Development and validation of the team grit scale

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Declaration

I, Paula Audrey Buchel, declare that the thesis/dissertation which I hereby submit for the degree Doctor of Philosophy at the University of Pretoria, is my own work and has not previously been submitted by me for a degree at this or any other tertiary institution.

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Abstract

The aim of this research was to build a valid and parsimonious scale to measure team grit. The construct of team grit is in its nascency with very little empirical research or theoretical explication of the construct. Given the importance of teams in society, including in work organisational contexts, and the identification of grit at the individual level, the researcher argues that team grit is an important driver of team effectiveness. Although several team-level measures exist, no scale exists for measuring grit in teams. Due to the lack of research into grit at a collective level the starting point for the study was to explicate the domain of team grit through a review of literature. Following the development of the team grit domain, a qualitative study was undertaken through ten team focus groups. The proposed elements of team grit were tested, and team functioning was explored. These engagements offered a deeper understanding of the team grit construct. An item pool was drafted from literature and the focus groups, and tested with expert reviewers, who were scholars in the field of organisational behaviour, grit, and scale development.

The main quantitative phase included four waves of data collection from 938 respondents across multiple countries. The first exploratory factor analysis wave was conducted among South African respondents obtained through social media. A second exploratory study, among South African respondents in business, was used to purify the scale. The third wave, based on data from the USA, again explored the factor structure and offered a confirmed factor structure for testing nomological validity. The fourth and final UK based panel data confirmed the factor structure, as well as the measurement invariance across the final two datasets. The resultant eight-item and two factor scale has discriminant validity in relation to individual grit. The scale also displays nomological validity, and evidence was found for metric, scalar and residual invariance across geographical samples.

This study contributed to theory in identifying two closely connected factors which constitute team grit. It also empirically links team grit to antecedents of team psychological safety and team goal commitment. Moreover, team grit predicts team innovation and team work engagement. The scale offers a new construct for measuring an important team quality, thus making a strong methodological contribution. For practitioners, the scale offers an opportunity to measure team grit with team development implications that may boost innovation and engagement.

Key Words: Team grit, grit, scale development, validity, nomological value, invariance.

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1 Chapter 1: Introduction

The aim of this research was to theorise the construct of team grit and develop a scale to measure grit in teams. Teams have become the cornerstone of organisational structures and are now common across organisations (Mathieu et al., 2017; Salas et al., 2018) with an increasing shift being seen towards the use of teams (DeShon et al., 2004). So important are teams to organisations, that they have been described as the "building blocks of modern organisational designs" (Mathieu et al., 2017, p. 460). Work teams have also become more complex over time and now include self-managed teams, virtual teams, multi-teams, and teams that assemble for short or long periods of time (Mathieu et al, 2018). These developments, combined with the introduction of multilevel research designs, which recognise the importance of levels of analysis in team research, have fuelled rapidly growing interest in this field (Mathieu et al., 2017). Team effectiveness is an area that has garnered much research interest. Organisations have noted that teams can be more effective than the sum of the individuals within them (Salas et al., 2018), leading to a drive to better understand team effectiveness (Salas et al., 2018). Therefore, it is important to continue to understand the antecedents of team effectiveness.

Several team-level constructs have been shown to be positively related to team effectiveness, and research into team outcomes and performance continues to expand. Examples of these include team efficacy (Bernardy & Antoni, 2021; Lindsley et al., 1995), team potency (Gully et al., 2002), team resilience (Meneghel et al., 2016), collective goals (Fitzsimons et al., 2016) and team entrepreneurial passion (Cardon et al., 2017). Each of these team constructs has been shown to have positive team outcomes. However, team grit is largely absent from the team literature and from empirical study. There is a paucity of research into team grit, with only a single journal article focused on the construct, and that being a theoretical explication of the construct and propositions on how it might function, specifically with regard to innovation teams (Bernardy & Antoni, 2021).

This research aimed to expand the literature on team grit by developing and validating the team grit scale. Although team grit is a nascent construct, it was believed to derive from its individual-level counterpart, individual grit, which has been extensively researched since the seminal study in 2007 by Angela Duckworth and her colleagues. That study introduced the grit construct, and developed and validated an instrument to measure individual grit (Duckworth et al., 2007). In researching the realm of individual performance and achievement, Duckworth and colleagues identified grit as the trait held in common by those who excel, regardless of their intellectual capabilities (Duckworth et al., 2007). They

defined grit as “perseverance and passion for long-term goals” (Duckworth et al., 2007, p. 1087). Research has shown grit to be positively correlated with performance, and to be a better predictor of performance than intelligence or conscientiousness (Duckworth et al., 2007). Duckworth and colleagues developed and validated the Grit Scale (Duckworth et al., 2007) and subsequently the Short Grit Scale (Duckworth & Quinn, 2009) and in so doing identified a two-factor structure for grit. They found that grit was comprised of Perseverance of Effort and Consistency of Interest. Perseverance of effort suggests that a gritty person has stamina and approaches challenges as a marathon, rather than a sprint, even in the face of setbacks. This perseverance aspect of grit has become the hallmark of grit in much literature. However, grit is also about consistency in the interest – or the goal – that inspires the pursuit. The goal is that long-term interest that captures the gritty person and which energises and mobilises them as they pursue it without distraction. Gritty persistence and goal-focus is enabled by passion. That is, the positive emotion which provides the fuel in pursuing that goal.

In developing a measure of team grit this study made several contributions. Firstly, theoretically, by explicating the nature of the team grit construct and in so doing distinguishing it from individual grit. Furthermore, team grit’s dimensionality was determined, as was its relationship to other constructs in a nomological net. This theoretical contribution was to extend the grit literature beyond the individual level and contribute to the growing body of team domain literature. Methodologically, the scale itself is the contribution, adding to the domain an instrument for further use in research across several areas, enabling future researchers to assess how team grit operates in relation to other constructs. Finally, the scale made a practical contribution, providing a valid instrument to assess team grit in organisational settings. This will be useful to human capital professionals and corporate leaders aiming to improve team outcomes. It further offers the opportunity for practitioners in organisations or team coaches and consultants to test the effectiveness of team-level interventions by measuring team grit before and after such interventions. The research asked questions about the domain specification, measurement, and value of the new team grit construct.

1.1 Background to the study

Teams are increasingly regarded as a fundamental mechanism around which companies are organised and function. There is a growing body of literature focused on teams, and many team-level constructs receive a great deal of focus in empirical and conceptual studies. This

is in response to growing understanding of how collective constructs work, and an appreciation of the fact that constructs behave differently at different levels, whether individual, team or organisation-level (Kozlowski, 2018; Mathieu et al., 2017; Salas et al., 2018). Much of the team-based research focuses on the positive outcomes that are possible with teams. But to date almost no emphasis has been placed on team grit, despite the expectation that like individual grit, team grit may have positive outcomes (Lee & Duckworth, 2018), and despite several calls for research into collective constructs and collective grit in particular (Bernardy & Antoni, 2021; Jordan et al., 2019; Luning et al., 2022; Schimschal et al., 2021).

One branch of extant grit research points to the potential for the study of grit at the collective level. This is the study of individual grit in collectivistic cultures, where the social and relational aspects of grit are prominent. Whereas grit was originally conceptualised as an individual's committed personal pursuit of their goals over time, research in collectivistic environments is pointing to a focus on common interests as fundamental to individual grit (Datu et al., 2021). In their global study of grit's relationship with wellbeing and strengths Disabato, Goodman and Kashdan draw the following conclusion: "Grit may be characterized by consistent striving for a personal goal that can be accomplished (e.g., becoming president of a company) in individualistic countries, whereas grit may be characterized by personal goals that are more relational or growth oriented (e.g., be a better parent) in collectivistic countries" (Disabato et al., 2019, p. 14). They propose that in these cultures an individual's passion and interest for long-term goals operates in relationship to others. Datu (2016) also notes that individuals in collectivistic cultures place greater importance on the goals of their group than on their individual goals and are likely to focus on goals that align to the goals of other people, rather than prioritising their own individualistic goals. These studies propose that group-aligned individual goals are an important facet of grit in collectivistic cultures. Although not the same thing as collective grit, there is clearly a relational and social dynamic that plays a role in grit's operationalisation in these cultural environments. This provides further impetus for research into shared goals and collective grit. The current research proposes that grit at the collective level (team grit) will emerge wherever individuals with grit work together in a team, and this process of team grit emergence ought to occur in work-based teams across geographical and cultural divides. However, the argument above for individual grit's relationship and social qualities does lend support for the arguments around the development of team grit. Based on the hypotheses articulated above regarding the importance of the relational and shared qualities of grit's goal pursuit in collectivist countries, it may be that team grit will be particularly strongly operationalised in these environments. It is hoped that this research offers a response

to the call for research into how social factors might drive grit and how social, interpersonal and contextual factors might be linked to the construct of grit (Datu, 2021).

In recent years the seminal author of individual grit, Angela Duckworth, has pointed to the value of understanding grit at a collective level, both at organisation level as well as team level (Lee & Duckworth, 2018). One such study was a qualitative empirical study researching grit at the organisational level in the military, and framing it as an organisational culture (Luning et al., 2022). Another was a theoretical explication of the construct of team grit and how it operates in innovation teams (Bernardy & Antoni, 2021). At the time of this study the theory of team grit was under-developed but, given the promise of its contribution to multi-level theory and team theory, the researcher anticipates this domain to receive substantial academic interest in years to come.

1.2 Problem statement

For any domain to be expanded it is necessary to conduct quantitative research to assess predictive relationships within that domain. In academic research the scale is one mechanism to enable quantitative research (DeVellis, 2003; Worthington & Whittaker, 2006). Prior to the current research no measure existed for team grit. The absence of a scale to measure team grit is an obvious challenge to the development of the team grit domain.

Individual grit is measured using the Grit scale. Duckworth and colleagues developed and validated two different grit scales. The original grit scale was developed in 2007 and named the Grit-O (Duckworth et al., 2007). However, in order to improve the scale's reliability, it was later shortened, resulting in the Grit-S scale (Duckworth & Quinn, 2009). The grit scale comprises two factors - consistency of interests, where an individual keeps their focus on a goal they have set and other interests do not distract them from that goal; and perseverance of effort, which sees the individual working toward that goal without tiring and with determination, and where they continue that pursuit even in the face of challenges and despite experiencing setbacks (Duckworth et al., 2007). The dimensionality of the individual grit construct is important for identifying what the dimensions of team grit may include.

Firstly, grit is about an individual's pursuit of their goals (Duckworth et al., 2007). Mathieu and colleagues (2017) suggest that teamwork is essentially the "integration of individuals' efforts toward the accomplishment of a shared goal" (Mathieu et al., 2017, p.458) Secondly, grit is about persistence and perseverance. Much research has demonstrated that motivational states, such as efficacy, potency, and goal orientation, exist at the team level, and these enable teams to persist in their challenges, a key component of grit (Gully et al., 2002; Mathieu et al., 2014). Lastly, grit is emotive in that it requires passion in the pursuit of the goal. Teams

have been shown to have passion towards their goals (Cardon et al., 2017) and group level emotion has been shown to exist and to emerge in the interactions between team members (Barsade & Gibson, 1998). Passion is a positive emotion (Cardon et al., 2009; Marsh et al., 2013), and one which, when employed collectively towards a shared goal, will likely contribute towards the emergence of team grit. In the absence of an extant team grit scale, the dimensions of individual grit become important inputs in developing the construct of team grit.

