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Nurturing productive conflict in South Africa's engineering teams

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NURTURING PRODUCTIVE CONFLICT

IN SOUTH AFRICA'S ENGINEERING TEAMS

Oluwaseun Moyosore, FARINDE

A research report submitted to the Faculty of Commerce, Law and Management, University of the Witwatersrand, in partial fulfilment of the requirements for the degree of Master of Business Administration

Johannesburg, 2017

ABSTRACT

There are positive aspects to conflict that historically have been overshadowed by the need to quell differences in teams (Ben-Hur, Jonsen, & Kinley, 2010; Farmer & Roth, 1998). Fortunately, the fact that stimulating and nurturing healthy productive conflict can be beneficial to team productivity is coming to light (Jehn, 1994; DeChurch & Marks, 2001; Eisenhardt, Kahwajy, & Bourgeois III, 1997; Vliert & Dreu, 1994; Thomas, 2008; Tjosvold, 2008). Of the five conflict handling styles discussed by Thomas and Kilmann (1977), this study focusses on three that incorporate high levels of cooperation, as this would ideally foster conflict nurturing (collaborate, compromise and concede which is also known as accommodating). Task-based conflict under pressure was researched by means of data gathered from a self-completed online survey.

Several internal and external factors can create a variety of pressures that potentially can impact team performance (Tsai & Chi, 2009; Dr. S. Williams, 2016; Shell, 2001). This forms the basis for the first research question: *How do engineering team members handle constructive conflict on task-based issues when under pressure?* Several literatures propose that conflict handling styles be employed as the situation warrants (Callanan, Benzing, & Perri, 2006; Coburn, 2016; Kilmann & Thomas, 1977). Three pressure scenarios are studied in this research – task outcome, time and relationships.

It has also been discussed in literature that if conflict is not handled effectively, from the perspectives of the effector (supervisor) and the receptor (subordinate), further damage may be done to team harmony and performance (Baron, 1988). This forms the basis for the second research question: *How effective are the styles chosen to nurture productive conflict by engineering teams from the perspectives of the team subordinates and supervisors?*

This study finds from the conducted research, that the preferred conflict handling style is

- **Collaboration** when under pressure to realise an **outcome**
- **Collaboration** when pressured for **time**
- **Conceding** (accommodating) when under pressure to maintain a relationship.

On probing survey data in response to task-based conflict scenarios, the observation is

- Most **supervisors** will **compromise** under outcome, time or relationship pressure
- Most s**ubordinates** will **collaborate** under outcome, time or relationship pressure
- **Jointly**, it is more effective for supervisors and subordinates to **collaborate** as this style choice garnered the most selection with low variance.

Searchable key words: nurturing conflict, conflict management, conflict resolution, engineering team performance, project management, emotional intelligence

DECLARATION

I, _OLUWASEUN M. FARINDE, declare that this research report is my own work except as indicated in the references and acknowledgements. It is submitted in partial fulfilment of the requirements for the degree of Master of Business Administration in the University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination in this or any other university.



Signed at WBS, PARKTOWN

On the 22ND day of JUNE 2017

DEDICATION

This research study is dedicated to my better half – Oyebola Olaosebikan – and my children – Oyedamola, Oyeyisola, and Oyewonuola – who have been rock-solid in supporting and encouraging me through the many months of conducting the research and putting the report together.

This work is also dedicated to my mum, Solape Adenike Adeniji, who crossed borders to spend a year with my family and selflessly took on strenuous chunks of my role at home while I spent time studying.

I am truly blessed to have you all in my life. Thank you very much.

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With a special feeling of deep gratitude, I appreciate everyone who has contributed to this research study.

First praises to the Almighty who daily loads me with benefits, sustains me with succour and lavishes my endeavours with favour.

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Profound gratitude to my dear husband who has truly been a rock in supporting my efforts and spurring me on lovingly. I whole-heartedly appreciate you.

Special thanks to my kids' grandmas and grandpas who graciously gave their support to my family.

I appreciate Robyn Uys' kind assistance with proof-reading this research report.

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1 INTRODUCTION

1.1 Purpose of the study

The intent of this research is to identify the styles that are employed to nurture productive conflict in South Africa's engineering sector when under pressure, and to evaluate the perceived effectiveness of the style opted for. In other words, how does the engineering industry, an industry sensed as being rugged and tough, nurture productive and constructive conflict under pressure, which requires soft skills and emotional intelligence?

Conflict management has been identified by Goleman (2001) as a competence of emotional intelligence, a term which he is well-known for coining. Emotional intelligence in conflict management encourages debate and open discussions while orchestrating success. In fact, it has been observed that where the correlation between professional success and first-class training plus an incisive mind plus an endless supply of good ideas starts thinning out, emotional intelligence becomes a necessary catalyst for continued success (Wilcox, 2016). The studied relationship between emotional intelligence, the thinking-feeling balance of leadership as well as employed conflict management styles are explored in this report's literature review (chapter 2).

It is important to clarify that conflict management, conflict resolution (constricting) and conflict nurturing are not the same thing - conflict management intends to regulate the antecedents, manage the phase and control the outcomes of conflict. It is best to employ conflict constricting if conflict is deemed destructive because conflict constricting aims at asphyxiating conflict. But what then is done with healthy productive conflict?

A concept that is hardly embraced is conflict nurturing, a means of fostering conflict with active management to a productive end (Weiss & Hughes, 2005; Tjosvold, 2008). The focus of this study is on conflict nurturing, which is a subset of conflict management.

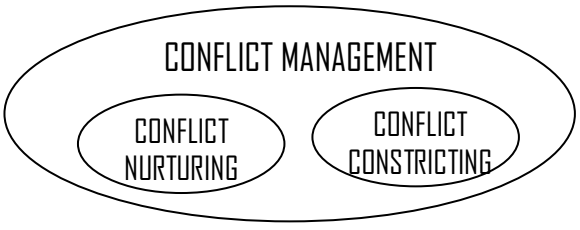


Figure 1.1: Conflict nurturing as a subset of conflict management

Conflict management intends to regulate the antecedents, manage the phase and control the outcomes of conflict (Rahim, 2002, pp. 206, 210).

Conflict resolution is employed if conflict is deemed destructive because conflict resolution aims at eliminating, constricting or stifling conflict (Rahim, 2002, p. 207).

Conflict nurturing is employed if conflict is deemed healthy and constructive because conflict nurturing aims at stimulating and fostering conflict with careful management to a productive end (Rahim, 2002, p. 210).

1.2 Conflicts and Conflict nurturing

Conflict abounds everywhere (Toledo, 2008) – amongst family, friends and firms - and if not managed properly, can impair cohesion and consequently, performance. Conflicts could be personal or relational (in terms of self-image, identity, loyalty, breach of confidence, lack of respect, and so on); instrumental (centring around goals, structures, procedures, and such); or manifest as conflicts of interest (concerned with the distribution of resources - time, money, space, staff). Conflict may also be about factors related to the aforementioned, such as relative importance, or knowledge and expertise (SkillsYouNeed, 2017).

Conflict has been defined broadly as

- Perceived incompatibilities (Boulding, 1963)
- “The interactive process manifested in incompatibility, disagreement or dissonance within or between social entities” (Rahim, 1992, p. 16)
- “Process in which one party perceives that its interests are being opposed or negatively affected by another party” (Wall & Callister, 1995, p. 517)
- “The experience between or among parties that their goals or interests are incompatible or in opposition” (Korsgaard, Jeong, Mahony, & Pitariu, 2008, p. 1224).

A quick glance at the definitions above and one’s thoughts may be directed towards conflict as negative. Is conflict entirely undesirable? In the words of Weiss and Hughes (2005, p. 1), “The quest for harmony and common goals can actually obstruct a team. Managers get truly effective collaboration only when they realize that conflict is natural

and necessary". This may seem self-contradictory. Questioning how a team can embrace conflict and achieve cooperation in the process is logical.

Studies (HarveyNash.com, 2012; Mercer, 2014) have shown that boards with members from diverse backgrounds debated (in other words conflicted) on subjects of goals, choices, procedures and decisions, arriving at different conclusions about appropriate courses of action. Engagement in such debates, if conducted constructively, could end up generating options and alternatives, improving mutual understanding, as well as enhancing creativity and innovation.

On the other hand, homogeneous groups that typically avoid conflict are susceptible to behaviour termed "groupthink" (Eisenhardt, Kahwajy, & Bourgeois III, 1997; Janis, 1972). While groupthink may seem desirable, it has significant downsides such as the undermining of individual creativity, exclusion of team members who have a "different idea", and ignoring viable alternatives, to name a few (Ben-Hur, Jonsen, & Kinley, 2010).

Conflict nurturing will seek to nurse debates, and not treat them as negative, especially if they are constructively engaging (Rahim, 2002). Engagement is a crucial ingredient in the recipe of team performance enhancement, which can be achieved by stimulating productive conflict and creatively eliciting options from various viewpoints (Jehn, 1997).

Destructive or non-constructive conflict on the other hand, if not asphyxiated, often ends in loss of self-confidence, low morale, derailed focus, failure to complete tasks, stress and decline in productivity (Baron, 1988).

As a whole, conflict management is crucial to team harmony and productivity. Engineering teams, supervisors and subordinates inclusive, require both interpersonal and technical competencies (Goleman, 2011; University of Maryland, 2004). Possession of one competency cannot replace the other, in fact, a deficiency in either one would more than likely result in or contribute to conflict and commotion. As bidden by Rahim (2002, p. 209), the outcome of this study may very well point out effective conflict nurturing styles, depending on the situation at hand, applied with emotional intelligence.

1.3 Conflict nurturing under pressure

It is becoming more evident that not every conflict management style works effectively in every situation (Warden, 2012; CPP, 2015). Kilmann (2011) echoes this sentiment and warns that even though a conflict handling mode may seem ideal to most people, due to its win-win nature, it can be deployed successfully only under the right conditions. He explains this further by highlighting the fact that when people are faced with overwhelming stress (or pressure), they may not have the opportunity and capability to engage in a productive dialogue. Under these circumstances, as observed in the research study by Callanan, Benzing, and Perri (2006), they may turn to one of the other modes more suited to the high-pressure situation. Some of these high-pressure situations could be due to

- The importance of a desired outcome
- Insufficient time
- Maintaining a relationship that is crucial
- Prevalent culture demands certain attitudes
- The environment requires certain behaviour, for example official codes of conduct
- One's role or power compared to the other party

Understanding how South Africa's work teams will nurture productive conflict when under pressure is one of the interests of this research study.

1.4 Context of the study

Seeing that a work team is influenced by interdependence and social interactions among its members to achieve common goals or tasks, it is imperative to understand the mind-set, culture and behaviour of the members of that group. Understanding the origins of conflict generally goes a long way in constricting, managing or nurturing it to a productive end. The broad sources of conflict are

- Emotion-based (affective) for example disagreements on personal or emotional matters (Guetzkow & Gyr, 1954; Kelly & Barsade, 2001)
- Task-based (substantive) for example disagreements among group members' ideas and opinions about the task being performed (Jehn, Chadwick, & Thatcher), competition for scarce resources; pursuit of autonomy; and divergence of assigned roles (Pondy, 1967).

It has been found that conflict stimulation, conflict nurturing in other words, enhances joint performance if the conflict is task-based (Vliert & Dreu, 1994; Jehn, 1994). The scenarios that are studied in this research centre on engineering project tasks where conflicts arise from the scarcity and allocation/re-allocation of project resources (time, money and manpower), when the team is under pressure, as described in section 1.3 and delimited in section 1.7.

Pondy (1967) identifies five stages of a conflict episode as:

(1) Latent conflict (conditions) – conflict conditions may be present in a relationship without any of the participants perceiving the conflict
(2) Perceived conflict (cognition) – awareness sets in that the concerned parties' positions are in opposition
(3) Felt conflict (affect) – one key distinction between perceiving conflict and feeling conflict is that the one party may be aware that its stance on a matter is in serious disagreement with another party's view, but this may not make the party tense or anxious, and may have no effect whatsoever on the one party's affection towards the other
(4) Manifest conflict (behaviour) – identifying conflictful behaviour needs to be within context, for example withdrawal may be because the concerned parties have completed their common tasks, or one party withdraws because it finds the relationship too stressful, and it could be that the one party withdraws wilfully to frustrate the other party
(5) Conflict aftermath (conditions) - If the conflict is genuinely managed to the satisfaction of all participants, the basis for a more cooperative relationship may have been set. On the other hand, if the conflict is merely suppressed but not managed, the latent conditions of conflict may be aggravated and erupt in more serious forms until they are dealt with or until the relationship dissolves.

In psychology, the workings of a person's mind, which often results in the manifest attitude or behaviour, is seen from three perspectives – cognitive (assumptions, perspectives, knowledge), conative (motivation, desires, impulses) and affective (feelings, emotions) (Dai & Sternberg, 2004).

This study focuses on task-based conflicts within engineering teams in South Africa that are perceived, felt or manifest for cognitive, conative or affective reasons. Latent conflict is excluded.

1.5 Problem statement

1.5.1 *Main problem*

To identify conflict nurturing styles employed in engineering teams under pressure-situations; and evaluate the perceived effectiveness of the style selections by supervisors and subordinates.

Five styles of conflict management are discussed widely in literature, these are

- Collaborate: eliciting cooperation by incorporating different viewpoints
- Compete: by pushing one viewpoint. This style is also known as dominating
- Compromise: by opting for a solution that satisfies all parties to a degree
- Concede: maintaining harmony by emphasizing areas of agreement rather than difference. This style is also known as accommodating
- Circumvent: by ignoring, avoiding or postponing the tackling of the issue

Only a subset (see Figure 1.1) of the five conflict management mentioned above are considered 'agreeable', and as such are ideally applicable to 'nurturing' conflict (DeChurch, Hamilton, & Haas, 2007), these are

- Collaborate
- Compromise
- Concede

Pushing or asserting one's viewpoint (competing) will not help in promoting a healthy debate. Avoiding conflict (circumventing) does not even provide the platform for allowing a healthy debate, much less nurturing it. As such, competing and circumventing are not considered nurturing styles as they both low on cooperativeness, see Figure 2.1.

1.5.2 *Sub-problems*

The first sub-problem is to identify conflict nurturing styles employed in engineering teams when under different forms of pressure. Choice of style utilised could depend on many factors – persons involved, positions of the persons involved, the nature of the task at hand, the urgency of the task, the desired outcome of the managed conflict, cultural expectations – to name a few. Pressure-situations include making a high-impact decision, maintaining a relationship with the other party in conflict, or the team is pressured for time. For example, as much as one would like to nurture a healthy debate to a productive

conclusion, as the project lead, one has to be cognisant of the time it consumes. However, being pressured for time does not warrant avoiding the conflict altogether, but it does call for utilising a suitable style (Thomas, 2006; CPP, 2015).

