carried out with the two team leaders.

Structured Interview
The framework was implemented into two different projects each being managed by one manager. A structured interview was done with both managers and the questions were formulated according to the eight aspects of the framework defined in the previous table.

Results and Discussions
The team climate and cohesion factor is directly linked to the inclusive performance of the project. The team climate and cohesion factor is included in the questionnaire in order to evaluate the satisfaction of the customers. The overall success of the project is directly related to the team climate and cohesion factor. A review is carried out to ensure a positive correlation of team climate and cohesion with respect to the other eight team factors. Thus, the positive correlation of all other variables with the team climate and cohesion factor

suggests that the proposed framework, with their particular factor, influences the overall quality of the project. The Pearson's correlation values are determined for the average score of all responders for the success factor with respect to the mean score of the other 8 variables. If the measured value is 1, it represents perfect correlation and 0 denotes no correlation. This is shown in Table 7.

Table 7. Pearson's correlation with team climate and cohesion factors.

Factors	Pearson's correlation with team climate and cohesion factor
Team problem solving	0.96
Team Learning	0.85
Team Formation	0.92
Task conflicts	0.84
Relationship conflicts	0.95
Process conflicts	0.91
Conflict resolution	0.92
Team performance	0.92

The results of the correlation therefore suggest that the team climate and cohesion factor positively correlates with the other factors, which reflects the performance of the proposed framework. The range of correlation values from 0.84 to 0.96 suggests that the variables are strongly correlated.

6. Conclusion

Businesses are set up dynamically nowadays and are pounded with many uncertainties both locally and internationally. A productive and competitive approach is required to generate profit and to cope with rapidly changing dynamics. Any changes, new requirement or digitalisation project is not a one-man job and a full fledge dynamic team is required. With team set up and creation, conflict is inevitable as each member of the team has a distinct mind-set. The aim described in this research was to analyse the different conflict types and causes and to produce resolution suggestions via a proposed framework for ultimate project success in a software company. An intensive literature review was conducted. The methodological approach used was a mixed one, representing both a quantitative and qualitative approach. To complement on the quantitative aspect survey was sent to the 167 companies registered to the National Computer Board (NCB). From the survey sent only 112 responses were obtained and from those responses 62.5% agreed that conflicts were occasional issues in a team and 52.7 % agreed that a resolution framework would be interesting to have for the conflict resolution. An eight stage framework was proposed and elaborated. The framework evaluation was based on a qualitative approach using a structured interview. Based on the evaluation it was found that the framework shows positive results. The Pearson's correlation for team climate and cohesion to the other eight factors illustrated near 1 values. This model can be studied by individuals, taught or applied by mediators. Another benefit of this framework and conflict resolution approach is that individuals are encouraged to freely express themselves.

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