A study on team grit requires a context in which teams are present. This research has identified the organisational work context as an area where team grit is likely to be valuable. To date, even at the individual level, and despite the growing interest in team processes and motivational states, only a few empirical studies on grit have been conducted in work settings (Eskreis-Winkler et al., 2014; Ion et al., 2017). Much research on individual grit has been conducted in schools and universities where it has focused on academic achievement (Strayhorn, 2014; Vela et al., 2015) and some in healthcare settings (Schimschal et al., 2021; Stoffel & Cain, 2018; Walker et al., 2016). Fewer studies have located their grit research in organisations, and those that have, have produced mixed findings about grit's relationship to performance outcomes. Some have suggested that grit is not adequately differentiated from conscientiousness in predicting work-related performance outcomes (Credé et al., 2017; Ion et al., 2017). Others believe that extant research has focused on the perseverance aspect of grit to the detriment of the goal-oriented passion aspect (Jachimowicz et al., 2019). Some criticism of workplace grit is centred on the grit scale, finding that the perseverance dimension shows significant correlation with performance, but the consistency of interest dimension does not (Credé et al., 2017). There is clear a gap in the research with differing views on how to build on the grit literature in organisations and, furthermore, to extend that to the team-level.

This research addresses the gap in the extant literature by developing and validating a scale to measure team grit, and by studying team grit in the organisational setting, and clearly delineating it from individual grit. Accordingly, the following research questions are proposed:

'What is team grit?'; 'How is team grit different from individual grit?'; 'How best can team grit be measured and psychometrically operationalised?'; and 'How does team grit fit into a net of team constructs?'

1.3 Research purpose

The purpose of the research was to determine what team grit is and how it could be measured. To answer the research questions the study had the following objectives: Firstly, to theoretically explicate the construct of team grit and distinguish it from individual grit; secondly, to develop items for the team grit scale and determine the factor structure for the scale; thirdly,

to establish the validity and reliability of the scale; fourthly, to assess the usability of the scale within a nomological net; and lastly, to establish the invariance of the scale across groups.

1.4 Contribution

This study makes a theoretical contribution to the domain of grit, in extending the theory of grit to the team level. The study further contributes to the team literature by defining and detailing the construct of team grit, including its dimensions, and its relationship to other constructs. Extending the theory of individual grit with the conceptualisation and measurement of team grit, in effect expands the understanding of what it means to flourish within a team. Additionally, in the study, the dimensions of team grit are identified and its relationships to other constructs within the nomological net in which it functions. Further, in differentiating team grit from individual grit, the study offers insight into the relationship between individual and team-level grit.

The research also has methodological value, in developing and validating a new scale, one which measures a construct that has not been measured before. The team grit scale enables scholars to further study the domain of team grit, and the broader team domain. The methodology employed to develop the scale was a mixed method approach, including team focus groups and surveys. In this way the study contributes to the mixed method research domain.

Finally, this study makes a practical contribution by contributing a scale which can be used by practitioners to further their understanding of team grit in several environments. Given the fundamental importance of teams to modern organisations and the value placed in them as the means to achieve organisational outcomes, the insights that this research offers into team functioning and enhanced performance through the emergence of team grit, will be of great benefit to individuals, teams, and organisations. It is expected that practitioners, consultants, and corporate leaders will find use in the scale, to assess the grittiness of teams within their organisations, and to measure the impact of team interventions.

1.5 Glossary of key terms

Grit: "Perseverance and passion for long term goals" (Duckworth et al., 2007, p.1087).

Team grit: "A team's competence to pursue common long-term goals despite adversities with passion and perseverance" (Bernardy & Antoni, 2021, p.68)

Nomological validity: "The degree to which predictions in a formal theoretical network, known as a nomological net, are confirmed" (Hagger et al., 2017, p.1)

Measurement invariance: "Measurement invariance assesses the (psychometric) equivalence of a construct across groups or measurement occasions and demonstrates that a construct has the same meaning to those groups or across repeated measurements" (Putnick & Bornstein, 2016, p.71)

2 Chapter 2: Literature Review

2.1 Introduction

In order to answer the research questions posed in the study it is necessary to build an argument from existing literature. Given the paucity of literature on team grit, a degree of theory construction is needed. This is done in four stages: first, by critically evaluating the theory of grit at the individual level; second, by investigating the theory of teams and the mechanisms through which team-level constructs emerge; third, by assessing the extant, albeit limited, research into grit at a collective level; and finally, putting forward a theoretical framework for team grit, including antecedents and outcomes within an initial domain specification for the construct. The literature review in the current chapter is organised according to this structure.

2.2 Grit at the individual level

2.2.1 The nature of grit

Duckworth, Peterson, Matthews and Kelly ask the question, "Why do some individuals accomplish more than others of equal intelligence?" (2007, p. 1087). They propose that although certain personality traits are associated with certain career types (for example, extraversion with a career in sales) there is one trait, grit, which predicts success regardless of career type or role. They define grit as "perseverance and passion for long term goals" (Duckworth et al., 2007, p.1087) and described gritty individuals as "working strenuously toward challenges, maintaining effort and interest over years despite failure, adversity and plateaus in progress" (Duckworth et al., 2007, p.1088). The empirical studies conducted by Duckworth and colleagues demonstrated that grit is positively associated with performance and is said to be a stronger predictor of performance than either intelligence or conscientiousness. Their research resulted in the development of the original Grit scale (2007), which was subsequently shortened to the more reliable Short Grit Scale, Grit-S (Duckworth & Quinn, 2009). They identify two factors underpinning grit: consistency of interests, where an individual sets a goal and maintains interest and focus on that goal over time, without being distracted by other interests, and perseverance of effort, which refers to the individual's determination to work tirelessly towards that goal, despite failures and setbacks (Duckworth et al., 2007).

Gritty people's persistence and drive has been evidenced through empirical studies in several life domains, including academic, work and exercise. Research has found that gritty individuals have a high degree of self-regulation (Wolters & Hussain, 2015), are high in self-

control (Duckworth & Gross, 2014) and have a good work ethic (Meriac et al., 2015). They are deliberate in practicing to become more competent at what they do (Duckworth et al., 2011), have high levels of motivation academically (Eskreis-Winkler et al., 2014), and show persistent and committed behaviour in their exercise regime (Reed et al., 2013).

Grit has been shown to be a predictor of performance and other positive outcomes. Gritty people enjoy greater academic achievement than peers of equal intelligence (Duckworth et al., 2007). In particular, the perseverance of effort aspect of grit has been found to be strongly correlated with academic success, while the consistency of interest facet was more weakly correlated (Lam & Zhou, 2022). Grit predicts higher performance in teaching (Robertson-Kraft & Duckworth, 2014), success in a business venture (Mueller et al., 2017) and job retention (Eskreis-Winkler et al., 2014). Grit is positively related to an individual's choice to start their own business (Wolfe & Patel, 2016).

Grit has not only been found to be related to positive attributes or outcomes, however. Arli and colleagues (2020) found that highly gritty individuals were more likely to behave unethically in their pursuit of long-term goals and were more likely to consider cheating and lying acceptable, than those with low grit levels. Lucas and colleagues (2015) found that grit predicted perseverance that was costly to the individual, that is, gritty people persevered on a task even after this task was no longer beneficial to them.

Given that grit is, in part, defined as passion for goals, it stands to reason that grit would be related to emotion. Grit has been shown to have a positive relationship with positive emotions and a negative relationship with negative ones. Lucas and colleagues found that higher grit predicted greater hope and joy, and reduced disappointment and fear (Lucas et al., 2015). They specifically tested the role of emotions in grit and found grittier participants to be more positive than their less gritty counterparts, holding greater expectations for the task facing them, which partly explained why they chose to persist on tasks. Grit was also found to be negatively related to stress. Meriac and colleagues (2015) investigated the relationship of both grit and work ethic to stress and found that grit explained incremental variance in stress beyond work ethic. They suggested that grittier individuals are better able to respond to stress-inducing situations. Grit has also been shown to be positively correlated with general psychological wellbeing, and negatively related to depression (Salles et al., 2017).

Grit has been shown to have a positive relationship with happiness (Singh & Jha, 2008), as well as with purpose commitment and positive affect (Hill et al., 2016); a sense of satisfaction in life (Singh & Jha, 2008), as well as a sense of meaning in life (Kleiman et al., 2013); and is also positively related to the three factors of wellbeing – psychological wellbeing, harmony

and satisfaction (Vainio & Daukantaitė, 2016), Von Culin and colleagues (2014), in researching the motivational aspects of grit, found that grittier individuals are most likely to be motivated through seeking engagement, secondly through seeking meaning in their lives, and least likely through the pursuit of pleasure. A similar study conducted in Japan (Suzuki et al., 2015) linked grit most closely to meaning, with engagement a secondary, yet still positive relationship, but also found a negative correlation between grit and pleasure. Mueller and colleagues found grit to be positively related to the passion to pursue a business venture (Mueller et al., 2017).

Taken together, perseverance with passion plus the focus on long term meaningful goals, distinguishes grit from constructs such as conscientiousness, goal commitment or resilience, which have similarities to grit (Bernardy & Antoni, 2021; Jordan et al., 2019).

The early grit studies were largely focused on academic domains, but more recently research has extended into the organisational and work context. In referring to grit research, Ion, Mindu and Gorbânescu commented that “so far, very little attention has been paid to testing its relevance for various work-related outcomes.” (Ion et al., 2017., p. 163). Grit studies in organisational settings have included medical practices (Meriac et al., 2015; Salles et al., 2017; Walker et al., 2016), new business ventures (Mueller et al., 2017), and more generically, simply ‘working adults’ (Ion et al., 2017; Suzuki et al., 2015). In these studies, higher grit was shown to correlate with better stress management (Meriac et al., 2015), lowered job attrition (Salles et al., 2017), greater job longevity (Walker et al., 2016), and higher entrepreneurial passion and venture performance (Mueller et al., 2017).

Research has shown that several mediating factors affect the relationship between grit and other constructs. Positive emotions and expectations surrounding a given task were shown to mediate the relationship between grit and the decision to persist on the task (Lucas et al., 2015). In a study on grit and passion in new business ventures, two aspects of self-regulation mediated the relationship: location and assessment. The study found that locomotion amplified grit, but assessment attenuated grit (Mueller et al., 2017). Vainio and Daukantaitė (2016) found a positive relationship between grit and wellbeing and found two important mediators: authenticity of self and coherence. They concluded that gritty goal pursuit requires that the individual has an authentic connection to the self as well as a sense that the world is coherent.

2.2.2 Extending the construct of grit

Over the years since the seminal study (Duckworth et al., 2007) grit has largely continued to be defined along two factors - perseverance of effort (‘perseverance’ in the grit definition) and

consistency of interests (‘passion’ in the definition). The studies above used either the original or shortened grit scale which consist of these two factors. One study stands out as broadening the grit definition. Datu, Yuen and Chen (2017) sought to adapt the grit scale for use in the Philippines, a society considered more collectivist than many Western societies where the grit scale had been used in prior research. The researchers conceptualised that grit would involve a tendency for individuals to adapt while persevering in the pursuit of their goal. They proposed that this tendency would be prominent in collectivistic cultures where social, relational, and context-specific ways of being were more typical, rather than the highly individualistic way of functioning in goal pursuit in more Western nations. They conceptualised that grit would entail a third facet, which they named ‘adaptability to situations. They conclude that this dimension enables gritty individuals to keep focused on their goal while adapting to changes in the context in which they find themselves. Datu and colleagues developed and validated a new grit measure which includes this element of adaptability, the Triarchic Model of Grit scale, or TMGS (Datu et al., 2017). The TMGS has subsequently been shown to be valid in several different contexts, including the Philippines (Datu et al., 2017; Datu et al., 2018), Japan as well as mainland China (Datu & Zhang, 2021), and Hong Kong (Datu et al., 2023).