The second sub-problem is to evaluate the perceived effectiveness of the style selections by subordinates and supervisors. It is expected that the choice of style would be in the best interest of the parties involved, but this may not always be the case. A supervisor, in the person of a team lead or project manager, may choose a particular style because an interim or temporary outcome is quicker to achieve, which may not suit the affected team member, but may serve the interest of the project team as the task can be progressed, saving the project some time or manpower or money. The question is, will this temporary fix be effective in the long run? As it has been found that agreeable conflict management strategies positively moderate the connection between task-based conflict and resulting performance (DeChurch & Marks, 2001), and that residual or unsettled conflict can accumulate over time, and beyond a certain degree, can become detrimental to the performance of the team (Jiang, Flores, Leelawong, & Manz, 2016).

1.6 Significance of the study

Many research studies have been carried out on organisational conflict management (Pondy, 1967; Henning, 2003), a few on nurturing constructive conflict (Manolis., et al., 2009; Pahlau & Ferguson, n.d.), and none on nurturing constructive conflict in South Africa's engineering sector, as at date. The interest in engineering teams stems from its competitive nature in proffering viable solutions to any one problem. There seems to be a need for engineers to prove their brilliance by being able to come up with smart ideas that are better than the next person's. Conflict nurturing is beneficial to engineering teams seeing that it would be counter-productive to shut down alternative viable ideas in favour of one.

The findings of this research may benefit the engineering industry by highlighting the conflict nurturing styles that would be most productive, effective and best suited to each situation (portrayed as scenarios), as the preferences of supervisors would be compared to those of subordinates in the teams.

Amicable management and constructive conflict nurturing within teams will keep the team on track and focussed while facilitating the generation of alternatives; thereby increasing innovative productivity and reducing the turnaround time for deliverables.

1.7 Delimitations of the study

The engineering industry is wide, comprising of oil and gas (upstream, midstream, downstream), mining, instrumentation, construction, manufacturing, automotive engineering, to name a few of its sectors, each of which would have its own peculiarities.

This study will focus on the management of task-based conflict in the downstream oil and gas sector and EPCM (engineering, procurement and construction management) companies that service this sector. Participants are limited to professionals in engineering teams; artisans and support staff in these teams are excluded.

The study is also restricted to conflict management styles that are nurturing and possess considerable levels of cooperativeness.

1.8 Definition of terms for this research

Effectiveness: the degree to which the conflict handling is preferred by the parties in conflict.

Party: a person or group of persons that constitute a team or subset thereof.

Perceive: a party's interpretation or regard of the conflict management's effectiveness

Pressure: when the conflict situation is subjected to forced situations.

Subordinate: a team member under the authority or control of another within a team.

Supervisor: person who supervises a team on an assigned task.

1.9 Assumptions

- Respondents will reveal normal perspectives and experiences and provide unbiased feedback
- Participants understand the concepts being surveyed.

2 LITERATURE REVIEW

2.1 Introduction

In order to understand how South Africa's engineering work teams choose to nurture conflict, this research is based on the Thomas-Kilmann model of conflict management styles for the following reasons:

- The Thomas-Kilmann instrument is used extensively in training as well as research (Womack, 2016), and is the most utilised instrument for discovering personal conflict-resolution styles (Callanan, Benzing, & Perri, 2006)
- The model has a wide application range, including conflict management, leadership development, performance improvement, employee retention, bargaining, negotiations, and others (CPP, 2016a; Shell, 2001)
- It proposes different styles depending on how important the outcome is and how much of a resource a person has to invest in managing a particular conflict. Thereby discouraging a 'default' mode for handling conflict (OPP Limited, 2016; Thomas, 2008)
- Application of the Thomas-Kilmann conflict-resolution model has been supported by research of others into topics ranging from its validity (Ben-Yoav & Banai, 1992), relationship with the Myers-Briggs Type Indicator® (MBTI®) assessment (Johnson, 1997), behavioral patterns (Volkema & Bergmann, 1995), leadership, and emotional intelligence (Morrison, 2008)
- Discriminant analysis of the Thomas-Kilmann Instrument revealed no significant differences for years of supervisory or work experience (Konovsky, Jaster, & McDonald, 2016)
- The model enhances self-understanding and awareness of others (Brown, 2012; CPP, 2016b)

Thomas and Kilmann (1977) developed a survey instrument for determining a person's choice of management style when in conflict mode. This instrument's norm sample and the percentile ranks were recently updated (Schaubhut, 2007). The findings listed below are the reasons why this research study will not employ the Thomas-Kilmann Conflict Mode Instrument verbatim, as

- The sample for the updating exercise is representative of the United States, as such may not be directly applicable to South Africa
- Only 12% of the sampled respondents were in computer and mathematical occupations, which is where oil and gas engineering, the key area of interest for this research would fall
- The instrument does not incorporate pressured situations

As well as the fact that the current research is focussed on task-based conflict.

Section 2.2 provides literature review on the different conflict management styles and propositions on when each style is best applied. This review is applied in answering research question 1.

Section 2.3 reviews literature on means to ensuring employed conflict nurturing styles are perceived as effective. This takes psychological functions and emotional intelligence into account. This review is applied in answering research question 2.

2.2 Conflict nurturing during incident pressure

2.2.1 *Conflict management*

Blake and Mouton (1964) first introduced the management grid on two axes – concern for people and concern for production – in essence a task-versus-people orientation. This was refined by Kilmann and Thomas (1975) into the inter-personal conflict-handling styles and became known as accommodating, avoiding, collaborating, competing and compromising. Kilmann and Thomas (1975; Kilmann, 2011) described these styles along two dimensions – assertiveness (the extent to which the individual attempts to satisfy his own concerns) and cooperativeness (the extent to which the individual attempts to satisfy the other person's concerns).

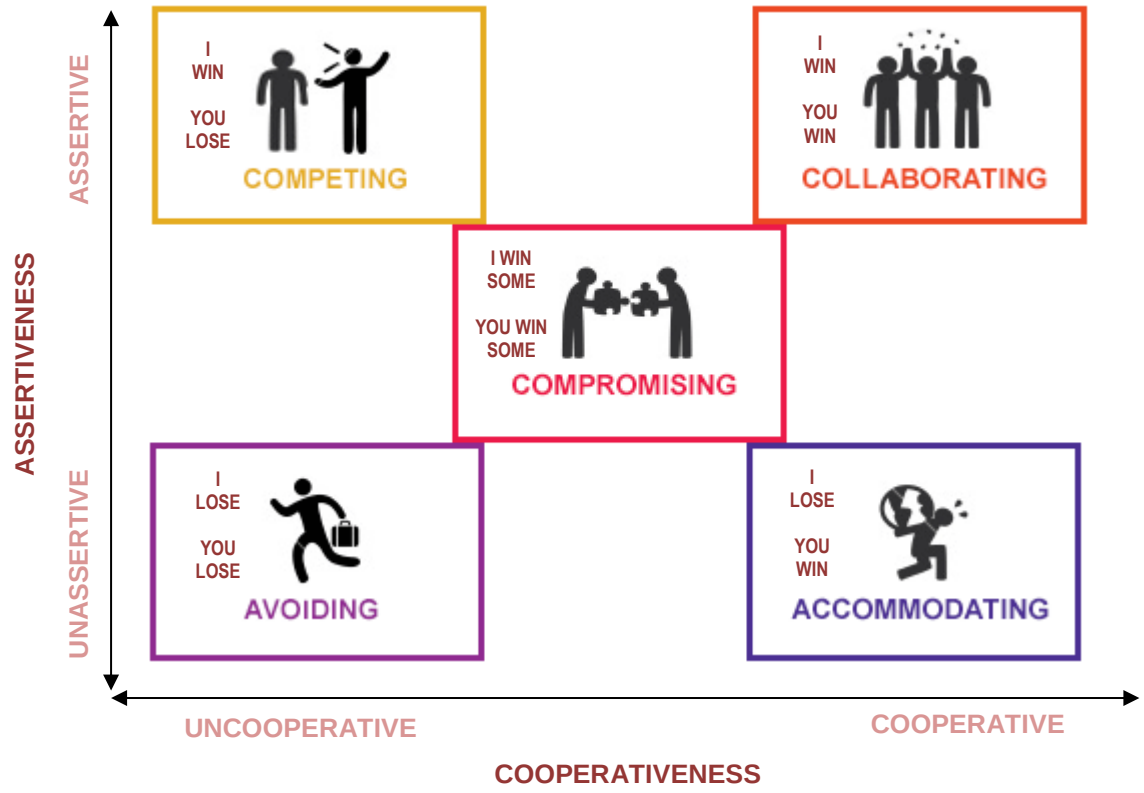


Figure 2.1: The Thomas-Kilmann Conflict MODE Instrument matrix

Source: (CPP, Thomas-Kilmann Conflict Mode Instrument (TKI), 2016a)

The Thomas-Kilmann Conflict MODE Instrument (1977; 2010) presumes that

1) a person would typically 'avoid' or **circumvent** – be unassertive and uncooperative – when the grounds of the conflict is thought to be petty or of transient importance; there's little or no chance that addressing the conflict will be productive (example: changing a team member's personality); the benefit of addressing the conflict is outweighed by potential damage; a cool down period is beneficial; it would be valuable to gain more insight or information about the issue than tackling it immediately; or other personnel are better equipped to deal with the conflict.

2) a person would typically '**compete**' – be assertive and uncooperative – when quick and decisive action needs to be taken (example: emergencies); unpopular decisions on important issues need to be taken (example: cost-cutting); vital team welfare issues where the manager is certain he/she is in the right; or where the person feels he/she needs to be protected from people who take advantage of non-competitive behaviour.

Some consequences of this mode include being shut out from the actual perceptions and goings on within the team as subordinates may have learned not to raise opposing views with the manager; also that team members may be afraid of admitting their ignorance to the manager and as such cannot ask his opinion.

3) a person would typically '**collaborate**' – be assertive and cooperative – the opposite of avoid, when both sides of the conflict are too important to be conceded and so finding an integrative solution is favourable; commitment can be extracted by incorporating the other party's view; or the aim is to learn from the other party.

   The downside of this mode is the time and energy consumption, easily the scarcest resources of a project or organisation.

4) a person would typically 'accommodate' or **concede** – be unassertive and cooperative – the opposite of competing, when the person realises the other's position is better; the issue is a lot more pertinent to the other party than to himself/herself; it is more beneficial to maintain the relationship for later when the issue would be a lot more pertinent to himself/herself; conserving harmony and evading disruptions is advantageous; or management seeks to allow subordinates learn from their own errors.

   Some drawbacks of this mode are laxity in team discipline and deprivation of influence, respect or recognition resulting from deferring or defaulting to the stance of others.

5) a person would typically '**compromise**' – find some middle ground between being assertive and cooperative – when it is expedient to arrive at a solution under the pressure of time; when both parties are of equal power and are strongly devoted to mutually exclusive goals (example: labour union versus management bargaining); or it is better to achieve temporary agreement on a complex matter.

2.2.2 *Conflict nurturing as a subset of conflict management*

This research study excludes conflict management styles that have low levels of cooperativeness as this study is focussed on conflict nurturing (Rahim, 2002). As described in section 1.5.1, these are

- Collaborate: eliciting cooperation by incorporating different viewpoints
- Compromise: by opting for a solution that satisfies all parties to a degree
- Concede: maintaining harmony by emphasizing areas of agreement rather than difference. This style is also known as accommodating

Williams (2016) expects that if there were never any time pressures, collaboration might always be the best approach to use. Understanding that this is not always the case, Williams (2016), alongside other authors (Kilmann, 2011; Tsai & Chi, 2009; Altmae, Turk, & Toomet, 2013), argues that pressure plays a significant role in how conflict is managed. Some of the highlighted pressured situations include:

- An important issue or a desired outcome (Dr. S. Williams, 2016; Shell, 2001) – upholding certain values, or reaching a consensual solution
- Insufficient time (Kilmann & Thomas, 1977; Kilmann, 2011; Dr. S. Williams, 2016)
- Maintaining a crucial relationship (Kilmann, 2011; Dr. S. Williams, 2016; Shell, 2001)
- Prevalent culture demands certain attitudes (Tsai & Chi, 2009)
- The environment requires certain behaviour e.g corporate codes of conduct
- Role or power compared to the other party (Tsai & Chi, 2009; Dr. S. Williams, 2016)

Of the scenarios mentioned above, this study will focus on scenarios that imply the team is dealing with constraints, such as being

a) Pressured to achieve desired task-outcomes
    - To gain commitment and reach consensual decision(s) or solution(s)
    - To settle issues vital to company (or team) welfare

b) Pressured for time
    - To take quick decisive actions
    - To arrive at expedient solutions under time pressure

c) Pressured to maintain important relationships
    - To build up social credits for later issues
    - To preserve harmony and avoid disruption

2.2.3 *Perceived effectiveness of conflict style choice*

A team lead or manager may opt to use the theoretically appropriate conflict handling style for a particular situation, while this choice may be efficient (get the job done quickly or to specification) it may not be effective (the job is done but the subordinate resents the way it was handled), as may be the case if the style employed is not the style preferred by the subordinate.

Two dimensions - the integrative and the distributive - were studied by Walton and McKersie (1965). The integrative dimension spans from avoiding to integrating the satisfaction of the conflicting parties; while the distributive dimension spans from dominating to obliging the satisfaction apportioned to each conflicting party.

Thomas (Kilmann & Thomas, 1975; Kilmann, 2011) organises the five conflict management modes along these two dimensions as seen in Figure 2.3. So for example, collaborating peaks at the integrating end of the integrative dimension because this mode seeks to contribute, while avoiding (or circumventing) falls to the other end because it is not integrative, and the other three modes are intermediary. Similarly, on the distributive dimension, accommodating (or conceding) represents the most giving and the competing party is the taker, along this facet the other three modes are intermediary.