Since the development and validation of the TMGS several studies have extended the construct through empirical research. Ting and Datu (2020) found relationships between the dimensions of TMG and career development. Notably, they found a significant link between the triarchic model of grit, self-efficacy in making decisions regarding careers, and setting career goals.

2.2.3 The cross-cultural relevance of grit

Since the original development of the grit scale several studies have researched grit in different parts of the world, either developing new scales or adapting (transadapting) the original grit scales (Grit-O and Grit-S) for use in different cultural contexts. One theme emerging is that there may be a difference in the way that the grit factor structure operates in individualistic cultures as opposed to collectivistic cultures (Abu Hasan et al., 2022; Datu et al., 2016; Disabato et al., 2019). Total grit scale reliability was found to be similar in individualistic cultures, while different in collectivistic cultures, and with the latter findings showing a lower reliability for the total scale. In addition, in collectivistic cultures the correlation between the two dimensions of grit was low (Datu et al., 2016; Disabato et al., 2019), suggesting that the grit scale does not measure overall grit in these countries. Datu and colleagues (2016) suggested that the perseverance of effort dimension is more relevant in collectivistic cultures than the consistency of interests dimension, due to the preference n

these cultures for adaptability and flexibility rather than dogged commitment that consistency of interests may denote. Disabato and colleagues (2019) went so far as to advise against using the total scores for Grit-O or Grit-S in collectivistic cultures.

The Triarchic model of grit has been found to be a suitable adaptation of the grit scale for use in collectivistic cultures (Datu et al., 2017, 2018; Datu & Zhang, 2021). In its addition of the adaptability to situations dimension, the TMGS model addresses the cultural preference to be flexible rather than dogged in the pursuit of goals. The model suggests that collectivistic cultures still pursue their goals but with a willingness to respond to situations and to others around them, and they adapt their strategies for goal pursuit. As is pointed out later in this study, adaptability is an attribute that is gaining greater acknowledgement in the grit construct (Southwick et al., 2019).

In contrast to some of the findings reported above some studies have found that grit's relationship with other constructs operates similarly across cultural contexts (Areepattamannil & Khine, 2018; Lam & Zhou, 2022). For instance, Lam and Zhou (2022) conducted a meta-analysis of 137 studies and found a positive relationship between grit and academic achievement in students. They determined that there was no significant difference in the strength of this association between individualistic and collectivistic cultural contexts.

It is evident that further research is required into the growing field of cross-cultural grit and adaptability as an important dimension of the grit construct.

2.2.4 Domain-specific models of grit

The grit domain continues to expand beyond the original 'individual grit' into new domains, conceptualising grit constructs that have unique features in their specific domain, and where instruments have been developed and validated to measure grit in those domains. This is because it is considered unwise to simply adopt existing approaches to grit in a new setting, and advisable to develop grit conceptualisation and measures that have been developed for that unique context. These include academic grit (Clark & Malecki, 2019) teacher grit (Zhang et al., 2023), and language acquisition grit (Liu et al., 2023). Although grit has been studied extensively in the academic context and with regard to academic achievement, research recently expanded into a domain-specific conceptualisation of grit. Academic grit is conceptualised as comprising of determination, focus, and resilience, specifically for adolescents in the context of their academic endeavours. (Clark & Malecki, 2019). It was operationalised through a new measure, the Academic Grit scale. Academic grit partially overlaps with original grit, but extends the conceptualisation into other areas such as 'focus', which refers to the adolescent's prioritisation of their academic goals over other goals in their

life. Subsequent research has found positive relationships between academic grit and critical thinking, as well as academic grit and autonomous learning (Yüce, 2023), and growth mindset (Liu et al., 2023). Teacher grit refers to “teachers’ dedication, perseverance, and passion in fulfilling their teaching objectives” (Robertson-Kraft & Duckworth, 2014, in Zhang et al., 2023). It denotes the commitment that teachers apply to realising their teaching goals and their ability to overcome setbacks in achieving those goals. Teacher grit is the sustained, passionate mindset that teachers have towards their work, and has been operationalised by the L2-Teacher Grit scale (Sudina et al., 2021). Teacher grit has been found to be positively related to several other constructs, including the enjoyment of teaching, self-efficacy of the teacher, and engagement with teaching work (Zhang et al., 2023). These new areas of study are opening up new avenues for understanding grit, and expanding the grit construct into new directions.

When considering the extension of grit into the new domain of team grit in this research, it is instructive to note the advice of Zhao and Wang who, in their review of grit literature in the second language acquisition domain, stipulate that “new instruments need to be developed and validated according to the needs of different contexts” (Zhao & Wang, 2023, p.8).

2.2.5 The development of grit

Grit can be developed over time. The development of grit is linked to the way that individuals pursue their goals that are organised into a goal hierarchy. Duckworth and Gross (2014) conceptualised the hierarchical organisation of goals, in which lower order goals serve higher order goals. In this hierarchy, an individual’s higher order goals are typically long term, meaningful and purpose-filled, and individuals have few of them. Lower order goals are short term, and less meaningful, although they are typically plentiful. Lower order goals are aligned to long term goals, such that achieving them takes the individual a step closer to achieving their long-term goals. Jordan and colleagues (2019) suggest that individuals frequently adapt their short-term goals when they encounter difficulties but continue to pursue their long-term goals. It is the process of setting goals and the adaptation of lower goals in the face of challenge that facilitates the growth of grit (Jordan et al., 2019).

2.2.6 Distinguishing grit from other constructs

In building the theoretical base for grit, several studies have sought to delineate it as a distinct construct, and differentiate it from other, related constructs. Some of those that are most relevant to this research are discussed here: conscientiousness, resilience, and self-control.

Although grit is closely related to the personality dimension of conscientiousness, it has been shown to be empirically distinct from it (Duckworth et al., 2007; Duckworth & Quinn, 2009; Reed et al., 2013). Duckworth and colleagues suggest that grit differs from other dimensions of personality in its focus on stamina. There are several ways in which grit and conscientiousness are differentiated. Conscientiousness does not necessarily have a long-term orientation (Duckworth et al., 2007). On the other hand, grit is future-oriented and long term, and is considered a dispositional characteristic. Conscientiousness has eight facets: perfectionism, industriousness, procrastination refrainment, control, cautiousness, task planning and perseverance. Although some overlap with facets of grit is apparent, this overlap is not comprehensive (MacCann et al., 2009). Unlike conscientiousness, grit has no aspect of tidiness or orderliness (Duckworth et al., 2007; Reed et al., 2013). Grit was found to be a better predictor of exercise behaviour than conscientiousness (Reed et al., 2013). Despite these studies finding a differentiation between grit and conscientiousness, two extant studies challenge this distinction; one conducted in the workplace (Ion et al., 2017) and another in a school context (Ivcevic & Brackett, 2014). Ion and colleagues (Ion et al., 2017) investigated grit's differentiation from conscientiousness, however, their results did not support grit as being an empirically distinct construct. The research found that grit had low validity in predicting work-related outcomes beyond the big five personality factors and suggested that grit is not a standalone construct distinct from conscientiousness.

Grit is distinct from resilience. The word resilience comes from the Latin "resiliere", meaning to bounce back from adversity (Duckett, 2005). It is this quality of responding to adversity that is the defining feature of resilience. Resilience is demonstrated in the response to adverse, challenging circumstances that the individual faces. Therefore, adversity is a requirement to demonstrate the presence of resilience, however, not a requirement to possess resilience. A team can be very high in resilience without facing any adversity at all (Stoverink et al., 2020). Grit is defined by the committed pursuit of a long-term goal, and the perseverance aspect of grit relies on the ability to push through challenging times (Duckworth et al., 2007). This suggests that resilience will at times be needed during the gritty pursuit, to bounce back from setbacks that are encountered on this long-term journey. In fact, resilience has been proposed to be an attribute of grit (Stoffel & Cain, 2018).

Grit departs from resilience is in its intense goal focus. Indeed, it is the presence of the goal that distinguishes grit from other closely related constructs (Ledford et al., 2021). Studies have shown that gritty people persist more in the face of adversity (Lucas et al., 2015). However, somewhat like resilience, the presence of adversity is not a requirement for grit. While an adverse event will enable resilience to be displayed as bouncing back from it, the same

setback will enable grit to be displayed as an increased positive commitment to overcome the setback and press on towards achieving the goal. Both grit and resilience have a quality of positive mental well-being. A gritty individual will face setbacks but is not discouraged by them (Duckworth et al, 2007). Resilience has been described as “the ability to maintain or regain mental health after experiencing adversity” (Stoffel & Cain, 2018, p.125).

Grit is not the same as self-control. Self-control is the ability to override immediate temptations to focus on a task at hand. Grit, however, involves pursuing a superordinate goal on a longer timescale (Duckworth & Gross, 2014; Vainio & Daukantaitė, 2016). Duckworth and Gross (2014) found that, although grit and self-control are both determinants of success, they are not the same thing. When controlling for self-control, grit predicts performance, but self-control is not a predictor of performance when controlling for grit.

Having reviewed the literature on grit, what emerges is a framework of individual grit, depicted in Figure 2.1. This figure presents the relationships that have been found to exist between grit and several other constructs, and the mediators that have been found to mediate these.

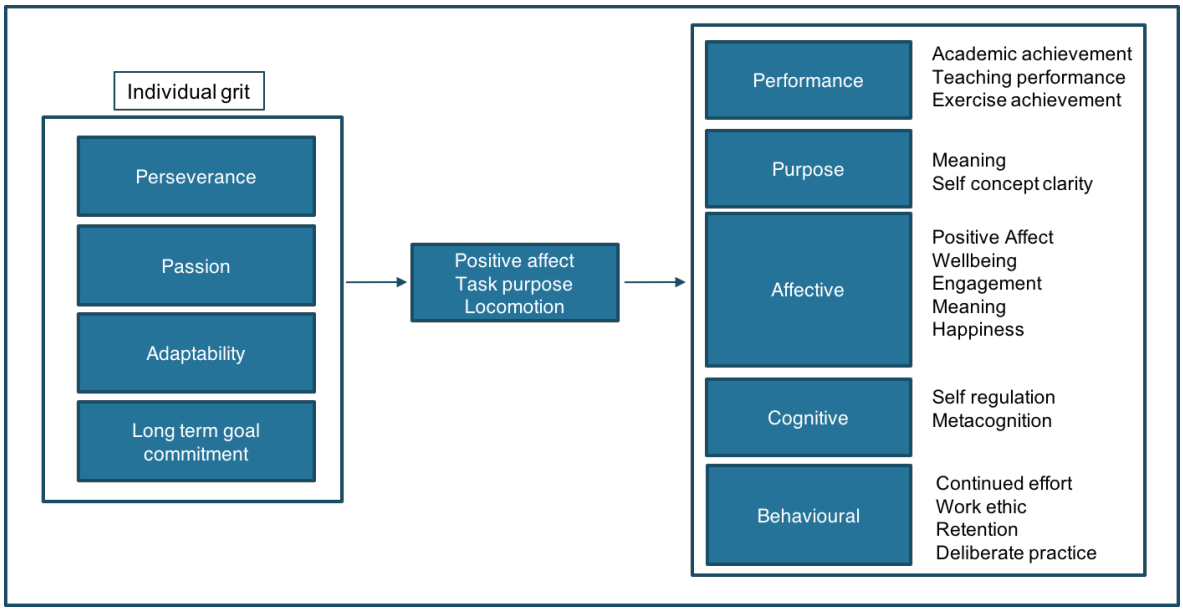

Figure 2.1: Individual grit framework (researcher’s own)

2.2.7 Criticism of grit factor structure

The grit construct has not escaped criticism. The scale comprises two factors – consistency of interest (passion) and perseverance of effort (perseverance). The former refers to a passionate focus on the same goal over time, while the latter refers to the dogged perseverance which is applied in reaching the goal. Several studies (Abuhassàn & Bates,

2015; Credé et al., 2017) have found disparities between how grit at the higher order predicts performance, as opposed to the relationship between performance and the two lower order factors of grit independently. Researchers have found that one of them – perseverance of effort – accounts for most of the predictive power. Consistency of interest does not correlate as strongly with the outcomes. Some studies propose that grit is a unidimensional construct (Areepattamannil & Khine, 2018; Abuhassàn & Bates, 2015). Abuhassàn and Bates suggest that grit would be better viewed as a univariate construct focusing on perseverance; what they term "effortful persistence" (Abuhassàn & Bates, 2015, p.212). Datu and colleagues (2016) questioned the generalisability of the two-dimensional structure of grit, finding that the perseverance of effort factor was more relevant than the consistency of interest factor, but suggesting that this difference in utility may be due to the difference between collectivistic and individualistic cultures. Credé and colleagues also challenged the value of the two-dimensional grit definition, commenting that "the primary utility of the grit construct may lie in the perseverance facet." (Credé et al., 2017, p.492).

One of the reasons given for the lack of predictive power of the consistency of interests factor is that the items which tap this latent factor in the grit scale do not in fact tap passion (Jachimowicz et al., 2019; Mueller et al., 2017). Jachimowicz and colleagues argue that passion has been under-represented in past grit measures. In their study of technology employees, they found that it was only when employees had expressed that they were passionate about their work that their grit predicted performance. Put another way, it is when work is considered more than just a job that grit matters most (Jachimowicz et al., 2018). Disabato and colleagues (2019) noted that the Consistency of Interest items, rather than measuring real passion, may be measuring rigidity, and exhort future researchers to generate new consistency of interests items which more closely reflect passion. It is noteworthy that Angela Duckworth, herself, has indicated that grit research should focus more on the passion component, as reflected in the quote below:

"I think the misunderstanding - or, at least, one of them - is that it's only the perseverance part that matters… But I think that the passion piece is at least as important. I mean, if you are really, really tenacious and dogged about a goal that's not meaningful to you, and not interesting to you - then that's just drudgery. It's not just determination - it's having a direction that you care about." (Dahl, 2016. para.7).

The discussion of individual grit offers signposts towards understanding the potential domain of team grit. At this point the researcher theorised that individual grit is a distinct construct from team grit, but that its conceptualisation offers a good starting point for understanding a

collective manifestation of grit. Moreover, in describing the construct of grit at the team level this research intentionally conceptualised team grit with a greater emphasis on the importance of passion for the goal and positive emotion as critical factors in sustaining grit over time. Before team grit can be defined however, it is important to investigate the broader conceptual domain of team related constructs. The researcher reasoned that the nature of teams is a critical component for understanding how a team quality, such as grit, would manifest.

2.3 Teams and the emergence of team constructs

It is necessary to understand team and multilevel theory and in particular the emergence of team constructs. This mechanism is essential to the emergence of team grit, which has been defined as an emergent team phenomenon (Bernardy & Antoni, 2021).

Kozlowski and Bell (2013) offer a definition of work teams and groups that "(a) are composed of two or more individuals, (b) who exist to perform organisationally relevant tasks, (c) share one or more common goals, (d) exhibit task interdependencies (i.e., workflow, goals, knowledge, and outcomes), (e) interact socially (face-to-face or, increasingly, virtually), (f) maintain and manage boundaries, and (g) are embedded in an organisational context that sets boundaries, constrains the team, and influences exchanges with other units in the broader entity" (Kozlowski & Bell, 2013, p.5). This definition of a team is important in the context of this research into a team-level construct, team grit. Notably, it frames shared goals as key to the definition of a team. Given the centrality of goals to the construct of grit, this suggests that the presence of a shared goal is key to the development of team grit. According to Mathieu and colleagues (2017), it is the integration of the individual team members' efforts toward the accomplishment of a shared goal which is considered the essence of teamwork. In addition, the definition above notes the interdependence of the members as well as their social interaction, both of which are factors that are necessary in the development of team-level grit within the team.

Teams operate as nested entities, with individual members nested within the teams and teams in turn nested within the organisational context (Mathieu et al., 2008). This nested structure describes the multilevel nature of organisations and gives rise to the need to apply multilevel theory to constructs within them. Various processes at the member, team, and organisational level result in team outcomes such as team performance. Collective constructs, such as team grit, come about through a process of emergence, whereby the shared state emerges over time and through interactions between the team members (Morgeson & Hofmann, 1999).

Multilevel theory suggests that team level constructs and individual level constructs are differentiated by the degree to which they are dependent on others to complete tasks

(Wageman, 1995). In their study of team resilience, Stoverink and colleagues support this, asserting that “Interdependence is highest in teams and is the key factor distinguishing team constructs from those at the individual level, where there is no interdependence, and the organizational level, where interdependence exists but is much weaker than in teams” (Stoverink et al., 2020, p.399).

Leadership, albeit an important factor within teams, plays a greater role in shaping constructs at the organisational level than it does at the team level. This means that purposeful leadership is key in shaping an organisation level construct, whereas at the team level the construct emerges more organically from the interdependent exchanges between team members (Stoverink et al., 2020).

2.3.1 The emergence of team-level constructs

Emergent states are defined as “cognitive, motivational, and affective states of teams [that are] ... dynamic in nature and vary as a function of team context, inputs, processes, and outcomes.” (Marks et al., 2001, p.357). They are individual-level psychological characteristics which require models of emergence to conceptualise them, to represent them at the team level (Kozlowski & Bell, 2013). A team-level construct does not represent a mere aggregation of the individual-level beliefs in themselves (Mathieu et al., 2008). It is collective action, the ongoings and events within the team, that give rise to the emergence of collective constructs. Morgeson and Hofmann go so far as to state that “absent this action the construct simply does not exist.” (Morgeson & Hofman,1999, p. 252).

Time plays an important role in the emergence of team-level phenomena (Klein & Kozlowski, 2000), as the notion of emergence denotes a process that is required for the unfolding events. It is over a period of time that the interactions between team members give rise to the new construct. These interactions include both affective and cognitive processes. Emergent states necessitate the combining of individual attitudes, behaviours, and cognition over time through work and social interaction. These bottom-up processes take longer than top-down processes (Kozlowski & Klein, 2000). Because of this, longitudinal studies are more appropriate to assess emergent phenomena and the time taken for team constructs to emerge. Unfortunately, few longitudinal studies exist, and cross-sectional studies proliferate, which results in their being little empirical research into the amount of time required for team phenomena to emerge (Kozlowski et al., 2016).

In line with multilevel research theory, this research proposes that the collective construct of team grit emerges from the affective and cognitive states of the individuals within the team (including their own individual grit), and the ongoings, events and processes that occur

between them over the progression of time (Morgeson & Hofmann, 1999). Affective states have been shown to spread within organisational groups, primarily through emotional contagion, which is the process through which emotions are shared between team members and emotional states converge within the team (Barsade & Gibson,1998).

It follows then, that the goal-directed passion and perseverance of team members (Duckworth et al., 2007), plus their ability to adapt while pursuing their goals (Datu et al., 2017), will emerge to form team grit, through interactions and processes between them over their time together.

2.4 Grit at the collective level

The preceding sections discussed the many empirical studies into individual grit since its first conceptualisation (Duckworth et al., 2007), and the nature and development of team constructs. Very little literature exists into grit at the collective level, and in recent years calls have been growing for research to address this gap (Jordan et al., 2019; Schimschal et al., 2021).

2.4.1 Organisational-level grit

Organisational-level grit has been identified as necessary for sustained organisational success and is recommended by researchers as the ingredient needed for organisations to be high performing (de Waal et al., 2023).

In 2018, Lee and Duckworth published an article in the popular magazine, Harvard Business Review, proposing the existence of organisational-level grit (Lee & Duckworth, 2018). They present a case study of Mayo Clinic, which they propose as being a gritty organisation, and through which they identify attributes and behaviours that demonstrate organisational grit. They conceptualise organisational grit as an organisational culture. They posit that gritty organisations are clear about their goal hierarchy, and they make this explicit to their people. Furthermore, the higher order goal of the organisation is ambitious and inspirational and something that people in the organisation will embrace. Organisational grit is enhanced by promoting a growth mindset, the individual's openness to challenge and setbacks recognising that these provide an opportunity to grow and learn (Lee & Duckworth, 2018). This is turn requires organisational openness to experimentation, failure, and course correction. Lee and Duckworth advise that organisations wishing to increase their grit levels, start by hiring gritty individuals, and look for people who are driven by a purpose which aligns with the organisational mission.

The notion of organisational grit as an organisational culture is echoed by Luning and colleagues (2022). In their empirical study, they explored the concept of organisational grit as

an organisational culture. Through a series of exploratory interviews they identified the following seven themes: a set of core values which are ingrained in individuals and teams within the organisation; an organisational growth mindset, specifically a willingness to learn; a sense of mission accomplishment whereby the organisation is driven to achieve its mission and goals; team unity, whereby teams accomplish their mission as a unified entity; professional pride in the work that the organisation performs; deliberate practice through hard training to ensure the organisation is ready for its mission; and organisational resilience-determination, whereby positive affect is displayed following setbacks. These themes were therefore considered in the initial specification of the domain of team grit as well.

de Waal and colleagues (2023) propose that a gritty organisation will enable employee success, which in turn will drive positive organisational outcomes, such as better staff retention, improved employee work engagement and superior financial returns. They collate what they term, “ways to foster grit in the organization” (de Waal et al., 2023, p.28) from the limited extant literature on organisational grit. These are as follows: “Promote a growth mindset; Make sure leaders serve as role models of the core values of sustained passion and perseverance; Create pride in achievements; Create team unity; Create a strong culture that promotes adaptability and resilience; Put customers first; Teach people political skills; Make sure leaders have an “authorative” (supporting and demanding) management style; and, Create jobs that encourage passion by being aligned with employees’ personal values and interests”. (de Waal et al., 2023, p.28).

2.4.2 Team-level grit

Multilevel theory stipulates that constructs operate at different levels: the individual level, team level and organisational level (Morgeson & Hoffman, 1999). Higher order constructs emerge over time, through the interactions between individuals. Team-level constructs have some commonality with their individual counterparts but possess key differences. They are not simply the collective representation of the individual construct, nor are they the aggregation of the construct of the individuals in the team (McEwen & Boyd, 2018). By way of example, resilience at work at the individual level is made up of the following seven dimensions: maintaining supportive networks at work, keeping healthy, interacting cooperatively, managing stress, maintaining perspective, finding your calling, and living authentically (McEwen & Boyd, 2018). However, at the team-level, team resilience at work includes a different (although related) seven dimensions: resourcefulness, robustness, perseverance, self-care, capability, connectedness, and alignment (McEwen & Boyd, 2018). Collective behaviours are a necessary component of a team construct (Morgeson & Hoffman, 1999). In

the team resilience example, if the behaviours and strategies of the team members are not aligned then team resilience will not exist (McEwen & Boyd, 2018). As is seen from this example, team-level and individual-level constructs, like resilience, and this research asserts, like team grit, although related, are conceptually different.