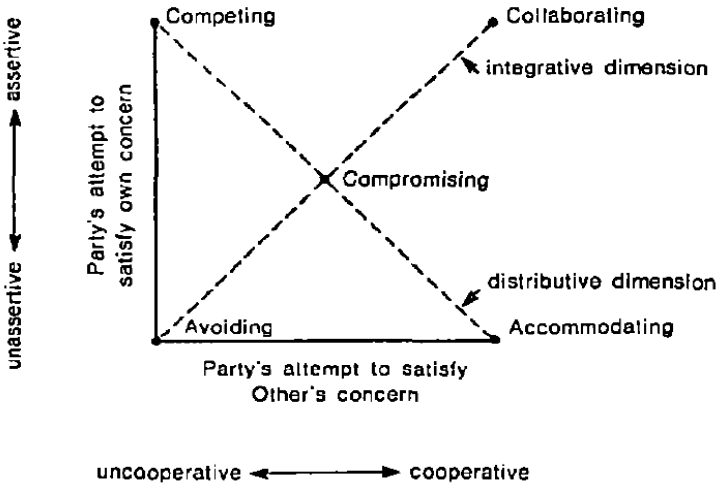


Figure 2.2: Kilmann and Thomas' (1975, p. 972; 2011) plotting of the five conflict-handling modes on the cooperativeness-assertiveness dimensions as well as the integrative-distributive dimensions

Source: (Kilmann &Thomas, Interpersonal conflict-handling behavior as reflections of Jungian personality dimensions, 1975)

Kilmann and Thomas (1975) also investigated how a person's choice of these conflict-handling methods correlates with the person's Jungian psychological functions (Jung C. , 1921) being judging (thinking versus feeling) and enactment type (introverted versus extraverted). So as to uncover trends between a leader's predominant disposition in terms of judgement or personality type and predominant style selection.

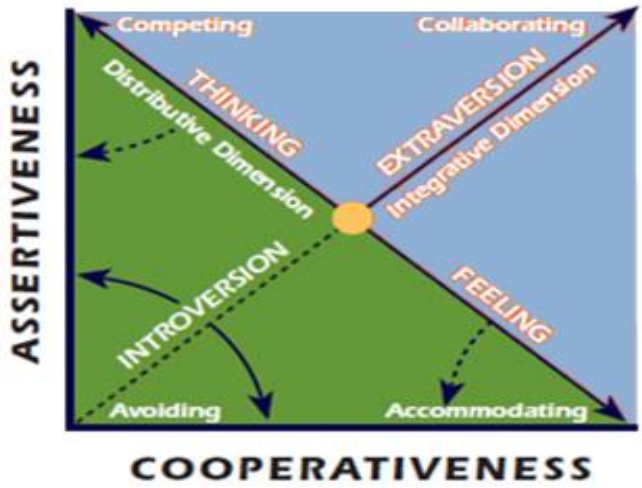


Figure 2.3: Conflict-handling behaviour as a reflection of the Jungian dimensions of thinking-feeling and extraversion-introversion

Source: (Kilmann, Celebrating 40 Years with the TKI Assessment: A Summary of My Favorite Insights, 2011, p. 9)

As depicted above, Kilmann and Thomas (1975) found that the Jungian enactment function (extraversion-introversion) plots onto the integrative dimension of conflict behaviour while the Jungian judgement function (thinking-feeling) plots onto the distributive dimension. These Jungian functions have been found to be associated with certain elements of emotional intelligence (Higgs, 2001). Emotional intelligence is the ability to understand one's effect on others and manage oneself accordingly (Goleman, 2004).

The importance of emotional intelligence is discussed here because human relations in groups (families, society, teams, organizations, and such) are affected by emotional factors more than by rational factors (Jung & Yoon, 2012). Spencer and Spencer (1993) analysed job competencies and found that employees who showed productive task-based outcomes generally demonstrated excellent emotion-related competencies. This finding is supported by Goleman's (1998) study.

Table 2.1: Emotional intelligence elements studied by Higgs (2001) in correlation with Myers-Briggs type indicators

EI ELEMENTS	MBTI
Self-awareness	Extraversion
Emotional resilience (Self-awareness)	Introversion
Motivation (Self-management)	Thinking judgement
Interpersonal sensitivity (Relationship management)	Feeling judgement
Influence (Relationship management)	Sensing perception
Intuitive decision making (Self-management)	Intuitive perception
Conscientiousness and integrity (Social awareness)	Perceptive attitude
	Judging attitude

In Higgs' (2001) study of the relationship between emotional intelligence elements and the Myers-Briggs type indicators (MBTI) which were built on the Jungian functions, Higgs found a positive correlation between MBTI extraversion and the emotional intelligence elements motivation, influence and intuitive decision-making; the converse was found true for introversion.

In the paragraphs above, correlations between emotional intelligence elements and the Jungian psychological traits (measured by the MBTI), as well as correlations between the Jungian psychological traits and conflict-handling modes, have been discussed. So in plain terms, why is emotional intelligence an important ingredient for nurturing conflict to a productive end?

- Successful application of a conflict management style depends on the situation
- The situation, more often than not, determines the degree to which conflict nurturing can be integrative or distributive
- Judging the situation from the point of view of the parties concerned requires emotional intelligence from the leader or conflict handling effector.

Emotional intelligence enhances one's ability to identify, understand, process, and influence one's own emotions and those of others to guide feelings, thinkings, and actions. Emotional intelligence, as stated by Kelly and Barsade (2001), is composed of

- perception, appraisal, and expression of emotion – the ability to identify one's own emotions and those of others as well as to accurately express your emotions to others;
- emotional facilitation of thinking – the aptitude to understand how emotions orient people toward important information and how different emotional states can induce varying approaches to problem solving;
- understanding and analysing emotions – comprehending the meaning, progressions, and complexity of emotions; and
- regulation of emotions in oneself and others to promote emotional and intellectual growth – the ability to stay open to feelings, to detach when necessary, and to manage one's own and others' emotions.

Sub problem 1 will identify which of Kilmann and Thomas's (1977) five conflict-handling styles are considered nurturing by engineering teams when the team is subjected to some form of pressure. The respondents' choices are compared to the choice of styles proposed in literature (Kilmann & Thomas, 1977; Shell, 2001; Gmelch & Carroll, 1991; Coburn, 2016). Sub problem 1 consists of three propositions.

Sub problem 2 will evaluate the perceived effectiveness of these styles by posing the same scenarios to both team supervisors/leads/managers and team members from the respective points of view of both groups. Responses to these scenarios are analysed to see in which cases did the perceptions of appropriate conflict nurturing match. A mismatch suggests potential ineffectiveness of the employed conflict handling style.

Conflict management styles have been well dealt with in literature [across cultures (Morris, et al., 1998); scrutinizing gender and organizational status (Brewer, Mitchell, & Weber, 2002); investigating its impact on group decision making (Kuhn & Poole, 2000); to name a few] but conflict nurturing has not benefited from the same amount of attention, this research question hopes to address this by surveying the choices of participants from engineering teams (see appendix B).

Sub-Problem 1: Identifying productive conflict nurturing styles employed by engineering teams when under pressure.

Sub-problem 1 seeks to identify which conflict-handling styles would be preferred where pressures such as time or reputation are significant factors. How would a team nurture productive conflict it is experiencing, for example, on how a task should be executed or what resources to employ or how resources should be allocated or other, under pressure.

Several authors presume certain styles would be best suited for handling conflict when under different forms of pressure, these form the basis for the propositions for addressing research question 1.

2.2.4 *Research Question 1*

How do engineering team members handle constructive conflict on task-based issues when under pressure?

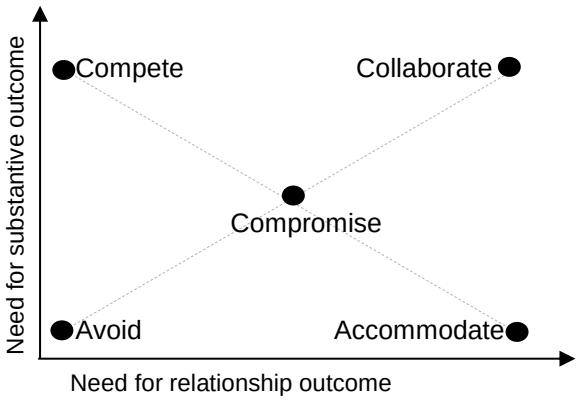


Figure 2.4: Conflict management strategies (Gmelch & Carroll, 1991; Altmae, Turk, & Toomet, 2013)

Proposition 1

Where a task outcome has to be realised, the parties collaborate, see Figure 2.4 (Kilmann & Thomas, 1977; Shell, 2001; Kilmann, 2011; Coburn, 2016).

Proposition 2

Where the team is pressured for time, one of the parties in conflict will compromise (Kilmann & Thomas, 1977; Shell, 2001; Kilmann, 2011; Coburn, 2016).

Proposition 3

Where it is valuable to maintain a relationship, one of the parties in conflict will concede (also known as ‘accommodate’), see Figure 2.4 (Kilmann & Thomas, 1977; Shell, 2001; Kilmann, 2011).

2.3 Sub-Problem 2: Evaluating the perceived effectiveness of the styles selected by subordinates and supervisors.

This study intends to highlight effective styles for certain pressure scenarios by matching the preferences of the conflicting parties in teams.

2.3.1 *Research Question 2*

How effective are the styles chosen to nurture productive conflict by engineering teams from the perspectives of the team subordinates and supervisors?

In hopes of answering this research question, a survey questionnaire has been designed based on scenarios to study how a supervisor, or team member, would choose to nurture productive conflict.

Scenario 1: Team credibility with client may be jeopardised (outcome pressure)

Scenario 2: Falling behind schedule on a critical task (time pressure)

Scenario 3: Subject matter expert is exhausting resources on gold-plating a deliverable (relationship pressure)

Would the engineering team (supervisor or subordinate) choose a style that requires:

a) Allowing the defaulting team member to carry on hoping he/she will self-adjust (concede)?
b) Offering the defaulting team member the choice of self-rectifying the issue or consenting to the re-assignment of the task (compromise)?
c) Discussing the defaulting team member's plan for achieving the deadline with a view of providing additional resources (manpower, money, machinery or technology) to assist the defaulting team member (collaborate)?

The corresponding options for circumventing or competing, respectively, would be:

i. recalling the task from the defaulting team member without discussions and re-assign it to a team member who has successfully delivered on a similar task previously (circumvent)
ii. Insisting that the defaulting team member adjust and meet the initial deadline (compete)

Options i and ii above are omitted from the survey because conflict nurturing will seek to nurse debates, and not treat them as negative, especially if they are constructively engaging.

Effective conflict nurturing has not been studied widely in literature, especially when the team is under pressure to manage the conflict. This research question hopes to address this by surveying the responses of participants from engineering teams (supervisors separate from subordinates), and then analyse and compare the styles chosen per scenario.

2.4 Conclusion of Literature Review

Conflict can be found anywhere and everywhere, in different forms, and for different reasons. Conflict, whether healthy or unhealthy, if unmanaged or managed poorly, can hamper team performance in several ways. To handle unhealthy or destructive conflict, constrict and asphyxiate it. To handle healthy or constructive conflict, stimulate nurture and foster it.

To nurture productive conflict to a constructive end, team leads, managers, supervisors and the likes require emotional intelligence (Goleman, 2001) in selecting the appropriate styles for each situation, especially when under pressure.

2.4.1 *Research Question 1*

How do engineering team members handle constructive conflict on task-based issues when under pressure?

Proposition 1

Where an outcome has to be realised, the parties collaborate (Kilmann & Thomas, 1977; Shell, 2001; Kilmann, 2011; Coburn, 2016).

Proposition 2

Where the team is pressured for time, one of the parties in conflict will compromise (Kilmann & Thomas, 1977; Shell, 2001; Kilmann, 2011; Coburn, 2016).

Proposition 3

Where it is valuable to maintain a relationship, one of the parties in conflict will concede, typically the less influential one (Kilmann & Thomas, 1977; Shell, 2001; Kilmann, 2011).

2.4.2 *Research Question 2*

How effective are the styles chosen to nurture productive conflict by engineering teams from the perspectives of the team subordinates and supervisors?

3 RESEARCH METHODOLOGY

Most surveys are quantitative tools for conducting research that is positivistic in nature, seeking to predict outcomes or understand 'if and how much' of a 'what' correlates with other constructs (Creswell, 2014). The intent of research conducted with quantitative methods of data collection is to make observations or predictions (Meyers, Gamst, & Guarino, 2006).

This research study is concerned with identifying the conflict-handling style choices made by supervisors trying to nurture productive conflict within the team and the choices their subordinates would have made given the same situation. This forms the ontological basis of the research where the constructs are the pressure situation and the respondents' preferred task-based conflict-handling style, as a team supervisor or team member. Predictions from these observations are based on the Random Utility Theory (RUT). This is done for sub-problems 1 and 2 in chapter 5.

This is tested by a self-completed online survey questionnaire with general sections, and sections dedicated to supervisors separate from subordinates within teams. The dedicated sections portray the same scenarios to both groups (see Appendix B).

The nurturing conflict-handling style with a choice probability greater than either of the other two is deemed the preferred nurturing conflict-handling style for the pressure situation being researched. Analyses based on these probabilities are applied to propositions 1, 2 and 3 to answer research question 1. Where a high percentage of persons administering a conflict nurturing style and a high percentage of the persons it's being administered to have the same preferences, then the chosen style is deemed to be effective in that situation. This will answer research question 2.

3.1 Research methodology / paradigm

An exploratory quantitative research method is employed by means of survey questions, which will paint conflict scenarios for which respondents will select their conflict management style choices. Choice options are limited to those of a nurturing nature in line with section 2.2.2.

Probabilistic discrete choice analysis, a means of analysing stated preferences from a group of alternatives, is used to examine the results of the survey.

Some assumptions of the quantitative method of research include

- Data collected is objective (ontological)
- The research study is not influenced by the researcher (epistemological)
- The research is unbiased and value-free (axiological)
- The process of research is deductive (methodological)
- The research study is based on set definitions (rhetorical)

Where a tight-fit may be lacking between these theoretical assumptions and this research study is in the axiological assumption being that respondents may place some personal value on some questions and therefore answer the question from a bias of a previous experience and not what they actually perceive to be appropriate (see section 3.7). To address this, all proffered options have been worded such that no option is portrayed as superior/inferior or more positive/negative than another, this is an inherent design to limit bias in the data collected from the survey (see section 3.8).

3.2 Research Design

A survey is appropriate for this study because it provides a means of getting primary data from persons involved in the scenarios being researched for effective team management in situations of conflict under pressure.

While some of the pitfalls of this method include limited validity when the questions are open-ended, the researcher not being present in person to clarify issues or that the respondents may rush through the survey just to get it done and out of the way; it is a quick, easy and inexpensive way of gathering large volumes of data. Online surveys afford the researcher flexibility in designing the questions and aid the automation of data input, output and handling. On the respondent's end, it is a convenient and confidential means of providing data.

3.3 Population and sample

3.3.1 *Population*

The study's population is limited to engineering teams in South Africa.

3.3.2 *Sample and sampling method*

The survey sample consists of professionals in the downstream oil and gas engineering teams. The selection of this sample is to ensure some degree of involvement in the scenarios that are illustrated and relatively high literacy. For example, it is highly unlikely that a project secretary would be involved in engineering-task-based conflict with a project engineer. More often than not, project secretaries play administrative and not engineering roles.