The preceding sections have discussed individual grit, describing the construct and its relationships to other constructs. As has been seen, individual grit is described as an individual's perseverance and passion for long term goals (Duckworth et al., 2007) as well as the individual's ability to adapt to changing circumstances as they pursue their goal (Datu et al., 2017). Applying the argument above to grit, an individual's passion, perseverance, and adaptability to situations will be related, but not identically replicated, in the construct of team grit. Lee and Duckworth (2018) posit that team-level grit is identified by the following team attributes: the team's desire to work hard; their drive to learn and improve; their resilience in dealing with challenges; their strong sense of purpose; trust between team members; alignment between the goals of members and those of the team; a shared sense of purpose; shared commitment; strong relationships between members; high levels of trust; and a capacity to adapt to changes as they pursue their goals (Lee & Duckworth, 2018, p.101).

Bernardy and Antoni (2021) draw on Duckworth and colleagues' definition of individual grit to define team grit as "a team's competence to pursue common long-term goals despite adversities, with passion and perseverance" (Bernardy & Antoni, 2021, p. 68). They further describe team passion as "a high level of commitment towards a common goal" (Bernardy & Antoni, 2021, p. 68), noting that team members encourage one another to keep their focus on the things that are Important to the team. In addition, they describe team perseverance as "a strong willingness to exert effort towards a teams' common goal and not give up despite difficulties" (Bernardy & Antoni, 2021, p. 68). Further, they propose that when faced with challenges or plateaus the team members motivate each to try and express the conviction that the effort needed to pursue their goals is worthwhile. It is notable in their description, that, underpinning both passion and perseverance at the team level, Bernardy and Antoni (2021) identify factors of team internal support, mutual encouragement and togetherness, which enable and fuel the passion for the goal and the perseverance towards it. The authors seem to be proposing that this dimension of team closeness is a key component of team grit.

Bernardy and Antoni (2021) put forward a theoretical explication of the emergence of team grit, outlining the attributes above and also describing how team grit operates in relation to other constructs and how it emerges in the team. They posit that team grit emerges through the grit of individuals and the team processes, that is, the interactions between these gritty

individuals (Marks et al., 2001). Using the theory of emotional contagion (Barsade et al., 1998) and crossover effects they suggest that this emergence process is enabled through emotions being caught between team members. The authors' study is situated in the domain of innovation teams, and they theorise that team grit will lead to team innovation. They identify four related states that are necessary for the emergence of grit in a team. The first is a shared interest which the team members passionately pursue. Secondly, they identify collective efficacy, the shared belief that the team will succeed (Bandura, 1997, cited in Bernardy & Antoni, 2021), which they suggest will be important as it strengthen the team's confidence in their ability to succeed despite tough times and setbacks. Thirdly, shared mental models, that is "shared cognitions about key elements in the team" (Cannon et al., 2001, cited in Bernardy & Antoni, 2021, p.72) which, when this is focused on the team's interests and strengths affects team passion and in turn supports the emergence of team grit. Finally, they identify team psychological safety, the shared belief that it is safe to take interpersonal risks in the team (Edmondson, 1999), as a necessary condition within the team which acts to strengthen the grit in the team. The propose that a team high in psychological safety is likely to display high levels of perseverance and passion as they feel safe to pursue their shared interests without fear of failure, and with a willingness to make mistakes. Relevant to this research, Bernardy and Antoni (2021) also acknowledge that adaptability plays a role in team grit, notably where the team members adapt their lower order goals while remaining focused on their higher order goals, and where they adapt their strategies when they hit challenges or plateaus. They describe the importance of adaptability inasmuch as it forms part of persevering towards the goal. Thus, they do not call it out as a separate component of team grit, but they acknowledge the importance thereof in the committed pursuit of a long term goal. The researchers propose that through these mechanisms team grit is enhanced, and greater team innovation is the result.

Bernardy and Antoni's theoretical explication of team grit (2021) is the most comprehensive discussion of the construct in extant literature. Their theorising, together with the contributions of other team and organisational grit theorists (Lee & Duckworth, 2018; Luning et al., 2022) form the basis for the team grit model and its associated dimensions developed in this study.

Figure 2.2 presents the identified components of grit at the individual level (Datu et al., 2017; Duckworth et al., 2007), the organisational level (Luning et al., 2022), and the team level (Bernardy & Antoni, 2021; Lee & Duckworth, 2018). The graphic identifies the seminal grit study which found Perseverance and Passion to be core factors (Duckworth et al, 2007), and the subsequent study which added Adaptability to Situations as a third factor (Datu et al., 2017). The colour coding in Figure 2.2 represents the conceptual elements proposed by each

set of authors. When reviewing the individual elements, it is possible to group them into themes. This thematic analysis was conducted by the researcher in order to derive the key dimensions of team grit, through extant literature and empirical studies. Across all the studies the following themes are apparent: perseverance, passion for the goal, adaptability in pursuit of the goal, and close connectedness between team members in driving towards their goal. These themes are colour coded in the diagram. The colour coding makes it possible to identify that perseverance is related to deliberate practice (Luning et al., 2022), a desire to work hard (Lee & Duckworth, 2018), willing effort (Bernardy & Antoni, 2021), and resilience in the face of setbacks (Lee & Duckworth, 2018). Passion goes hand in hand with having a higher order purpose, an overarching goal structure in which all sub-goals align to the higher order goal. It includes strong commitment (Lee & Duckworth, 2018) and pride in their work (Luning et al., 2022). Adaptability to situations is related to having a growth mindset rather than a fixed mindset (Luning et al., 2022), a desire to learn and improve, and an ability to adapt (Lee & Duckworth, 2018). Finally, the cohesive bond between team members is identified by Lee and Duckworth as 'mutual trust' (2018), Bernardy and Antoni as 'mutual encouragement' (2021) and Luning and colleagues as 'team unity' (2022).

While the elements of passion and perseverance are well accepted as the components of grit, including being core to the definition of grit, adaptability to situations, albeit core to the definition of grit in the triarchic model of grit conceptualisation, is a less known construct within individual grit and requires further explication in order to demonstrate its relevance to the team grit construct. Similarly, the notion of connectedness is new and also requires discussion to argue its relevance in team grit.

2.4.2.1 Adaptability

As outlined previously, adaptability to situations, is the third factor of the Triarchic model of grit scale (TMGS), developed and validated by Datu and colleagues (2017). It was originally identified as a relevant factor among a Filipino sample and proposed by the authors to be important in collectivistic cultures, which several subsequent studies on the TMGS have echoed (Datu et al, 2018; Datu, 2021; Datu et al., 2021; Ting & Datu, 2020). The authors propose that in collectivistic cultures, which prize social relationships and operating within sensitivity to the context, individuals will be flexible in their pursuit of goals, and will align their goals with those of others. Datu and colleagues found that adaptability and perseverance were particularly relevant to individuals in collectivistic cultures, while consistency was less relevant (Datu et al., 2016), and proposed that it is not necessary for an individual to commit themselves solely to a particular goal in order to be considered gritty. Given that these findings emerged form research in collectivistic cultures, it raises the question as to whether

‘adaptability’ as a component of grit has merit outside of such cultures. It is the assertion of this research that it does, and that it is a valuable component of team-level grit. Adaptability has been linked to grit in other studies. Citing Datu, Jordan and colleagues note that “flexibility and willingness to adapt and change keep high-grit people “on track” to achieve higher level goals” (Jordan et al., 2019, p.331). In their discussion of grit at work, Southwick, Tsay and Duckworth (2019) propose a link between grit, adaptability and growth mindset. They point to organisational cultures and emphasize that to enable success in pursuit of their long-term goals, organisations must prioritise adaptability. They note that adaptability relates to having a growth mindset, enabling gritty cultures to persist in achieving their goals despite encountering unexpected obstacles and opportunities that emerge along the journey. It is the capacity to adapt in the face of obstacles that allows gritty organisational cultures to persist in achieving their goals. They note that “grit is encouraged in strong cultures that promote norms of adaptability and that endorse a growth mindset” (Southwick et al., 2019, p.8).

This research asserts that adaptation is important in the pursuit of goals. It relates to the proposed hierarchy of goals, put forward in the context of individual grit (Duckworth & Gross, 2014; Jordan et al., 2019), and also organisational grit (Lee & Duckworth, 2018). Gritty teams also have a hierarchy of goals, where short term goals are aligned to the overarching ultimate goal. Gritty teams constantly reassess the utility of the short-term goals in the pursuit of the overarching goal. If needed, they adapt their short-term goals, and may even abandon some if they prove no longer to be as relevant in the ultimate pursuit. This research asserts that gritty teams will passionately push ahead towards their goal, slightly changing their originally intended path (lower order goals), and in so doing overcoming obstacles, to achieve their ultimate goal.

2.4.2.2 Connectedness

Team-level constructs differ from individual constructs due to the interdependence between team members (Stoverink et al., 2020). The relational aspects of team constructs is fundamental to their operation and the theory of emergence states that the team-level construct emerges through the interactions between team members (Kozlowski & Klein, 2000). Although the grit of individuals within a team plays a role in the development of team grit (through the interactions between members), a team of gritty individuals does not necessarily make a gritty team, to paraphrase Stoverink and colleagues (2020) in their comment regarding team resilience.

This research conceptualises team grit as the shared, cohesive competence of the group to persevere with passion, and with an ability to adapt in pursuit of their long-term goals. The

research asserts that what distinguishes team grit from individual grit is the element of connectedness, the bond between team members, involving trust, support of one another, and positive affect, that binds team members into a collective whole. This study proposes that team connectedness is more than simply the relationships between team members. It refers to the way that team members bond with and support one another to persevere towards their goal. Metaphorically, connectedness is the state of linking arms together as the team members press ahead to reach their goal. It is a commitment to one another not to let the other down and not to let the other fall behind in the pursuit. It is the confidence that team members have that they will be held by one another on their mission.

In their qualitative study on team resilience, Morgan and colleagues refer to a 'band of brothers' mentality that typifies resilient teams (Morgan et al., 2015, p.96). This metaphor expresses the deep confidence that team members have in one another and the commitment to support each other no matter what. It is important to note that connectedness in team grit has a purpose. It is not a static state of the interdependence of the team members, but a dynamic state of intimate support for one another to achieve their mutual success.

Several team construct researchers include connectedness-like constructs in their theories as core components of the team-level construct. Morgan and colleagues (2013) propose that team cohesion is a component of collective efficacy, which in turn is relevant for team resilience. Bowers et al. (2017) identify cohesion as one of several emergent states that enable team resilience. The other states are adaptability, familiarity, shared mental models, culture and collective efficacy. They also assert that team cohesion is related to group identity. This research proposes that team grit is likely to have a similar link to group identity, that is, the members interpret who they are as a team through their connections with one another. Morgan et al (20165) refer to social capital, which they describe as the existence of high-quality interactions and caring relationships (Morgan et al., 2015, p.92). In grit literature, the cohesive bond between team members is termed by Lee and Duckworth as 'mutual trust' (2018), Bernardy and Antoni as 'mutual encouragement' (2021) and Luning and colleagues as 'team unity', in which the team reaches its goals as a unified entity (2022). The analysis depicted in Figure 2.2 which identified the elements proposed by grit researchers lends support to the relevance of team connectedness for the team grit construct.

Constructs like connectedness appear as factors within team-level scales, which further provides support for this element as a fundamental component of team grit. McEwen and Boyd (2017) developed and validated their team-based resilience at work scale, with 'Connectedness' as one of seven latent factors. Sharma and Sharma (2016) developed and

validated a team resilience scale, with four subscales, one of which is ‘social capital’, and it in turn is comprised of a further three subscales - network ties, shared language and trust. These studies lend support to the inclusion of team connectedness in the model of team grit proposed here.

In the section that follows, team grit is presented in relation to constructs that are proposed as antecedents to and outcomes of team grit.

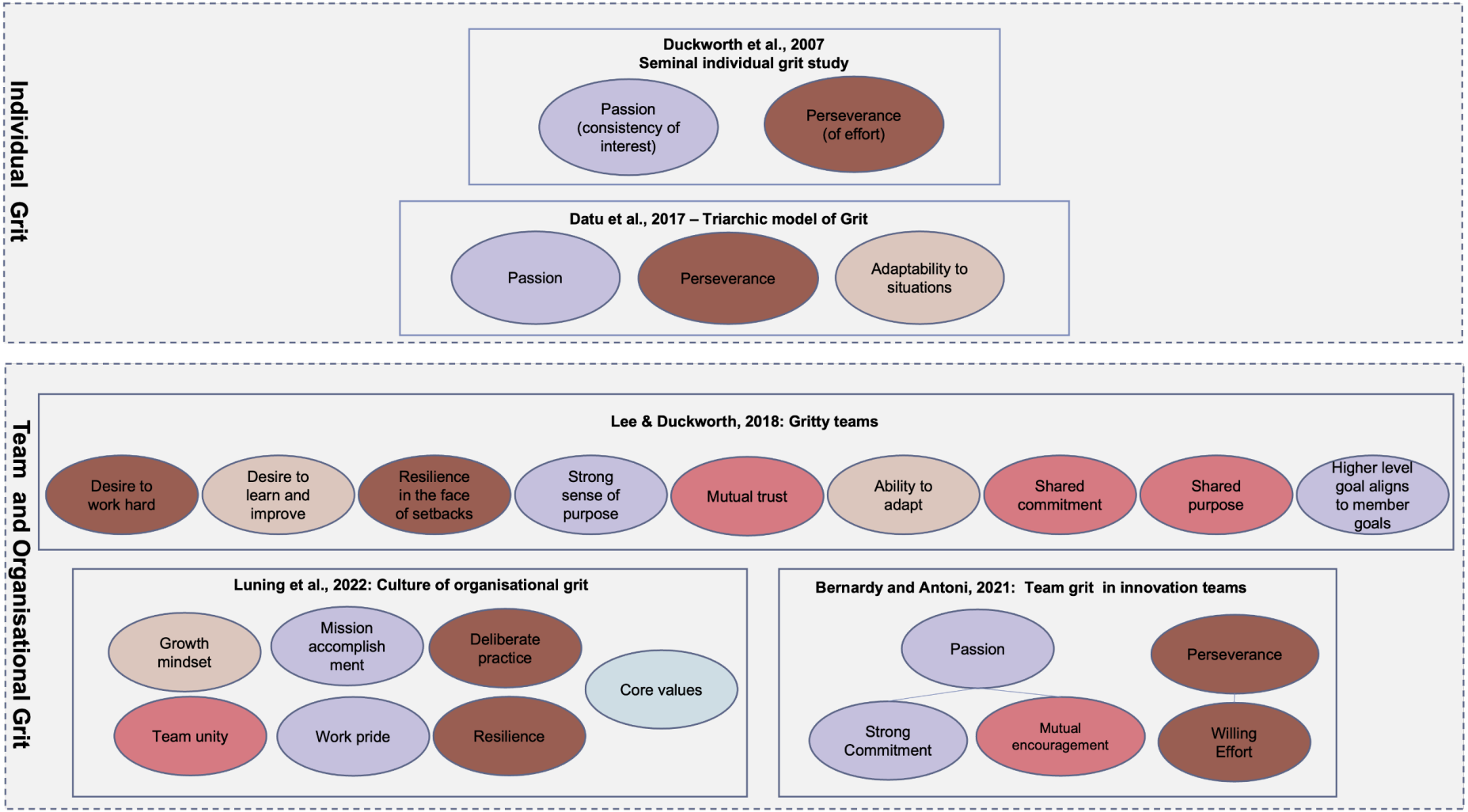

Figure 2.2: Team grit dimensions derived from extant grit literature

2.5 Antecedents and outcomes of team grit

This section of the study identifies several constructs which are proposed to be linked to team grit, either as antecedents to team grit or as outcomes of the construct. The proposed constructs have been conceptualised and studied empirically in literature; however, they have not previously been shown to be linked to team grit. It is the assertion of this research that they operate in relationship with each other. In putting forward these antecedent and outcome links the researcher theoretically positions team grit within a nomological net. These relationships are proposed to have predictive validity which, if upheld, will provide support for the efforts to develop the team grit scale. Therefore, theorising some antecedents and outcomes of team grit offers the opportunity to show the nomological validity of the construct and the new operationalisation thereof. By no means does this offer a full theoretical map of the interrelations of team grit with other constructs. There are many team-level constructs that may operate as antecedents to or outcomes of team grit, which have not been theorised in the study. The purpose of the nomological net was to demonstrate that team grit is located within a network of other related constructs It was not to map or empirically prove a comprehensive ecosystem of all possibly related constructs. Undoubtedly, the nomological framework for team grit needs further expansion. This is a limitation of the study and has been noted as such in the Limitations section of the thesis.

2.5.1 Conceptual antecedents of team grit

The study proposed four possible to team grit. Two of them have been discussed in some detail below and their predictive relationships to team grit tested in the nomological validity study of the team grit scale. These are team psychological safety and team goal commitment. A further two have been discussed in relation to team grit and theorised as antecedents to team grit. However, these relationships were not tested as part of the nomological validity study.

Team psychological safety is defined as the “shared belief held by members of a team that the team is safe for interpersonal risk taking” (Edmondson, 1999, p.354). In a team high in psychological safety there is “a sense of confidence that the team will not embarrass, reject or punish someone for speaking up” (Edmondson, 1999, p.354). Bernardy and Antoni (2021) posit that team psychological safety strengthens team grit. This then brings about team innovation. These suppositions have been confirmed in empirical studies. Specifically, it was found that team psychological safety leads to innovation. Moreover, team psychological safety drives team creativity, the latter being an early phase of the innovation process (Newman et al., 2017). Team psychological safety enables team learning behaviour (Edmondson, 1999).

This construct acts as a mediator between entrepreneurial team leadership and team creativity (Mehmood et al., 2021). Team psychological safety appears as an antecedent to team resilience (Stoverink et al., 2020), a construct which has some similarity to team grit in its facet of perseverance. Bradley and colleagues found a relationship between a team's conflict on a task and their performance, which was moderated by team psychological safety (Bradley et al., 2012). They argued that a degree of conflict when completing a task is necessary to stimulate team creativity and innovation, but that it only results in positive team performance in a context of high team psychological safety. The constructs of team psychological safety, team grit and team innovation appear to be related. A psychologically safe team is likely to demonstrate high levels of team grit as they feel safe to explore and even make mistakes in their pursuit of their goal. This freedom helps to fuel their passion for their goal and enables them to persevere despite challenges, in the knowledge that they are safe from recrimination. The supposition of this research, therefore, is that team psychological safety leads to team grit, which and in turn results in team innovation outcomes.

This study operationalised team psychological safety with Edmondson's (1999) seven-item measure, which has been applied extensively in empirical studies. These studies have shown that the scale has strong construct, content and criterion validity, and those studies that used the measure reported good internal consistency reliability (Newman et al., 2017).

The second antecedent to team grit proposed in this study is team goal commitment, defined as follows: "team goal commitment means that team members feel an attachment to the team goals and that they are determined to reach these goals" (Weldon & Weingart in Aubé & Rousseau, 2005, p.190). Teams with high goal commitment display a determination to reach their goals. Research by Aubé and Rousseau found that team goal commitment predicts team effectiveness across three measures. These are team performance, team viability and the quality of the group experience. They found that the relationship between team goal commitment and team performance is moderated by two factors: the degree of team task interdependence, and the behaviours and actions that were supportive of one another (Aubé & Rousseau, 2005).

In considering how team goal commitment relates to team grit, it is useful to look at the gritty team's connection to their goal. Theory suggests that team members bring their own goals into alignment with the team's goal (Duckworth & Gross, 2014; Southwick et al., 2019). Moreover, teams will operate a goal hierarchy in which they are willing adapt their lower order goals to achieve their higher order, long term 'purpose'. A team with high levels of goal commitment will probably show high team grit. This is expected when the members individually buy into the higher order long term team goal. Bernardy and Antoni (2021)

suggested that team goal commitment is a requirement that assists teams to set their goals. In their explication of the team grit construct they identify passion, made up of strong commitment plus mutual encouragement, and perseverance, which they consider as underpinned by willing effort. However, team grit differs from team goal commitment in its focus on longer term, meaningful goals (Jordan et al., 2019). This research suggests that these two constructs operate in a close relationship, but there are key differences. Being committed to the team goal does not automatically assume that the team will be gritty, in the case where the goal is short term. However, it is likely that gritty teams will have strong goal commitment towards those goals that are long term and meaningful to them as a group. That is, team grit presupposes team goal commitment, however team goal commitment does not presuppose team grit.

This study operationalised team goal commitment using Aubé and Rousseau's 3-item team goal commitment scale (2005).

As mentioned above, several other team-level constructs may also operate as antecedents to team grit and are briefly discussed here to point to potential future research into these relationships. Team potency is the team members' collective belief about their team's ability to be successful (Shea & Guzzo, 1987). A team high in team potency has a general belief in its capabilities to be successful across different contexts and on different tasks. Team efficacy is a construct which has similarities to team potency. However, it differs from team potency in that it refers to the team's belief in its potential to succeed on specific tasks (Shea & Guzzo, 1987). Team efficacy has been defined as "a shared belief in a group's collective capability to organize and execute courses of action required to produce given levels of goal attainment" (Kozlowski & Ilgen, 2006, p.90). Both team potency and team efficacy have been theorised to be important drivers of team performance (Gully et al, 2002), although team efficacy has a curvilinear relationship with performance, meaning that too high a level of team efficacy results in a dropping off of performance. Additionally, team efficacy and team potency both generate a high level of confidence in team members with regard to their team, and it is this confidence that enables teams to persevere when facing adversity (Gully et al, 2002). Given that gritty individuals have been found to persevere when faced with adversity (Lucas et al., 2015) it seems possible that there is a link between grit at the team-level, team potency and team efficacy. This research suggests that both team efficacy and team potency may operate as antecedent to team grit and encourage future researchers to further explicate and test these relationships.

Future researchers may investigate several constructs which relate to team grit and in so doing expand the team grit nomological network. Possible further antecedents may include

team confidence, teamwork roadmaps, and team capacity to improvise, which are theorised as antecedents to team resilience (Stoverink et al., 2020); power distance, which drives perceived team effectiveness (Appelbaum et al., 2020): visionary leadership which predicts team innovation mediated by team cohesion (Van der Voet & Steijn, 2021): team boosting behaviours, which predict team work engagement, positive team climate and team performance (Fortuin et al. 2021).