Non-probability-based judgement sampling is employed in the design of the questionnaire, to ensure that only professionals are permitted to proceed with the survey.

3.3.3 *Sample size*

For discrete choice experiments, Johnson and Orme (2003) have proposed the following formula for estimating the required number of survey respondents based on the design of the discrete choice experiment:

$$[(n * t * a) / c] \geq 500$$

where

n (number of respondents) = unknown

t (number of tasks (or DCE questions)) = 6 (3 general and 3 position-specific questions)

a (number of alternatives per task[1]) = 3 (only 3 options per question)

c is the number of multivariate components = 1 (the choices are not broken down any further)

$$\therefore n \geq 500\ c / t\ a$$

$$\Rightarrow n \geq 500 \times 1 / 6 \times 3 \qquad \Rightarrow n \geq 500 / 18 \qquad \Rightarrow n \geq 28$$

This implies that 28 respondents will be sufficient to conduct this research. 54 respondents participated

[1] number of alternatives per task should not include the none alternative. By virtue of the survey's design, there are no "none" answers in the choices provided.

3.4 The research instrument

The survey is designed as a probabilistic discrete choice experiment to obtain stated preferences with respect to hypothetical situations (Hall, Viney, Haas, & Louviere, 2004). The converse would be obtaining revealed preferences by actual observation. Both methods of eliciting preferences are founded on the economic assumption of rational behaviour.

Discrete choice experiments were based on the random utility theory (RUT) proposed by Thurstone (1927) for binary choices but have been extended by McFadden (McFadden, 1986; McFadden & Train, 2000) to multiple choices, allowing this research study to elicit preferences for complex multidimensional concepts, whether it be goods, services, or courses of action (Hall et al, 2004). Stated preferences can be elicited by conjoint analysis also, but this would require ranking (from least to most preferred) or rating (degree of preference on a scale) of the respondents' preferences. Discrete choices reveal the most preferred option.

Five styles of conflict management have been described by Kilmann and Thomas (1977); those deemed to be nurturing are collaboration, compromise and concession (see sections 1.5.1 and 2.2.2). The questionnaire in Appendix B will test the propensity for these choices by engineering team members.

Section A serves a dual purpose (i) to ease the respondent into the survey by providing familiar information and (ii) to collect bio-data.

Section B is designed to also be dual-purposed (i) collect industry experience-related general information (ii) use the information to direct the respondent to the section (D or E) that corresponds to their role within the team.

Section C consists of three open-ended questions to test the respondent's understanding and perception of conflict, and three pressure-situation questions with options to determine which conflict nurturing style is preferably employed by the respondent (sub-problem 1).

Sections D and E portray three scenarios, similar to Section C but task-specific. Respondents, supervisors and subordinates separately, were asked to select a choice of preferred action from a list of options that tally with the conflict nurturing styles discussed in chapter 2. The respondents are not made aware of this to maintain objectivity (sub-problem 2).

Table 3.1: Alignment of survey questions to research

S/N	SURVEY QUESTION	RELEVANCE TO RESEARCH	SCENARIO
12	Where high impact decisions need to be taken, would you (*choose an option*)	Proposition 1 of research question 1	Outcome pressure
13	Where you are pressured for time, would you (*choose an option*)	Proposition 2 of research question 1	Time pressure
14	Where maintaining a relationship matters, with a person or group you are in conflict with, would you (*choose an option*)	Proposition 3 of research question 1	Relationship pressure

Table 3.2: Alignment of survey's response options to research

RESPONSE OPTIONS	RELEVANCE TO RESEARCH	ALIGNMENT WITH LITERATURE REVIEW
Elicit cooperation by incorporating different viewpoints	Productive conflict nurturing style that utilises Collaboration (See report section 2.1)	Ideal for getting conflicting parties on the high end of the integrative dimension of 'I win, You win'.
Opt for a solution that satisfies all parties to a degree (compromise)	Productive conflict nurturing style in which one party Compromises in with the other. (See report section 2.1)	Conflicting parties are halfway on both the integrative and distributive dimensions summarised as 'I win some, You win some'.
Maintain harmony by emphasizing areas of agreement rather than difference	Productive conflict nurturing style in which one party Concedes in favour of the other. (See report section 2.1)	Conflicting parties are on the high end of the distributive dimensions by adopting an 'I lose, You win' strategy. This style is also known as 'Accommodating'.

3.5 Procedure for data collection

Survey participants were approached via their colleagues, friends, and families, by email distribution containing the qualtrics survey link (see Appendix B).

3.6 Data analysis and interpretation

The data collected is based on comparative judgement (Thurstone, 1927), and as such is scrutinized based on probabilistic discrete choice analysis, in which an alternative *i* with true but not totally observable stimulus *Ui* is perceived as having an observable component *Vi* and an error *Ei* (the unobservable factor). The random utility theory (RUT) assumes that the individual is a utility-maximizer, and so acts rationally and chooses the alternative with the most level of utility.

It is then assumed that the individual has made his or her best choice, and will most probably repeat this choice under similar circumstances (Anderson, Palma, & Thisse, 1991; Kjær, 2005).

3.7 Limitations of the study

Possible limitations and weaknesses (Podsakoff, MacKenzie, Lee, & Podsakoff, 2003) in employing a self-completed online survey for this study include

- Consistency motif (inclination of respondents to try to maintain consistency in their responses to the questions)
- Social desirability (tendency to respond to items more as a result of one's social acceptability than one's true feelings)
- Transient mood state (the impact of relatively recent mood-inducing events to influence the manner in which respondents view themselves and the world around them)

All of the above could potentially skew the findings of this study.

3.8 Validity and reliability

It is important (Ryan, Gannon-Slater, & Culbertson, 2012) that a survey questionnaire

- Is easy to comprehend
- Is easy to respond to
- Inherently minimises bias
- Is easy to administer and analyse

Pilot testing was conducted to test the validity and reliability of the survey questions in addressing the sub-problems of this research study.

3.8.1 *Reliability*

The pilot study was carried out on a team of 6 project management consultants that were working on the same task. Some of the consultants have an engineering background. The pilot study was subjected to the Test-Retest method (Brooks, Reed, & Savage, 2016) of determining reliability. Reliability is often affected by

- The design or consistency in the survey instrument
- Change in individual preferences
- Occurrence or change in external factors

The Test-Retest method administers an instrument twice with a time lapse between. The method measures the reliability of the instrument by analysing variances in responses in the two assessments. Typically, where responses are not prone excessively to subjective circumstances as listed above in bullet points, the difference between the means of the data collected on both occasions will be zero or negligible. This forms the basis of the pilot's reliability hypotheses in Appendix C.

The results shown in Appendix C show that this hypothesis of zero mean difference is significant and cannot be rejected. Hence, it can be concluded that the survey instrument is reliable.

3.8.2 *External validity*

Imperatively, the results of a study on a sample should generally be representative of the target population (Brooks, Reed, & Savage, 2016), the extent to which this holds true with the online survey is analysed in Appendix D. The results from the t-tests comparing the section C pilot results and the section C survey results show that the difference between the means of the two sets of survey data (pilot and actual) is zero. Hence, it can be concluded that the survey instrument is externally valid.

3.8.3 *Internal validity*

The outcome of the proposal panel's findings determined the appropriateness and the accuracy with which the survey questions gather the information required to resolve the research questions (Brooks, Reed, & Savage, 2016).

3.8.4 *Readability*

To enhance the validity of the questionnaire, a readability test was carried as shown below, using Gunning's (1952) Fog-Index.

Fog-Index = 0.4 x (Average Sentence Length + Number of hard words), where

Average Sentence Length = the number of words divided by the number of sentences

Number of hard word = number of words that are more than two syllables long

Table 3.3: Estimated Reading Grades of the Fog-Index

Fog-Index	Estimated Reading Grades
17	College graduate
16	College senior
15	College junior
14	College sophomore
13	College freshman
12	High school senior
11	High school junior
10	High school sophomore
9	High school freshman
8	Eighth grade
7	Seventh grade
6	Sixth grade

Sections A and B of the questionnaire are typical bio-data, geo-data and professional experience data which need not be subjected to readability tests because they are well-known to the respondents.

For section C of the questionnaire, the Fog-Index = 0.4 x (9 + 12), which is 8.4.

While for sections D and E, the Fog-Index = 0.4 x (32 + 10), which is 17. The survey questions in this section require a high reading ability, which is in line with the levels of literacy expected of the professionals that this questionnaire has been designed for.

4 PRESENTATION OF RESULTS

4.1 Introduction

This research study seeks to understand how engineering teams in South Africa handle conflict, section 4.2 presents survey data in response to research question 1 while section 4.3 presents survey data in response to research question 2.

Bio-data and team function data collected from the survey's sections A and B are presented in Appendix E. Survey questionnaire section C was administered to both supervisors and subordinates, while section D was specific to supervisors and section E was specific to subordinates. Sections D and E are task-specific questions based on Section C

Section C: Q12 tests proposition 1, Q13 tests proposition 2, and Q14 tests proposition 3.

The same options, as listed below, were provided for survey questions Q12, Q13, Q14

- Elicit cooperation by incorporating different viewpoints (collaborate)
- Opt for a solution that satisfies all parties to some degree (compromise)
- Maintain harmony by emphasizing areas of agreement rather than difference (concede)

Section D (supervisors only): survey Q15 addresses research question 2 with respect to outcome pressure, Q16 addresses research question 2 with respect to time pressure, and Q17 addresses research question 2 with respect to relationship pressure.

For survey questions Q15, Q16, Q17, the same options were provided, as listed below

- Discuss the team member's plan for executing the task with a view of providing additional resources such as manpower, money, machinery or technology (collaborate)
- Offer the team member the choice of catching up on the task or agree that the task be re-assigned to another team member (compromise)
- Allow the team member to carry on, hoping he/she will execute the task as required (concede)

Section D (subordinates only): survey Q18 addresses research question 2 with respect to outcome pressure, Q19 addresses research question 2 with respect to time pressure, and Q20 addresses research question 2 with respect to relationship pressure.

For survey questions Q18, Q19, Q20, the same options were provided, as listed below

- Discuss your plan for executing the task with a view of providing additional resources such as manpower, money, machinery or technology (collaborate)
- Offer you the choice of catching up on the task or agree that the task be re-assigned to another team member (compromise)
- Allow you to carry on, trusting you will execute the task as required (concede)

The proportion of supervisors (58%) who participated in the survey surpassed the proportion of subordinates (42%), for this reason survey data was normalised as percentages.

In testing the statistical significance of the collected data, it is assumed that the null hypotheses (H0) of zero mean differences are true, while the alternative hypothesis (HA) is two-tailed, that is the differences in means is not zero.

The t-Stat value will determine if the survey data follows a t-distribution with n-1 degrees of freedom, such that the probability of making a Type I error (rejecting the null hypothesis when it is true) is insignificant.

The critical value approach tests if the t-Stat is more extreme in the direction of the alternative than the critical value. If this is the case, then the null hypothesis is rejected in favor of the alternative hypothesis. However, if the test statistic is less extreme than the critical value, then the null hypothesis cannot be rejected.

p-Value approach checks the probability of observing a t-Stat that is more extreme in the direction of the alternative hypothesis than currently observed. If the p-value is less than (or equal to) α, then the null hypothesis is rejected in favor of the alternative hypothesis. However, if the p-value is greater than α, then the null hypothesis cannot be rejected.

Both the critical value and the p-value approaches are used. The significance level, α, is set at 0.05 (5%) for this research study.

Table 4.1: Conditions for rejecting or not rejecting the null hypothesis

If	Then
test statistic > critical value (t > tcrit)	Reject the null hypothesis
test statistic < critical value (t < tcrit)	Cannot Reject the null hypothesis
p value ≤ α	Reject the null hypothesis
p value > α	Cannot Reject the null hypothesis

4.2 Results pertaining to Research Question 1

How do engineering team members handle constructive conflict on task-based issues when under pressure?

The results depicted in Figures 4.1 and 4.3 show that to a great extent, South Africa's engineering team handle conflict as presumed in literature. However, Figure 4.2 shows a deviation from this trend.

4.2.1 *Results pertaining to Proposition 1*

Where a task-outcome must be achieved (high impact), the parties in conflict will collaborate (Kilmann & Thomas, 1977; Shell, 2001; Kilmann, 2011; Coburn, 2016; Gmelch & Carroll, 1991).

Survey **Q12**: Where high impact decisions need to be taken, would you (*choose from the options provided*)



Figure 4.1: survey results pertaining to proposition 1

More than 50% of the participants chose to collaborate. The statistical significance of this outcome is tested assuming a null hypothesis (H0) of a zero mean difference (normal distribution); and an alternative hypothesis (HA) that there is a statistical variance in the means.

Table 4.2: t-test results for hypothesis on proposition 1

	Observed	*Expected*
Mean	0.333333	0.333333
Variance	0.045981	0.285208
Observations	3	3
Hypothesized Mean Difference	0	
df	3	
t Stat	0	
P(T<=t) one-tail	0.5	
t Critical one-tail	2.353363	
P(T<=t) two-tail	1	
t Critical two-tail	3.182446	

p-value =	1
alpha =	0.05 (confidence level = 95%)
t Stat =	0
t Critical (two-tail) =	3.1824
p value > alpha	∴ H0 cannot be rejected
test statistic < critical value	∴ H0 cannot be rejected

4.2.2 *Results pertaining to Proposition 2*

Where the team is pressured for time, the parties in conflict will compromise (Kilmann & Thomas, 1977; Shell, 2001; Kilmann, 2011; Coburn, 2016).

Survey **Q13**: Where you are pressured for time, would you (*choose from the options provided*)

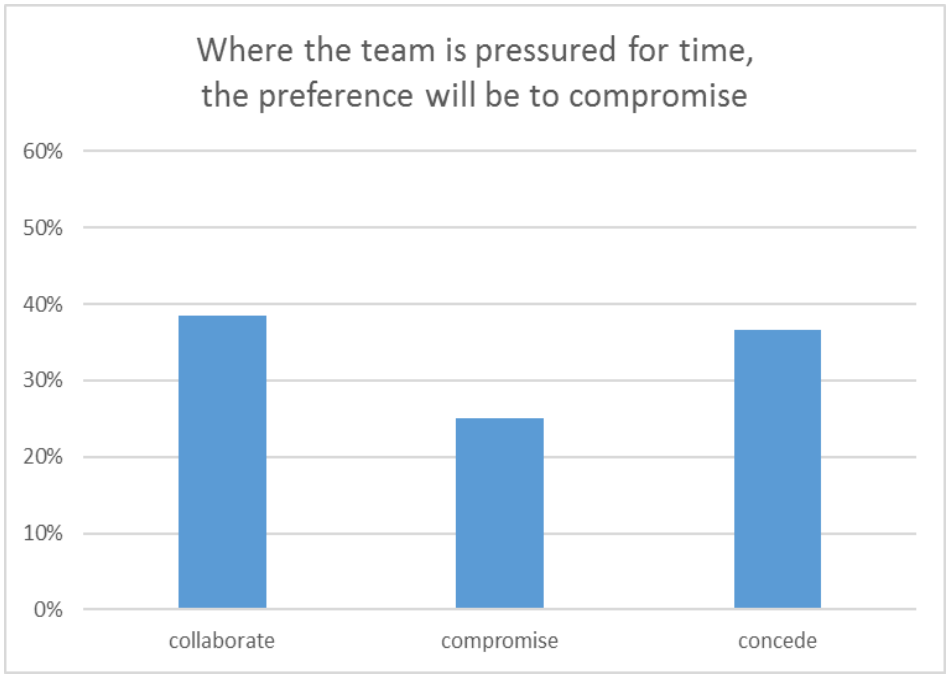


Figure 4.2: survey results pertaining to proposition 2

While only marginally more than the fraction of participants who chose to concede, 47% chose to collaborate when pressured for time. The statistical significance of this outcome is tested assuming a null hypothesis (H0) of a zero mean difference (normal distribution); and an alternative hypothesis (HA) that there is a statistical variance in the means.

Table 4.3: t-test results for hypothesis on proposition 2

	Observed	*Expected*
Mean	0.333333	0.333333
Variance	0.005301	0.285208
Observations	3	3
Hypothesized Mean Difference	0	
df	2	
t Stat	0	
P(T<=t) one-tail	0.5	
t Critical one-tail	2.919986	
P(T<=t) two-tail	1	
t Critical two-tail	4.302653	

p-value =	1
alpha =	0.05 (confidence level = 95%)
t Stat =	0
t Critical (two-tail) =	4.3027
p value > alpha	∴ H0 cannot be rejected
test statistic < critical value	∴ H0 cannot be rejected

4.2.3 *Results pertaining to Proposition 3*

Where it is valuable to maintain a relationship, the party in conflict will concede (Kilmann & Thomas, 1977; Shell, 2001; Kilmann, 2011; Coburn, 2016; Gmelch & Carroll, 1991).

Survey **Q14**: Where maintaining a relationship matters, with a person or group you are in conflict with, would you (*choose from the options provided*)

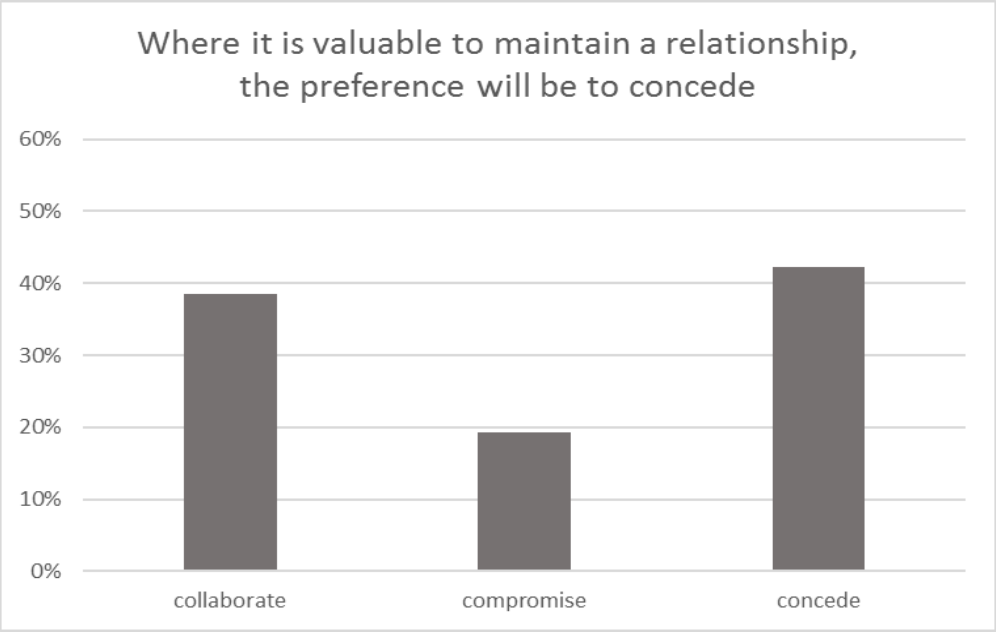


Figure 4.3: survey results pertaining to proposition 3

When the pressure scenario changed to maintaining a relationship, it was observed that more participants (42%) chose to concede rather than collaborating or compromising. The statistical significance of this outcome is tested assuming a null hypothesis (H0) of a zero mean difference (normal distribution); and an alternative hypothesis (HA) that there is a statistical variance in the means.

Table 4.4: t-test results for hypothesis on proposition 3

	Observed	*Expected*
Mean	0.333333	0.333333
Variance	0.015286	0.285208
Observations	3	3
Hypothesized Mean Difference	0	
df	2	
t Stat	0	
P(T<=t) one-tail	0.5	
t Critical one-tail	2.919986	
P(T<=t) two-tail	1	
t Critical two-tail	4.302653	

p-value =	1
alpha =	0.05 (confidence level = 95%)
t Stat =	0
t Critical (two-tail) =	4.3027
p value > alpha	∴ H0 cannot be rejected
test statistic < critical value	∴ H0 cannot be rejected

4.3 Results pertaining to Research Question 2

How effective are the styles chosen to nurture productive conflict by engineering teams from the perspectives of both the team supervisors and subordinates?

4.3.1 *Outcome pressure responses from supervisors and subordinates*

When asked for preferred options in managing task-based conflict while under pressure to make high-impact decisions to ensure realising a task-outcome, 50% of the supervisors chose to compromise while 57% of the subordinates preferred collaboration.

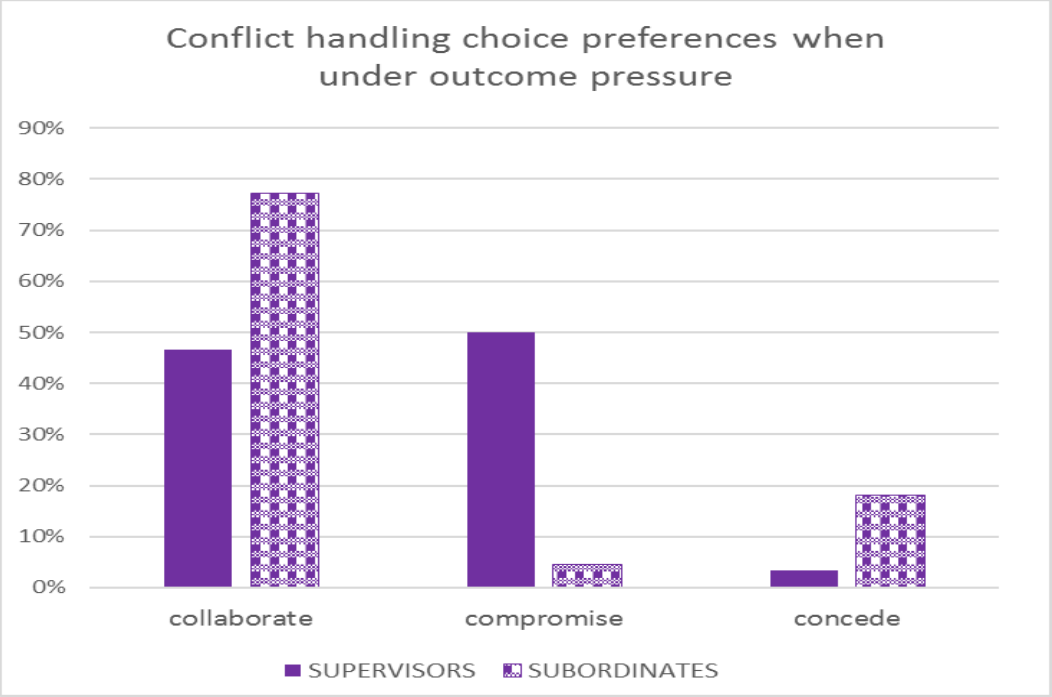


Figure 4.4: survey results pertaining to research question 2 with respect to outcome pressure

The statistical significance of the differences between the means of the three style choices is tested by ANOVA analysis, assuming a null hypothesis (H0) of zero mean difference, confidence interval of 95% and an α of 0.05. Analysis results are shown below.

Table 4.5: ANOVA analysis results pertaining to research question 2 with respect to outcome pressure

SUMMARY			
Groups	*Sum*	*Average*	*Variance*
collaborate	1.239394	0.619697	0.046837
compromise	0.545455	0.272727	0.103306
concede	0.215152	0.107576	0.011024
One-way ANOVA			
Source of Variation	*SS*		*P-value*
Between Groups	0.273287		0.225941
Within Groups	0.161166		
Total	0.434454		

p-value = 0.23
alpha = 0.05 (confidence level = 95%)

p value > alpha ∴ H0 cannot be rejected

4.3.2 *Time pressure responses from supervisors and subordinates*

When asked for preferred options in managing task-based conflict when under pressure for time, most supervisors chose to compromise while most subordinates preferred collaboration.

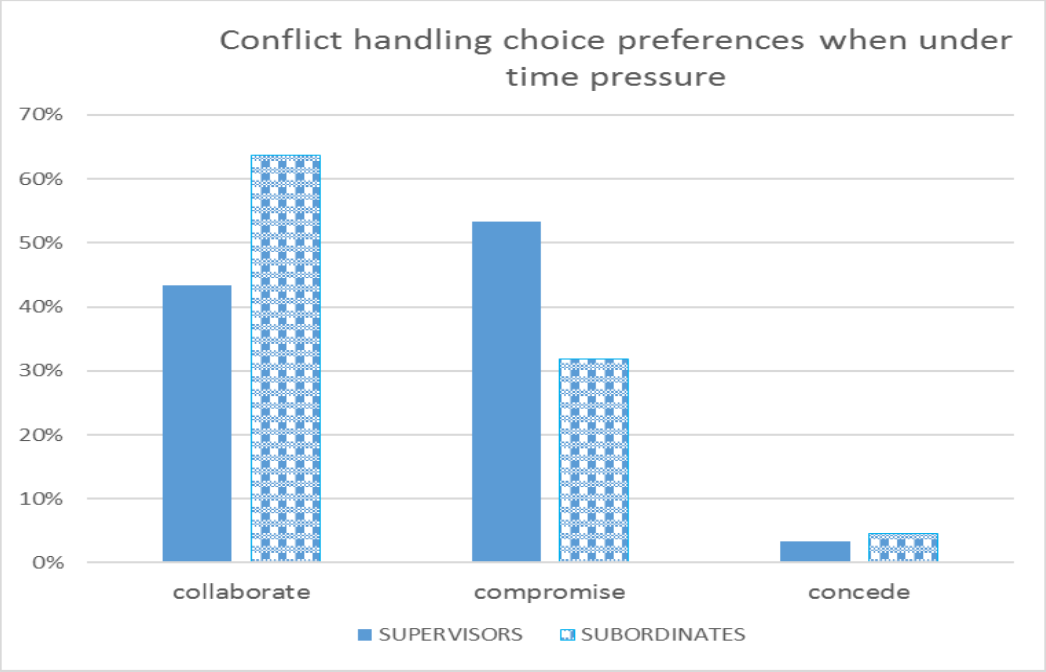


Figure 4.5: survey results pertaining to research question 2 with respect to time pressure

The statistical significance of the differences between the means of the three style choices for this pressure scenario is tested by ANOVA analysis, assuming a null hypothesis (H0) of zero mean difference, confidence interval of 95% and an α of 0.05. Analysis results are shown below.

Table 4.6: ANOVA analysis results pertaining to research question 2 with respect to time pressure

SUMMARY			
Groups	*Sum*	*Average*	*Variance*
collaborate	1.069696	0.534848	0.020610
compromise	0.851515	0.425757	0.023145
concede	0.078787	0.039394	7.346E-05
One-way ANOVA			
Source of Variation	*SS*		*P-value*
Between Groups	0.271102		0.051918
Within Groups	0.043829		
Total	0.314931		

p-value = 0.052
alpha = 0.05 (confidence level = 95%)

p value > alpha ∴ H0 cannot be rejected

4.3.3 *Outcome pressure responses from supervisors and subordinates*

When asked for preferred options in managing task-based conflict when under pressure for time, most supervisors chose to compromise while most subordinates preferred collaboration.

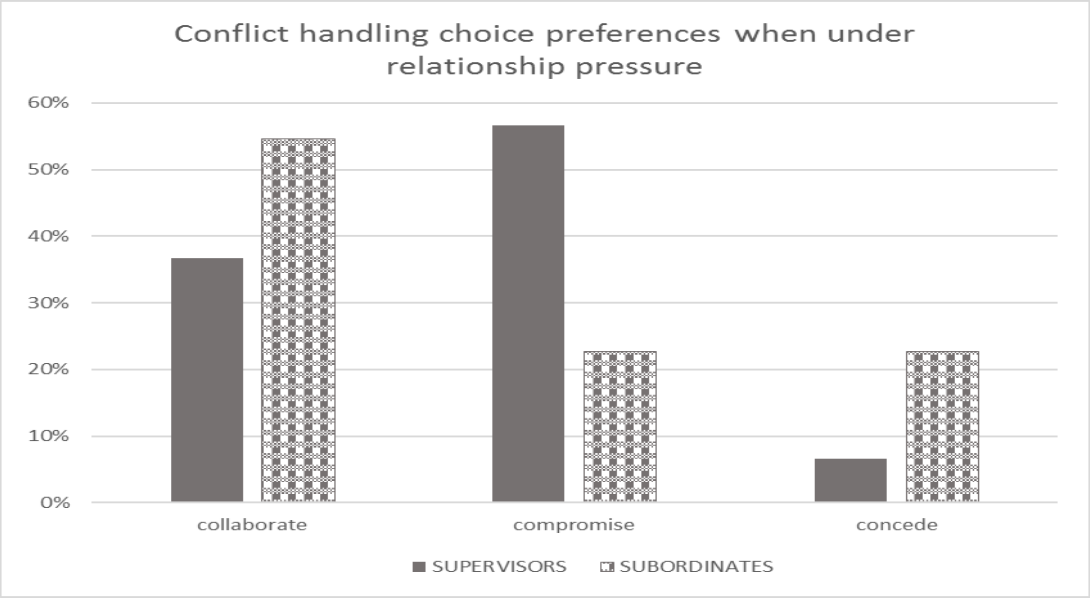


Figure 4.6: survey results pertaining to research question 2 with respect to relationship pressure

The statistical significance of the differences between the means of the three style choices is tested by ANOVA analysis, assuming a null hypothesis (H0) of zero mean difference, confidence interval of 95% and an α of 0.05. Analysis results are shown below.