2.5.2 Conceptual outcomes of team grit

Similar to the argument on the team grit antecedents within the nomological net, there are many other constructs which may be relevant outcomes of team grit, and which deserve further study.

The study specifically investigated and proposed two outcomes of team grit, and then tested these proposed predictive relationships within the nomological validity study. These are team work engagement and team innovation. Extant individual grit research has demonstrated a positive correlation between grit and work engagement (Duckworth et al., 2007; Suzuki et al., 2015). Work engagement has been defined as “a positive, fulfilling work-related state of mind that is characterized by vigor, dedication, and absorption, and that is used to predict high work performance in organizations” (Bakker in Suzuki et al., 2015, p.2). Team work engagement is further described as a “shared, positive, fulfilling, motivational emergent state of work-related wellbeing`’ (Costa et al., 2014, p.35). Costa and colleagues proposed several relationships with team work engagement, several of which have conceptual connections to team grit. They identify that team work engagement is positively related to a sense of identification with the team. Gritty teams are strongly bonded and united in their pursuit of their goal. In this close connection they too have a sense of identification, which this research proposes, will see team grit relating positively to team work engagement. Team work engagement is proposed as having a high degree of positive affect between team members and towards their work. Members of gritty teams have a shared sense of commitment to their goal (Jordan et al., 2019). Team work engagement was operationalised using the TWES, a 9-item scale (Costa et al., 2014).

The second proposed outcome of team grit is team innovation. Bernardy and Antoni (2021) developed a theoretical model in which they hypothesised the process of emergence of team grit, and how team grit contributes to team innovation. Their view is that there is a dynamic interplay between team processes and affective and cognitive states within the team. It is this interplay that leads to the emergence of team grit and in turn promotes team innovation. They also point to the role that team psychological safety is expected to have in strengthening team

grit and in turn leading to greater team innovation. Empirical studies in team innovation finds several relationships that have are insightful for team grit. Gu and colleagues (2013) found that the social capital in teams is positively linked to team innovation. The research here posits that social capital as described by Gu and colleagues bears many similarities to the components of team grit, and the findings of Gu et al., support the notion that team grit will also lead to greater team innovation. Specifically, Gu and colleagues found that structural capital (which they describe as social interaction) and cognitive capital (described as shared goals) are positively related to innovation in research and development teams. In addition, they found that relational capital (which they conceptualise as mutual trust) enhances innovation and is mediated through psychological safety (Gu et al., 2013). Team innovation was operationalised using a four-item measure developed by Mitchell and colleagues (2022).

Further studies may investigate other outcome relationships. A few are listed here: Additional team grit outcomes may include team performance, team viability and quality of group experience, which are outcomes of team goal commitment (Aube & Rousseau, 2005); organisational commitment, which is an outcome of team goal commitment (Chai et al., 2017); co-operation, conflict and satisfaction, which are proposed as outcomes of team resilience, team optimism and team efficacy (West et al., 2009).

Following the literature review on the proposed antecedents and outcomes of team grit, the researcher put forward the team grit conceptual framework, as seen in Figure 2.3.

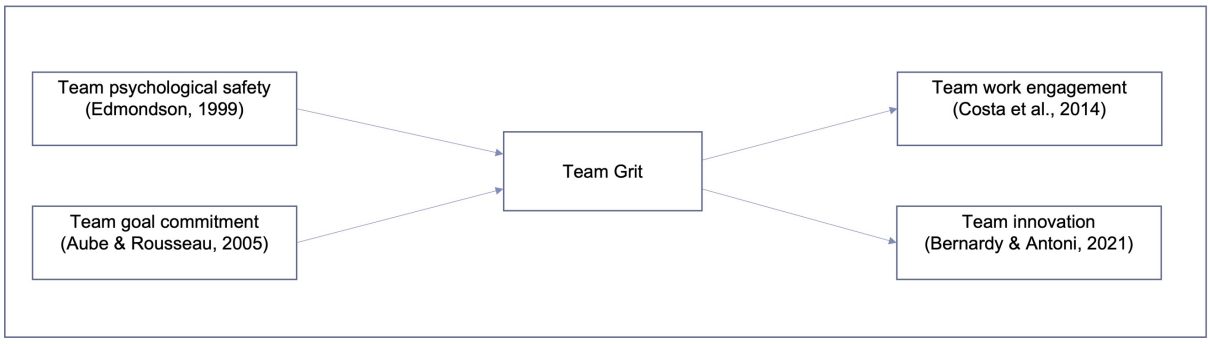

Figure 2.3: Team grit conceptual framework

2.6 Conclusion

At the conclusion of the literature review, team grit was defined as the shared, cohesive competence of the group to persevere with passion and with an ability to adapt as needed in pursuit of their long-term goals. It appeared at this stage that team grit bore similarities to individual grit. Three of the proposed team grit dimensions were also dimensions of individual grit at the individual level: team-level perseverance, team-level passion for the goal, and team adaptability to changes (Datu et al., 2017; Duckworth et al., 2007). However, the researcher argued that team grit was distinct from individual grit, as a fourth dimension had emerged as being fundamental to the team grit construct, which was not a component of individual grit. This was termed 'connectedness', which is the team's close and supportive bond.

What this research termed as the team's 'connectedness', is referred to in extant research by several different names: mutual encouragement (Bernardy & Antoni, 2021), mutual trust (Lee & Duckworth, 2018) and team unity (Luning et al., 2022). It is argued that team connectedness is a necessary component to enable the team to persevere, in a way that is not relevant to an individual. The team level grit is fuelled by the members' mutual passion for the goal and their support, encouragement, and trust of each other to persevere through the toughest times to achieve that goal. Without connectedness there can be no team grit. And it is proposed that teams that lack a strong bond will fail to develop grit. Finally, the antecedents and outcomes of team grit were assessed, and the researcher put forward a nomological net, in which team psychological safety as well as the team's capacity to be committed to their goal lead to team grit, while team grit in turn results in innovation and greater engagement in their work.

The section that follows outlines the research methodology that was employed in the study to develop the team grit scale.

3 Chapter 3: Research Design and Methodology

The main purpose of this research was to develop and validate the team grit scale. However, the first research question asks, “What is team grit?”. To answer this question required an exploratory phase of research, as team grit is a nascent and largely undeveloped concept in literature. It is common practice in scale development to begin the process with a qualitative exploratory phase. This is the case when a new concept is being developed, like grit (Duckworth et al., 2007), or when a concept is being adapted for a different context, like the triarchic model of grit (Datu et al., 2018). Scale development researchers, Worthington and Whittaker (2006) present a compelling argument for clarifying the construct prior to developing and validating a scale to measure it. Their view lends support to the two-phase approach to scale development that has been observed in the extant grit research mentioned above and adopted by this study. They emphasise the importance of using existing theory and empirical research to provide a conceptual foundation that is sound. It is this conceptual foundation, they suggest, that enables the construct to be defined clearly and concretely. They furthermore note that this is more difficult than it may appear as it requires that abstract concepts are distinctly defined and, as they state, “Nothing is more difficult to measure than an ill-defined construct because it leads to the inclusion of items that may be only peripherally related to the construct of interest or to the exclusion of items that are important components of the content domain” (Worthington & Whittaker, 2006, p.813).

The study included an initial qualitative phase in which focus groups were conducted with teams, to explore the concept of team grit. Focus groups have often been used as a precursor to quantitative studies and have been used by researchers to identify survey questions (Onwuegbuzie et al., 2009) or to generate new hypotheses to be tested using quantitative methods (Lunt & Livingstone, 1996).

The second research question, “How might the construct of team grit be measured?” follows on from the first question, and points to the development and validation of a scale to measure team grit. Once the exploratory qualitative phase identified the themes that are important in team grit, a quantitative research process was implemented to develop and validate a scale to measure the construct. The research design therefore was mixed methods, an approach that, in recent years, has become increasingly common (Bryman, 2006) and is purported to provide richer, more comprehensive insights into phenomena being studied (Onwuegbuzie & Leech, 2005). In fact, it has been described as being the most appropriate research design for scale development (Zhou, 2019, p.45). The design includes a small qualitative research phase followed by a larger quantitative research phase. These two phases are explained in greater detail in the sections that follow.

3.1 Research philosophy, paradigm and approach

Although the qualitative and quantitative phases to this research were distinct phases, they formed part of a single, overarching research design. The interpretation of the data generated within the phases was paradigm-specific, but it is the sequential nature of the phases that made them relevant and necessary components of the overarching work. This is because the focus groups served to provide a necessary foundation for the scale development. The outcome of the focus groups was a narrative of the construct of team grit, with the construct well defined and its dimensions clearly outlined. This provided an important input into the first step of scale development, the generation of an item pool.

A combination of deductive and inductive methods is seen in the process of scale development. Both methods have been used for item pool development in extant studies. In their meta-review of scale development practices, Morgado and colleagues identified that 56.2% of studies in their review combined inductive and deductive approaches (Morgado et al., 2017). Hinkin (1995) identifies two approaches to item generation: a deductive approach and an inductive approach. The deductive approach uses an information typology which is informed by a thorough literature review and definition of the construct. The definition of the construct is then used to develop the items. The inductive approach assumes very limited theory at the outset of the scale development process and attempts to identify constructs and develop items based on individual responses. It is typical to build the item pool based on qualitative information. In such cases, the qualitative data is obtained through a variety of qualitative, exploratory methods, including semi-structured interviews (Kapuscinski & Masters, 2010).

Both phases of the research described here contain exploratory and confirmatory elements. In the qualitative phase, focus groups were undertaken to generate team-level insights into team grit, and analysis conducted using thematic analysis (Braun & Clarke, 2006), a method that can be used inductively or deductively. Thematic analysis is known for its flexibility and is not tied to any particular theoretical or epistemological framework (Clarke & Braun, 2014). Among its benefits are that it can be used to answer a variety of research questions, it can be used with any type of data and that it is effective with small or large data sets (Clarke & Braun, 2014). Thematic analysis can be used inductively or deductively (Clarke & Braun, 2014). In an inductive application of thematic analysis, the analysis is led by the content of the data while in the deductive approach, the analysis is conducted through the lens of pre-existing theories. This research employed thematic analysis deductively, and analysed interview responses as they pertain to the construct of team grit. This approach is termed theoretical

thematic analysis and is differentiated by the authors from inductive thematic analysis (Braun & Clarke, 2006).

3.2 Unit and level of analysis

The team is the unit of analysis for this research. Various authors assert that researchers must consider levels of analysis when drawing inferences in collective contexts (Chan, 1998; Morgeson & Hofmann, 1999), and identify that the team is the appropriate level of analysis (Gully et al., 2002). In the qualitative phase, focus groups were used to generate data and to gather team-level insights, albeit expressed by the team members in discussion with each other. Focus group researchers contend that "the unit of analysis in focus groups is the thematic content" (Lunt & Livingstone, 1996, p.15). It has been noted that focus groups are not used to identify individual perspectives, but rather group perspectives and group dynamics. For the purposes of this study, focus groups were selected over interviews as the intention was to identify collective constructs within the group context. In the focus groups conducted within the qualitative phase of this study, the discussions surfaced the team's views on the team's functioning, and these contributed to the researcher identifying the themes related to team grit. In the quantitative phase of the research, responses were drawn from individuals who completed the survey. The unit of analysis remained the team, as, in their answers, the respondents were required to consider the functioning of their team, not of themselves.

Table 3.1 that follows provides a comprehensive overview of the research process.