Table 4.7: ANOVA analysis results pertaining to research question 2 with respect to relationship pressure

Groups	*Sum*	*Average*	*Variance*
collaborate	0.912121	0.456061	0.015983
compromise	0.793939	0.39697	0.057594
concede	0.293939	0.14697	0.012897
One-way ANOVA			
Source of Variation	*SS*		*P-value*
Between Groups	0.107686		0.297227
Within Groups	0.086474		
Total	0.194160		

p-value = 0.3
alpha = 0.05 (confidence level = 95%)

p value > alpha ∴ H0 cannot be rejected

4.4 Summary of the results

In answering research question 1, *How do engineering team members handle constructive conflict on task-based issues when under pressure?* The propositions deduced from literature (Kilmann & Thomas, 1977; Shell, 2001; Coburn, 2016), were true only under outcome and relationship pressure for engineering work teams in South Africa, in line with the need for substantive versus relationship outcomes as purported by Gmelch and Carroll (1991) (see Figure 2.4)**.** Where the team is under pressure for time, most respondents opted for collaboration instead of conceding as expected from the literature review.

The obtained survey data were all statistically significant at the 5% significance level when subjected to t-tests with hypothesised zero means of difference, indicating normal distribution within a confidence interval of 95%.

In answering research question 2, *How effective are the styles chosen to nurture productive conflict by engineering teams from the perspectives of the team supervisors and subordinates?* The options most preferred by supervisors and subordinates separately did not coincide for any of the pressure scenarios. Consistently, most supervisors chose to compromise regardless of the pressure scenario presented, while most subordinates preferred collaboration for every scenario.

The statistical significance of collected data at the 5% significance level, when subjected to one-way ANOVA analyses with hypothesised zero difference in means, indicating normal distribution within a confidence interval of 95%.

5 DISCUSSION OF THE RESULTS

5.1 Introduction

The probability of repeated choice selection that is presented in chapter 4, is discussed in this chapter, by applying the principles of Random Utility Theory (RUT) discussed in chapter 3. These probabilities are measured in percentages of survey respondents who pick one conflict nurturing style alternative over the others. See tables below.

Table 5.1: Style choices in response to task-based questions pertaining to Research Question 1 (to test Propositions 1, 2 and 3).

Pressure scenario / Conflict nurturing style choice	Outcome pressure (Survey **Q12)**	Time pressure (Survey **Q13)**	Relationship pressure (Survey **Q14)**
Collaborate (alternative i)	58%	38%	39%
Compromise (alternative j)	17%	25%	19%
Concede (alternative k)	25%	37%	42%

Table 5.2: Style choices by Supervisors in response to task-based questions pertaining to Research Question 2

Pressure scenario / Conflict nurturing style choice	Outcome pressure (Survey **Q15)**	Time pressure (Survey **Q16)**	Relationship pressure (Survey **Q17)**
Collaborate (alternative i)	47%	43%	37%
Compromise (alternative j)	50%	53%	57%
Concede (alternative k)	3%	3%	7%

Table 5.3: Style choices by Subordinates in response to task-based questions pertaining to Research Question 2

Pressure scenario / Conflict nurturing style choice	Outcome pressure (Survey **Q18)**	Time pressure (Survey **Q19)**	Relationship pressure (Survey **Q20)**
Collaborate (alternative i)	57%	47%	40%
Compromise (alternative j)	3%	23%	17%
Concede (alternative k)	13%	3%	17%

5.2 Discussion pertaining to Research Question 1

In line with section 3.6, choices consist of observable and unobservable components (Thurstone, 1927; McFadden, 1986; McFadden & Train, 2000).

$$U = V + E \quad \text{.....(eq.1)}$$

Where there are alternatives, the choice of an alternative can be written as

$$U_i = V_i + E_i \quad \text{.....(eq.2)}$$

Where

U_i is the true but not totally observable stimulus associated with alternative i

V_i is the observable component of alternative i

E_i is the error associated with the unobservable factor of U_i

The link between the observed respondents' choices and the assumption that the respondents are utility-maximisers, can be expressed in probabilities, as

$$P_i = \text{Prob}\,(U_i > (U_j) \text{ and Prob } (U_i > U_k)] \quad \text{.....(eq.3)}$$

$$= \text{Prob}\,(V_i + E_i > V_j + E_j) \text{ and Prob } (V_i + E_i > V_k + E_k)] \quad \text{.....(eq.4)}$$

Assuming the error E is negligible, the equation 4 above can be simplified to

$$P_i = P\,(V_i > V_j) \text{ and } P\,(V_i > V_k) \quad \text{.....(eq.5)}$$

Equation 3 above can read in plain terms as, the probability of repeatedly choosing option i is the same as the probability that a respondent finds greater utility in option i than either j or k.

5.2.1 *Discussion pertaining to Proposition 1*

When working as a team on set deliverables, deviance from this expected outcome often creates anxiety for other team members and the team leader, which can result in conflict (Jehn, 1997; Jehn, Chadwick, & Thatcher).

Literatures suggest the parties in conflict should collaborate when the team is under pressure to reach a consensual solution or realise a desirable outcome such as team harmony, intact reputation, and so on. (Kilmann & Thomas, 1977; CPP, 2015; Gmelch & Carroll, 1991). In this research study, **most respondents opted for collaborating as expected,** as represented graphically in Figure 4.1 and tabulated in Table 5.1. Equation 5 can be used to buttress this stated preference.

To determine the plausibility of this style selection being repeated under similar circumstances, that is, collaborating is the most preferred style when under outcome pressure:

Pi = P (Vi > Vj) and P (Vi > Vk)

Where

P is the probability of choosing an alternative

V is the survey data associated with an alternative

i is the alternative ‘collaborate’

From the responses to Q12 (see Table 5.1),

Vcollaborate = 0.58; Vcompromise = 0.17; Vconcede = 0.25.

Pcollaborate = P (Vcollaborate > Vcompromise) and P (Vcollaborate > Vconcede)]

Pcollaborate = P (0.58 > 0.17) and P (0.58 > 0.25)

which is true in both cases.

As such, engineering teams would most probably repeatedly choose to collaborate under similar conditions.

5.2.2 *Discussion pertaining to Proposition 2*

Time is a scarce resource (Mankins, Brahm, & Caimi, 2014). Keeping progress on track is one of the key performance measurements for team leaders (Center for Business Practices, 2005). This often puts the team leader under pressure to ensure completing the task on time is not jeopardised.

Several literatures recommend compromising when under time pressure (Coburn, 2016; Kilmann, 2011; Shell, 2001) as 'giving a little, getting a little' can help the team reach an agreement quickly. In this research study, **most respondents opted for collaborating** (see Figure 4.2 and Table 5.1). To determine the plausibility of this selection being repeated:

From the responses to Q13 (see Table 5.1),

Vcollaborate = 0.38; Vcompromise = 0.25; Vconcede = 0.37.

Pcollaborate = P (Vcollaborate > Vcompromise) and P (Vcollaborate > Vconcede)]

Pcollaborate = P (0.38 > 0.25) and P (0.38 > 0.37)

which is true in both cases.

As such, engineering teams in South Africa are most likely to repeatedly choose collaboration over compromise, when nurturing conflict under similar time pressure conditions.

5.2.3 *Discussion pertaining to Proposition 3*

Maintaining relationships within a team impacts on successful completion of tasks. How conflict is dealt with has more effect on productivity than the diversity in personalities and capabilities within a team (Farmer & Roth, 1998).

Quite a number of literature recommend conceding when under pressure to maintain a relationship (Gmelch & Carroll, 1991; Altmae, Turk, & Toomet, 2013; Coburn, 2016) as this may help in minimising losses because the valued relationship is preserved. In line with literature, **most respondents opted for conceding** (see Figure 4.3 and Table 5.1).

From the responses to Q14 (see Table 5.1),

Vcollaborate = 0.39; Vcompromise = 0.19; Vconcede = 0.42.

Pconcede = P (Vconcede > Vcompromise) and P (Vconcede > Vcollaborate)]

Pconcede = P (0.42 > 0.19) and P (0.42 > 0.39)

which is true in both cases.

As such, engineering teams in South Africa are expected to repeatedly choose the conceding conflict nurturing style, when nurturing conflict under similar relationship-oriented pressure conditions.

From the results discussed above,

- Engineering work teams prefer to collaborate under task-outcome pressure (Section 5.2.1)
- Engineering work in task-based conflict teams prefer to concede when under pressure to maintain a relationship (Section 5.2.3)
- Engineering work teams go against the grain deduced from literature, by preferring to collaborate when under pressure for time (Section 5.2.2). it is important to point out the fact that collaboration is considered a time-consuming management style (Shell, 2001; Kilmann, 2011; Coburn, 2016).

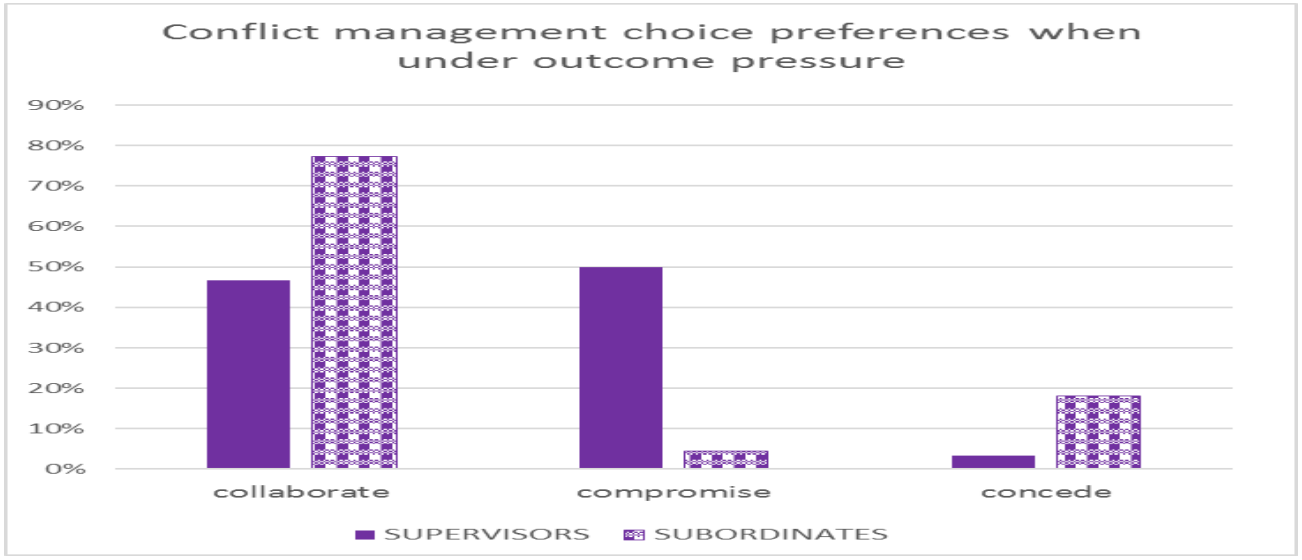
On the other hand, when the questions were more role- and task-specific (sections D and E of Appendix B), there was a change in choices as compared to the more general questions (section C of Appendix B) used to test propositions 1, 2 and 3. It is found that

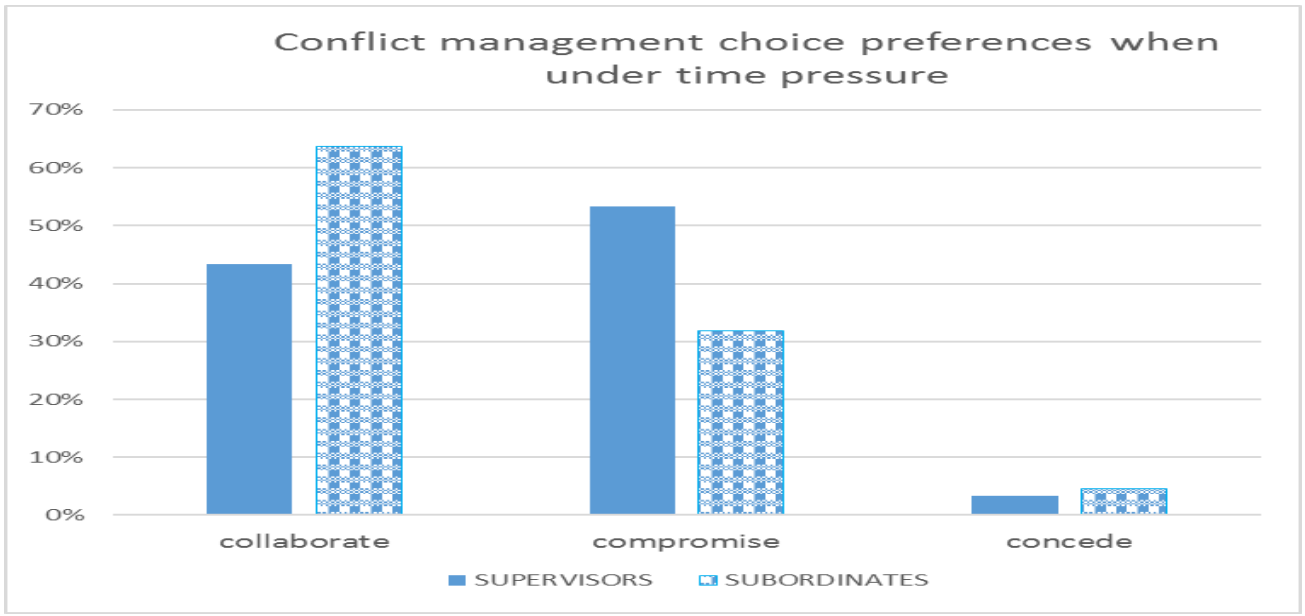
- Most supervisors will compromise under outcome, time or relationship pressure (Section 5.3)
- Most subordinates will collaborate under outcome, time or relationship pressure (Section 5.3)

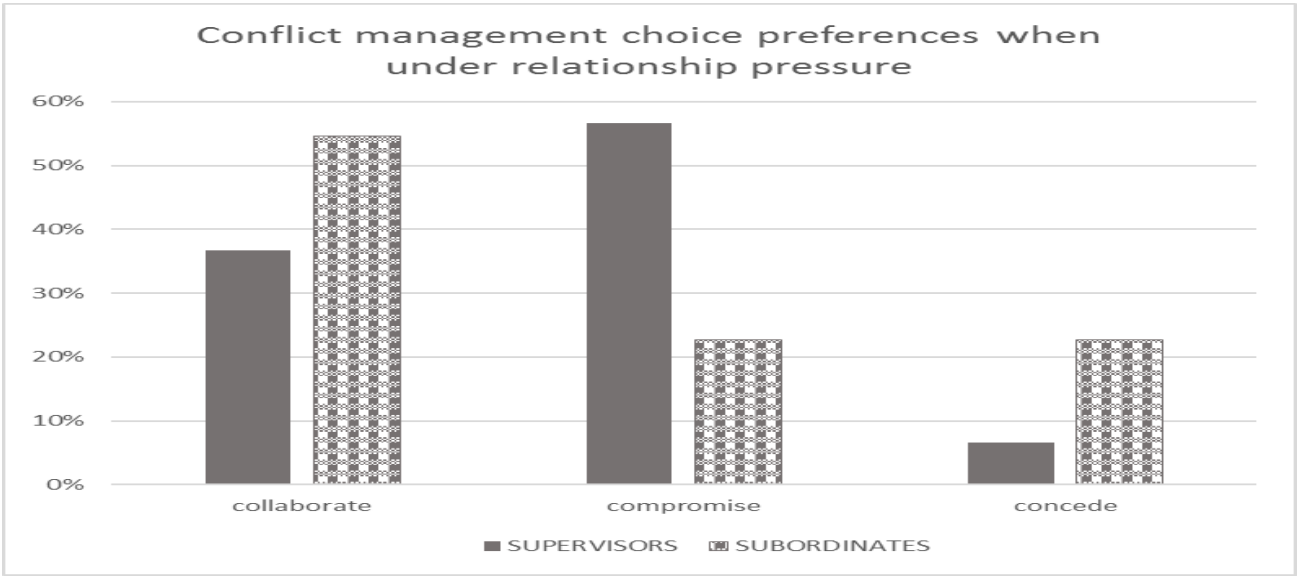
Recalling that compromising is right in the middle of the distributive dimension (partly dominates and partly obliges, see Figure 2.3), it's probably easy to see why most team leaders under pressure will opt for it as a conflict management style, being that it apportions satisfaction partly to the subordinates and partly to himself/herself as the supervisor.

On the other hand, subordinates under pressure seem to always be prepared to collaborate, which on the integrative dimension allows for satisfaction of both parties.

From these results, the role or relative power of the parties in conflict plays a big role in how either chooses to nurture the conflict. The survey data corresponding to research question 2 are depicted in Figures 4.4, 4.5 and 4.6, shown below for ease of reference.


Conflict management choice preferences when under outcome pressure
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
collaborate
compromise
concede
SUPERVISORS
SUBORDINATES


Conflict management choice preferences when under time pressure
70%
60%
50%
40%
30%
20%
10%
0%
collaborate
compromise
concede
SUPERVISORS
SUBORDINATES


Conflict management choice preferences when under relationship pressure
60%
50%
40%
30%
20%
10%
0%
collaborate
compromise
concede
SUPERVISORS
SUBORDINATES

5.3 Discussion pertaining to Research Question 2

Picking up from the trends observed from the survey data, reality may vary from what is presumed ideal. Reaction to conflict varies with

- Presence or absence of pressure, and
- Role within the team.

Research Question 2 seeks to uncover the most beneficial intersection between the two notions listed above, where both supervisors and subordinates can potentially administer a productive conflict nurturing style optimally even when under pressure.

As such, where a high proportion of both supervisors and subordinates select the same style (highest mode with least variance), then the chosen style is deemed to be effective in that situation. This method is similar to the 'measurement of satisfaction' between conflict senders and receivers in the research study by DeChurch, Hamilton, and Haas (2007).

In tabular form, the survey data that answers research question 2 is as given below in Tables 5.4, 5.5 and 5.6. For all three pressure scenarios, the most effective style would be that with the highest mode and low variance.

Table 5.4: Variances and modes of frequency between style selection between supervisors and subordinates when under outcome pressure

	Outcome pressure		
	Group collaborate	Group compromise	Group concede
Supervisors	47%	50%	3%
Subordinate	77%	5%	18%

ANOVA analysis (Table 4.5)

SUMMARY				
Groups	*Sum*	*Variance*	*Source of Variation*	*SS*
Collaborate	1.239394	0.046837	Between Groups	0.273287
Compromise	0.545455	0.103306	Within Groups	0.161166
Concede	0.215152	0.011024		

The ANOVA anlaysis shows that the least SS (sum of squares of deviation) occurs within groups, implying that the means of data grouped by style alternatives are close.

When an engineering team is presented with a pressure-scenario to achieve a task-outcome, the following deductions can be made

- From Table 5.4 above, most supervisors prefer to compromise while most subordinates prefer to collaborate. This difference in preference may be due to the role-disparity between both groups of respondents – the supervisors may want to exert some assertion by offering a re-assignment of the task while the subordinate understandably prefers the option of being supported through the process.
- The highest variance between the preferred choices of supervisors and subordinates occurs with the choice of compromising (see ANOVA analysis summary above). Potentially, supervisors' instinct of compromising under task-pressure may result in secondary conflict as this style was the least favoured by subordinates.
- The conflict nurturing style that would most likely be effective when under task-outcome pressure, based on the ANOVA analysis, is **collaboration**, as it is the group with the highest sum (most selected) with low variance. This is in line with expectations from literature reviewed in chapter 2.

Table 5.5: Variances and modes of frequency between style selection between supervisors and subordinates when under time pressure

	Time pressure		
	Group collaborate	Group compromise	Group concede
Supervisors	43%	53%	3%
Subordinate	64%	32%	5%

ANOVA analysis (Table 4.6)

SUMMARY				
Groups	*Sum*	*Variance*	*Source of Variation*	*SS*
Collaborate	1.069696	0.020610	Between Groups	0.271102
Compromise	0.851515	0.023145	Within Groups	0.043829
Concede	0.078787	7.346E-05		

The ANOVA anlaysis shows that the least SS (sum of squares of deviation) occurs within groups, implying that the means of data grouped by style alternatives are close.

When an engineering team is faced with time pressure as seen from this research study, the following deductions can be made

- As anticipated in literature, most supervisors chose to compromise; while most subordinates deviated from the expected norm by choosing to collaborate, as can be seen in Table 5.5.
- Again, the style choice with the highest variance between the preferences of supervisors and subordinates is compromising (see ANOVA analysis summary above). Applying this style under these circumstances may lead to more conflict.
- The survey results suggest that when an engineering team is pressured for time, the most effective conflict nurturing style is **collaboration,** seeing that it is the most preferred with a low variance as shown in the ANOVA analysis above.

Table 5.6: Variances and modes of frequency between style selection between supervisors and subordinates when under relationship pressure

	Outcome pressure		
	Group collaborate	Group compromise	Group concede
Supervisors	37%	57%	7%
Subordinate	55%	23%	23%

ANOVA analysis (Table 4.7)

SUMMARY				
Groups	*Sum*	*Variance*	*Source of Variation*	*SS*
Collaborate	0.912121	0.015983	Between Groups	0.107686
Compromise	0.793939	0.057594	Within Groups	0.086474
Concede	0.293939	0.012897		

The ANOVA anlaysis shows that the least SS (sum of squares of deviation) occurs within groups, implying that the means of data grouped by style alternatives are close.

While many authors (Coburn, 2016; Kilmann, 2011; Shell, 2001) may consider conceding the most effective style when there is pressure maintain a relationship, the style garnered the least selection from the survey respondents by both supervisors and subordinates alike as seen in Table 5.6 and its ANOVA analysis. Even though the pressure scenario is different, compromising is still the choice with the highest variance while **collaboration** is still deemed the most effective, garnering the most selection with low variance.

5.4 Conclusion

It is note-worthy that 79% of the participants in the survey do not consider conflict to be altogether negative (see Appendix E).

In conclusion from the results presented in Table 5.1, proposition 1 holds true for South Africa's engineers in work teams when nurturing task-based conflict, seeing that most respondents chose to collaborate under outcome pressure. This outcome is statistically significant at the 5% significance level, and based on the RUT methodology applied in section 5.2.1, is likely to repeatedly be the style choice in similar scenarios.

However, proposition 2 does not hold true for South Africa's engineers in work teams when under pressure to manage task-based conflict. Most respondents preferred to collaborate still, as shown in Table 5.1, even though the pressure scenario is now founded on time, which is considered a consumed resource by employing this conflict handling style. This outcome is also found to be statistically significant at the 5% significance level, and based on the RUT methodology applied in section 5.2.2, is plausibly the style choice in similar scenarios, recurrently.

In line with literature, proposition 3 holds true for South Africa's engineers in work teams when nurturing task-based conflict under relationship-oriented pressure. The revealed stated style preference for most respondents is conceding. This observation from the administered survey is found to be statistically significant at the 5% significance level, and based on the RUT methodology applied in section 5.2.3, and is most probably the preferred choice in similar scenarios, repeatedly. Expectedly, it is better to maintain harmony with valued team members by emphasizing areas of agreement rather than differences.

To answer research question 1, survey data shows that engineers in South Africa's downstream oil and gas industry teams will nurture productive task-based conflict by

- **Collaboration** when under pressure to realise an **outcome**
- **Collaboration** when pressured for **time**
- **Conceding** (accommodating) when under pressure to maintain a **relationship**.

On probing survey data in response to specified task-based conflict scenarios, the observation is

- Most **supervisors** will **compromise** under outcome, time or relationship pressure
- Most s**ubordinates** will **collaborate** under outcome, time or relationship pressure

To answer research question 2, survey data shows that engineers in South Africa's engineering teams will most probably find **collaboration** the most effective conflict management style while nurturing productive task-based conflict when under outcome pressure, time pressure or relationship pressure.

Discussion of results pertaining to research question 2, in section 5.3, also highlight the fact that mismatched preferences in conflict handling styles can lead to greater variances, in other words more conflict, as seen in the ANOVA analysis. This is where studies on dominant leadership styles and emotional intelligence can play a big role in ensuring effective conflict handling as it entails understanding one's self, the situation and the others involved which requires self-awareness, self-management, social awareness, and relationship management (Goleman, 2004; Goleman, 2001; Jung & Yoon, 2012; Morrison, 2008; Dr. S. Williams, 2016).

6 CONCLUSIONS AND RECOMMENDATIONS

6.1 Introduction

Observations from this research study are summarised in this chapter in comparison to the objectives as set out in section 1.5. Section 6.2 draws conclusions on the research study from which recommendations are mined and presented in Section 6.3. Section 6.4 lays out suggestions for future research which potentially can add value to the school of thought that conflict nurturing holds promise for enhancing team productivity.

6.2 Conclusions of the study

The words conflict and nurture are not typically paired. However, it has been firmly established in literature that not all conflict should be exterminated or constricted. All conflict should not be viewed through the same lenses as problems to be extinguished, but rather that the conflict may be serve as an opportunity for growth (Pahlau & Ferguson, n.d.). Where the conflict is deemed healthy and constructive, and possesses potentials of contributing viable alternatives that can augment the team's productivity (Rothman, 1997), such conflict should be nurtured and in fact stimulated.

Many studies have found collaboration to be the most utilised conflict handling style (Farmer & Roth, 1998). This study however finds that when teams are under pressure, they may choose to handle conflict differently.

The purpose of this study was to understand how South Africa's engineering teams (supervisors and subordinates) prefer to handle healthy conflict. In general, the respondents made choices in line with trends predicted in literature for task-outcome and relationship-oriented pressure, but deviated when the scenario posed was related to time pressure.

The findings pertaining to research question 1, *How do engineering team members handle constructive conflict on task-based issues when under pressure?* are summarised below in section 5.4. With regards to sub-problem 1, the following have been identified by this research study as the conflict nurturing styles employed by engineering teams when under pressure:

- As proposed in literature, **collaboration** was the preferred conflict handling style when engineering teams are under pressure to realise an **outcome**
- **Collaboration, not compromising,** was the most selected style when engineering teams pressured for **time**
- In line with literature, **conceding** (accommodating) was the most prevalent conflict nurturing style of choice when under pressure to maintain a **relationship**.

This study also sought to understand how well the style choices opted for by South Africa's engineering team supervisors matched the styles opted for by subordinates. Baron (1988) argues that poor correction is perceived as a more relevant cause of conflict than actual competition over resources.

This premise of residual or secondary conflict resulting from mismatched, hence ineffective, conflict handling preferences to handle healthy conflict, formed the basis for research question 2, *How effective are the styles chosen to nurture productive conflict by engineering teams from the perspectives of the team subordinates and supervisors?* The findings from the research survey showed that supervisors' preferences did not match those of the subordinates in any of the pressure scenarios presented. The findings are summarised in section 5.4. With regards to sub-problem 2, evaluating the perceived effectiveness of style choices by supervisors and subordinates showed a variance in their dominant preferences as shown below:

- Most **supervisors** will **compromise** under outcome, time or relationship pressure
- Most s**ubordinates** will **collaborate** under outcome, time or relationship pressure
- However, based on ANOVA analysis, the conflict nurturing style deemed most effective is **collaboration** under outcome, time or relationship pressure, as this choice was the most frequently selected with the low variance within the choice group.

6.3 Recommendations

Seeing that there is an inherent strategic advantage for businesses that promote a healthy conflict climate (Thomas, 2008), it is therefore prudent to note the dynamics of work teams and enhance these dynamics productively (Eisenhardt, Kahwajy, & Bourgeois III, 1997).

Following from the results pertaining to research question 1, engineering teams should be cognisant of the fact that different situations often warrant different conflict handling strategies (Rahim, 2002; Kilmann, 2011).

It may be helpful to conduct exercises that reveal personality traits and dominant leadership strategies during conflict from the onset of team formation. Both supervisors and subordinates may derive beneficial value from self-awareness, self-management, social awareness, and relationship management.

Having this knowledge afore-hand, may help a team that find itself employing conflict handling styles with mismatched preferences between the effector and the receptor, adjust the style opted for.

Seeing as the three conflict nurturing styles fall within the extraversion dimension, as depicted in Figure 2.3, it may be imperative that team members develop extraversion to an appreciable degree on task-related issues. As found by Higgs (2001), the emotional intelligence elements motivation, influence and intuitive decision-making are likely precursors to the MBTI extraversion type, and Goleman (2004) is of the opinion that emotional intelligence can be learned. All in all, nurturing productive conflict effectively can attract rapport, empower inclusion, foster progress, catalyse transformative learning, and boost productivity.

6.4 Suggestions for further research

Despite growing evidence of the positive relationship between productive conflict and increased team productivity (Thomas, 2008; Tjosvold, 2008), this area of business study has not benefited from wide research studies. Further research focus areas could be:

- Organisational or interpersonal interactions
- Social and structural pressures
- Emotion-based conflicts.

A wide selection of geographical and industrial sectors, engineering or other, abounds to study the nurturing of productive conflict, constriction of destructive conflict, or even conflict management in general.

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APPENDIX A: Motivation letter to participants

09 Aug 2016

Dear Participant:

My name is Moyo and I am a postgraduate student at the Wits Business School. For my research project, I am examining conflict nurturing style choices in South Africa's engineering sector and the effectiveness of those style choices.

Because you are a professional working in the oil and gas downstream sector, or servicing the sector, as part of a team involved in engineering tasks, I am inviting you to participate in this research study by completing the survey accessed via the link provided. The survey will require approximately 15 minutes to complete.

There is no compensation for participating, however, if you are interested in the outcome of this research, the information can be provided on request from your employer.

In order to ensure that all information will remain confidential, please *do not* include your name. Copies of the project will be provided to my supervisor Drikus Kriek (Prof) PhD, MA, MBA (cum laude), an Associate-Professor and Director of the Leadership Development Centre, Wits Business School.

If you choose to participate in this project, please answer all questions as honestly as possible. Participation is strictly voluntary and you may refuse to participate at any time. There no known risk in participation.

Thank you for taking the time to assist me in my educational endeavours. The data collected will provide useful information for improving project execution.

By completing and submitting this survey, you are indicating your consent to participate in the study. Your participation is very much appreciated.

If you require additional information or have questions, please contact me at the number listed below. If you are not satisfied with the manner in which this study is being conducted, you may report (anonymously if you so choose) any complaints to the Wits Business School MBA program by calling 011 717 3544.

Sincerely,

Moyo Farinde
Omabelle7@yahoo.com

Prof Drikus Kriek
Drikus.Kriek@wits.ac.za

APPENDIX B: Online survey questionnaire

Question	Pre-populated answer field
SECTION A - BIO DATA	
Q1) Select your gender	Male, Female, I do not wish to disclose
Q2) Select your age group	20-24, 25-29, 30-34, 35-39, 40-44, 45-49, 50-54, 55-59, 60-65, 65+, I do not wish to disclose
SECTION B - EXPERIENCE RELATED	
Q3) What province do you work in?	Eastern Cape, Free State, Gauteng, KwaZulu-Natal; Limpopo; Mpumalanga; Northern Cape; North West; Western Cape *To ensure respondent is part of a team in South Africa*
Q4) What company do you work for?	*Open answer field (not pre-populated, respondent to fill in.*
Q5) Select your work function department	AutoCAD engineering, Chemical engineering, Civil engineering, Electrical engineer, Industrial engineering, Instruments and Controls engineer, Marine engineering, Mechanical engineer, Petroleum engineering, Piping engineer, Project engineer, Quality engineering, Safety Health and Environmental engineering, Other If 'Other', please provide details *To ensure respondent is a professional in an engineering team*
Q6) How many years of industry experience do you have?	0-4, 5-9, 10-14, 15-19, 20--24, 25-29, 30-34, 35+
Q7) Are you in a supervisory role?	Yes, No, Not sure *Only respondents who answer 'Yes' would be directed to Section D*
Q8) How many years of supervisory or management experience do you have?	0, 1-4, 5-9, 10-14, 15-19, 20--24, 25-29, 30-34, 35+ *To confirm if respondent is in a supervisory role or not*
SECTION C - RESEARCH RELATED (Research Sub Problem 1)	
Q9) What would you consider as conflict?	*Open answer field (not pre-populated) to test understanding of the survey's concept*
Q10) What has been the most frequent source of conflict in your experience? Some examples are difference in personal opinions or perceptions, task assigned to team, conflict of interest.	*Open answer field (not pre-populated) to test vastness / limitation of exposure to the survey's concept* *Respondent may have more than one answer*
Q11) Is conflict always negative?	*Open answer field (not pre-populated) to test understanding of the survey's concept*

TO TEST PROPOSITION 1 Q12) Where high impact decisions need to be taken, would you	a) Elicit cooperation by incorporating different viewpoints (collaboration) b) Maintain harmony by emphasizing areas of agreement rather than difference (concede) c) Opt for a solution that satisfies all parties to a degree (compromise)
TO TEST PROPOSITION 2 Q13) Where you are pressured for time, would you	a) Elicit cooperation by incorporating different viewpoints b) Maintain harmony by emphasizing areas of agreement rather than difference c) Opt for a solution that satisfies all parties to a degree
TO TEST PROPOSITION 3 Q14) Where maintaining a relationship matters, with a person or group you are in conflict with, would you	a) Elicit cooperation by incorporating different viewpoints b) Maintain harmony by emphasizing areas of agreement rather than difference c) Opt for a solution that satisfies all parties to a degree
SECTION D - FOR SUPERVISORS (Research Sub Problem 2)	
Q15) Where the stakes are high, and one of your team members, X, seems to be falling short on organising the agreed milestone review meetings that may cause your team to lose credibility with the client, the team member disagrees with your assessment of the need for these meetings, what would you consider the best course of action to ensure the team's reputation is intact?	a) Allow team member X to carry on at his/her pace hoping he/she will meet the deadline (concede)? b) Offer team member X the choice of speeding up on the task by working longer hours for the remnant of the task duration or allow the task to be re-assigned to team member Y (compromise)? c) Discuss team member X's plan for achieving the deadline with a view of providing additional resources (manpower, money, machinery or technology) to assist team member X with completing the task by the initial deadline (collaborate)?
Q16) Where it is essential to maintain the relationship with a team member, Z, who is a subject matter expert that keeps reworking a deliverable in order to achieve perfection beyond the agreed quality metrics, and this is costing you manpower and monetary resources, he/she believes giving the client more would keep them happy but this will cause you to overrun your project budget which is a performance appraisal measurement for you, what would you do?	a) Allow team member X to carry on at his/her pace hoping he/she will meet the deadline (concede)? b) Offer team member X the choice of speeding up on the task by working longer hours for the remnant of the task duration or allow the task to be re-assigned to team member Y (compromise)? c) Discuss team member X's plan for achieving the deadline with a view of providing additional resources (manpower, money, machinery or technology) to assist team member X with completing the task by the initial deadline (collaborate)?

Q17) Where you are pressured for time, and one of your team members, X, seems to be falling behind on a critical deliverable that may cause your team to pay a late delivery fine, the team member disagrees with your assessment of his/her competence and pace, what would you consider the best course of action to ensure the team's progress is on track?	a) Allow team member X to carry on at his/her pace hoping he/she will meet the deadline (concede)? b) Offer team member X the choice of speeding up on the task by working longer hours for the remnant of the task duration or allow the task to be re-assigned to team member Y (compromise)? c) Discuss team member X's plan for achieving the deadline with a view of providing additional resources (manpower, money, machinery or technology) to assist team member X with completing the task by the initial deadline (collaborate)?
SECTION E - FOR DIRECT REPORTS (Research Sub Problem 2)	
Q18) Where the stakes are high, and you seem to be falling short on organising the agreed milestone review meetings that may cause your team to lose credibility with the client, you disagree with your team lead/manager's view of the need for these meetings, what would you consider the best course of action from the lead/manager to keep the team's reputation is intact?	a) Allow you to carry on with the task trusting you will see the need and adjust? b) Offer you the choice of quickly organising the reviews or allow the task to be re-assigned to team member Y? c) Discuss your plan for achieving the deadline with a view of providing additional resources (manpower, money, machinery or technology) to assist you with completing the task by the initial deadlines?
Q19) You keep reworking a deliverable in order to achieve perfection although it is beyond the agreed quality metrics because you believe giving the client more would keep them happy. However, this is exhausting the project manpower and monetary resources, and will cause the team to overrun its project budget which is a performance appraisal measurement for your lead/manager, what would you prefer your lead/manager does, seeing that it is essential he/she maintains the relationship with you, as the team's subject matter expert?	a) Allow you to carry on working on the task trusting you would soon wrap it up? b) Offer you the choice of wrapping up the task or allowing the task to be re-assigned to team member Y? c) Discuss your plan for wrapping up the task with a view of providing additional resources (manpower, money, machinery or technology)?
Q20) Where team lead/manager is pressured for time, and you seem to be falling behind on a critical deliverable that may cause your team to pay a late delivery fine, you disagree with lead/manager's assessment of your competence and pace, what would you consider the best course of action by the lead/manager to ensure the team's progress is on track?	a) Allow you to carry on at your pace trusting you will meet the deadline? b) Offer you the choice of speeding up on the task by working longer hours for the remnant of the task duration or allow the task to be re-assigned to team member Y? c) Discuss your plan for achieving the deadline with a view of providing additional resources (manpower, money, machinery or technology) to assist you with completing the task by the initial deadline?
If your preferred method was not employed, how would you react?	*Open answer field (not pre-populated) to gain some understanding of the impact of unsettled conflict*

APPENDIX C: Survey questionnaire test-retest reliability analysis

		Count of responses - PILOT **TEST**			Count of responses - PILOT **RETEST**		
		ALL (survey section C)	SUPERVISORS (survey section D)	SUBORDINATES (survey section E)	ALL (survey section C)	SUPERVISORS (survey section D)	SUBORDINATES (survey section E)
outcome pressure survey questions (Q12, Q15, Q18)	collaborate	3	0	2	3	0	2
	compromise	1	3	0	1	3	0
	concede	2	0	1	2	0	1
time pressure survey questions (Q13, Q16, Q19)	collaborate	2	2	2	2	2	2
	compromise	3	1	0	3	1	0
	concede	1	0	1	1	0	1
relationship pressure survey questions (Q14, Q17, Q20)	collaborate	2	0	1	2	1	1
	compromise	2	3	1	1	2	1
	concede	2	0	1	3	0	1

The paired t-test method is used to test the statistical significance of the survey responses to the pilot test and the pilot re-test.

The null hypothesis assumes that the variance between the test-retest data is negligible such that the difference between the means of the two sets of data is zero. The alternative hypothesis is that the variance between the test-retest data is not negligible.

H_0 = zero mean difference

$H_a \neq$ zero mean difference (This is two-tailed. A one-tailed hypothesis would assume $H_a <$ zero mean difference or $H_a >$ zero mean difference)

To test the H_0, zero is entered as the value for the hypothesized mean difference when computing the Two-Sample t-test (assuming unequal variances) for the following pairs of survey data:

- ALL: Outcome pressure, time pressure, and relationship pressure for section C of the pilot test *versus* outcome pressure, time pressure, and relationship pressure for section C of the pilot retest
- SUPERVISORS: Outcome pressure, time pressure, and relationship pressure for section D of the pilot test *versus* outcome pressure, time pressure, and relationship pressure for section D of the pilot retest
- SUBORDINATES: Outcome pressure, time pressure, and relationship pressure for section E of the pilot test *versus* outcome pressure, time pressure, and relationship pressure for section E of the pilot retest

The results of the t-test analysis are as follows:

ALL: SECTION C	*Variable 1 (Pilot test)*	*Variable 2 (Pilot retest)*
Mean	2	2
Variance	0.5	0.75
Observations	9	9
Hypothesized Mean Difference		0
df		15
t Stat		0
P(T<=t) one-tail		0.5
t Critical one-tail		1.75305
P(T<=t) two-tail		1
t Critical two-tail		2.13145

p-value = 1
alpha = 0.05 (confidence level = 95%)
t Stat = 0
t Critical (two-tail) = 2.13145

p value > alpha ∴ H0 cannot be rejected
test statistic < critical value ∴ H0 cannot be rejected

SUPERVISORS: SECTION D	*Variable 1 (Pilot test)*	*Variable 2 (Pilot retest)*
Mean	1	1
Variance	1.75	1.25
Observations	9	9
Hypothesized Mean Difference		0
df		16
t Stat		0
P(T<=t) one-tail		0.5
t Critical one-tail		1.745883676
P(T<=t) two-tail		1
t Critical two-tail		2.119905299

p-value = 1
alpha = 0.05 (confidence level = 95%)
t Stat = 0
t Critical (two-tail) = 2.119905299

p value > alpha ∴ H0 cannot be rejected
test statistic < critical value ∴ H0 cannot be rejected

SUBORDINATES: SECTION D	*Variable 1 (Pilot test)*	*Variable 2 (Pilot retest)*
Mean	1	1
Variance	1.75	1.25
Observations	9	9
Hypothesized Mean Difference		0
df		16
t Stat		0
P(T<=t) one-tail		0.5
t Critical one-tail		1.745883676
P(T<=t) two-tail		1
t Critical two-tail		2.119905299

p-value = 1
alpha = 0.05 (confidence level = 95%)
t Stat = 0

t Critical (two-tail) = 2.119905299

p value > alpha ∴ H0 cannot be rejected
test statistic < critical value ∴ H0 cannot be rejected

APPENDIX D: Survey questionnaire external validity analysis

		PILOT TEST	ACTUAL SURVEY
		ALL (survey section C)	ALL (survey section C)
outcome pressure survey questions (Q12, Q15, Q18)	collaborate	50%	58%
	compromise	17%	17%
	concede	33%	25%
time pressure survey questions (Q13, Q16, Q19)	collaborate	33%	38%
	compromise	50%	25%
	concede	17%	37%
relationship pressure survey questions (Q14, Q17, Q20)	collaborate	33%	38%
	compromise	33%	19%
	concede	33%	42%

The paired t-test method is used to test the statistical significance of the survey responses to the pilot test and the actual survey.

The null hypothesis assumes that the variance between the pilot-actual data is negligible such that the difference between the means of the two sets of data is zero. The alternative hypothesis is that the variance between the pilot-actual data is not negligible.

H_0 = zero mean difference

$H_a \neq$ zero mean difference (This is two-tailed)

To test the H_0, zero is entered as the value for the hypothesized mean difference when computing the Two-Sample t-test (assuming unequal variances

The results of the t-test analysis are as follows:

ALL: SECTION C	*Variable 1 (Pilot test)*	*Variable 2 (Pilot retest)*
Mean	0.33	0.33
Variance	0.0139	0.0166
Observations	9	9
Hypothesized Mean Difference		0
df		16
t Stat		9.5309 E-16
P(T<=t) one-tail		0.5
t Critical one-tail		1.74588
P(T<=t) two-tail		1
t Critical two-tail		2.1199

p-value =	1
alpha =	0.05 (confidence level = 95%)
t Stat =	9.5309 E-16
t Critical (two-tail) =	2.1199
p value > alpha	∴ H0 cannot be rejected
test statistic < critical value	∴ H0 cannot be rejected

APPENDIX E: Profile of Survey respondents