Table 3.1 Research summary

Step	Purpose	Data sources	Method	Key outcomes
Specify the research domain	Delineate the meaning, salient characteristics, and theoretical positioning of individual grit, team construct emergence and collective grit.	Literature	• Literature reviewed to determine the theoretical position of individual grit, team theory and collective grit, to conceptualise the team grit construct, including its antecedents and consequences	• Critical conceptualisation of team grit, including team grit definition and three factors proposed: passion, perseverance and adaptability
Develop initial item pool	Devise an item pool that is consistent with the literature review and interview findings	• Qualitative team focus groups • *N* = 10 focus groups, total of 77 participants • Team members had worked together for minimum 3 months • Teams operating in high pressure, deadline-driven professional industries	• Interview schedule structured to tap proposed three factors of team grit • Conducted Thematic Analysis to derive themes from which items could be drawn: data coded, categorised into themes, items written • Formulate items to reflect literature and focus group findings	• Deepen understanding of team grit in operation. • Proposed a fourth team grit factor: Connectedness • Drafted 56 items
Review of the item pool by experts	Attain scholarly opinion on the initial item pool for content validity and formulation	• *N* = 6 experts • Ph.D. qualifications • Scholars in grit (2), scale development (1) and organisational behaviour (3) • South Africa-based but with global academic experience	• Survey with evaluation criteria and commentary box accessed via Google Forms • Reviewers assessed each item against three criteria: simplicity, clarity and validity, and provided open commentary as preferred	• Content validity upheld • Deleting and revision of items: of the 56 items assessed, 11 were deleted, 3 added, 22 reworded • Resultant 48 items in the item pool
Pilot review of items	Evaluate the face validity and suitability of the items in practice from the target population	• *N* = 5 • Individuals working in teams for >3 months • High pressure, professional industries	• Survey accessed via Survey Monkey • Respondents completed full survey including introductory	• 48 items retained • Introductory letter simplified

		• Range of industries	letter, demographic questions and items • Respondents tested the survey's functioning by accessing via mobile as well as web interface	
Wave 1 study: Exploratory factor analysis	Explore the factor structure of the first draft scale (48 items)	• First-wave quantitative data • N = 205 • Respondents sourced via LinkedIn • Worked in team >3 months • Professional industries, with high pressure • South Africa-based respondents	• Sphericity and sampling adequacy indicate suitable data. • Exploratory factor analysis (principal axis factoring with oblimin rotation)	• Four-factor solution, with internal consistency • 23 items removed • Resultant 25 items for next wave
Wave 2 study: Exploratory factor analysis for scale purification	Explore the factor structure of the second draft scale (25 items) and examine whether the model is upheld through confirmatory factor analysis	• Second-wave quantitative data • N = 236 • Professionals with > 3 months team experience in high pressure industries • Respondents: Global management consulting firm and global engineering consultancy • South African based respondents	• Sphericity and sampling adequacy indicate suitable data • Exploratory factor analysis (principal axis factoring with oblimin rotation)	• Principal axis factoring resulted in the removal of 11 items to retain 14 items
Wave 3 study: Exploratory factor analysis for scale purification	Explore the factor structure using 14 retained items	• Quantitative data • *N* = 269 • Accessed through global panel • USA-based respondents • Worked in team >3months, any industry	• Exploratory factor analysis (principal axis factoring with oblimin rotation)	• Six items removed to improve stability • One-factor solution confirmed for remaining eight items. • Convergent and discriminant validity confirmed

		with high pressure, age range 18-65		
Nomological net testing	Establish the usability of the scale in the nomological net	• Combined wave 3 and wave 4 data	• Four scales were added – two expected antecedents and two expected outcomes • Structural equation modelling	• Nomological validity established with two antecedent and two outcomes of team grit
Scale discriminant validity	Compare team grit scale with individual grit scale (Grit-S)	Compared items for Team grit with Duckworth's Grit-S scale	• Factor analysis – principal component analysis with Varimax rotation (random data set)	• PCA showed that factors loaded separately for individual and team grit, confirming team grit scale as discriminant from individual grit scale. • Grit perseverance of effort factor loaded closer to team grit than did consistency of interests factor
Wave 4 study: Confirm factor structure	Confirm the factor structure and path model using the 8 retained items	• Quantitative data • N = 228 • Accessed through global panel • UK-based respondents • Worked in team >3months, any industry with high pressure, age range 18-65	• Confirmatory factor analysis with bootstrapping and eight fit indices	• Team grit shown to be an eight-item, one-factor solution
Scale invariance	Determine scale invariance across samples	• Comparing wave 3 and wave 4 sample data: USA vs UK	• Goodness of fit statistics for the combined sample	• Scale is found to be invariant across all levels for the two samples

3.3 Phase 1: Qualitative phase

Qualitative research is useful when a new construct is being explicated because it enables a deeper exploration of the meaning of the construct. This is typical where the construct is newly developed or is being applied within a new domain or context (Duckworth et al., 2007; Schmidt et al., 2017). Very few studies of grit have employed qualitative research, with a few exceptions (Armstrong et al., 2018; Datu et al., 2018; Duckworth et al., 2007; Eskreis-Winkler et al., 2014). Datu and colleagues (2018) conducted a small qualitative research phase to confirm their proposed grit model in a collectivist setting. The seminal study on grit employed a qualitative component upfront, prior to the development of the Grit Scale (Duckworth et al., 2007). In both studies, the upfront interviews were a small component of the later research. A similar approach was used in this study where the exploratory phase laid the groundwork for the subsequent scale development phase.

An effective scale is only as good as the conceptual model underlying it (Worthington & Whittaker, 2006). Thus, the starting point in this research was to explicate the conceptual model for team grit and derive the core components of the construct. This was initially done through the literature review, through which the components of team grit were proposed. These components were used to draft focus group prompts which formed the basis of the questionnaire used to guide the focus group discussions.

3.3.1 Focus groups

Focus groups were selected over interviews as the most suitable data generation method to explore dynamics within teams, and to surface themes related to the team's pursuit of their goal. Several attributes of focus groups led to the selection of this data generation approach. Firstly, focus group research is a method of data generation that is commonly conducted with existing groups (Rabøl et al., 2012). It was important in this study to surface insights from groups which already operated as a team, rather than bringing a group of strangers together to opine on a specific topic. Secondly, focus groups are used to gather data in domains where there is a paucity of existing knowledge (Rabøl et al., 2012), which was the case in this study into team grit. Thirdly, focus groups are mechanisms of data gathering where data is collected "through group interaction on a topic determined by the researcher" (Morgan, 1996, p.130). Put another way, the focus group is a simulation of the social relations being studied. Lunt and Livingstone (1996) argue that the focus group is not intended to derive individual viewpoints on the topic being studied, but rather to surface group-level perspectives. They contend that "the group context may itself be significant to the theoretical framework of the research" (Lunt & Livingstone, 1996, p.9). While scholars have questioned the value of focus groups

compared to interviews (Stokes & Bergin, 2006), more recently the technique has been shown to favourably compare to field trials in marketing research (Hamlin et al., 2017), and, relevant to this research, has applicability for item development for scales (de Sousa et al., 2020).

Given the collective nature of the study, the research purposefully relied on this interaction between focus group members, rather than individual interviews, to generate insight about the team's functioning and practices. The focus groups were intended to surface shared views among the team's members regarding their team's grit, rather than individual perspectives.

Ten focus group discussions were held, each with a different team, and each in a different organisation. The teams were established teams with members who had worked together and knew one another. The researcher acted as moderator for each group and used a semi-structured question schedule to guide the discussion (Lunt & Livingstone, 1996). Questions were posed to the team, and all team members were invited to respond. Probing was used to delve deeper into certain responses and to encourage team members to comment on one another's responses. This is in keeping with the approach for successful focus groups, in which the moderator needs to be able to stimulate interaction between the focus group participants (Lunt & Livingstone, 1996).

3.3.2 Population and sample

The focus groups were conducted over a period of several months and were analysed as they took place, in order to determine the point at which theoretical saturation occurred, that is, the point at which when no new themes were raised in the focus groups. This was reached after ten focus groups. This sample size is in line with the guidelines for focus group research of between four to six groups to achieve saturation (Morgan, 1996). Furthermore, the selection of Thematic Analysis (TA) as the analytical approach offers flexibility in sample size, as TA can be conducted on small or large data sets (Clarke & Braun, 2014).

A criterion for team selection was that they had operated together for a minimum of three months. This requirement is supported by the theory of emergence of team-level phenomena which asserts that team constructs emerge over time through the interaction and emotional exchanges of the individuals (Kozlowski & Klein, 2000). Hence, time operating together as a team was a requirement for participation in the interviews.

Given the focus of the research on team grit in the workplace, respondents needed to be members of a team within an organisational context. This was to assess perceptions of the dimensions of team-level grit. Teams were identified and accessed through the researcher's personal network. In selecting the teams this research was guided by extant theory on individual grit, which showed that grit is particularly relevant in high stress environments

(Lucas et al., 2015). Consequently, non-probability purposive sampling was employed to select teams who operated in high stress environments. The study drew teams from the financial services, software development, management consulting and engineering consulting industries, where the use of teams is prevalent and performance-related pressure is common. Table 3.2 summarises the industries and team types as well as the number of team members who participated in the focus groups.

Table 3.2 List of focus groups for qualitative research

Focus group number	Industry	Team type (Client industry)	Manager present Y/N?	Number of participants in interview	In-person/ Virtual/ Hybrid?
1.	Technology	Software development and implementation project team	Yes	15	12 in-person, 3 dialled in (audio only)
2.	Management Consulting	Strategy and Operations consulting Project Team	Yes	6	In-person
3.	Management Consulting	Strategy and Operations Consulting Project Team	Yes	6	5 in-person, 1 dialled in (audio only)
4.	Management Consulting	Human Resources Consulting Project Team	Yes	7	All virtual using MS Teams, with video
5.	Management Consulting	Strategy and Operations Consulting Project Team	No	7	All virtual using MS Teams, with video
6.	Management Consulting	Strategy and Operations Consulting Project Team	No	7	All virtual using MS Teams, with video
7.	Financial Services Organisation	IT Division Leadership Team	Yes	8	All virtual using MS Teams, with video
8.	Engineering Consulting	Client Services Division team	Yes	7	All virtual using MS Teams, with video
9.	Engineering Consulting	Project Delivery Team	Yes	6	All virtual using MS Teams, with video
10.	Insurance	Sales Team	Yes	8	All virtual using MS Teams, with video

3.3.3 Data collection

Data collection was guided by a focus group questionnaire (Appendix 1). The data generation approach was primarily deductive, with the questions structured according to the hypothesised elements of team grit. However, there was also an element of inductive data gathering as the moderator endeavoured to explore topics and allowed the discussion to stray at times, in order to surface additional elements that could be relevant to team grit. The interviews were recorded using a voice recorder and transcribed verbatim after the interview. The researcher uploaded all transcripts to Atlas software programme, a qualitative research analysis tool widely used in academic research.

3.3.4 Data analysis: Thematic Analysis

The analysis of focus group data followed the phases of thematic analysis. (Braun & Clarke, 2006). Thematic Analysis is recursive, meaning the phases are not necessarily discrete but a researcher may go back and forward between the phases to generate deeper insights as they look for themes. Braun and Clarke (2006) identified six phases: (1) Familiarising yourself with the data and identifying items of potential interest, (2) Generating initial codes, (3) Searching for themes (4) Reviewing potential themes. (5) Defining and naming themes, and (6) Producing the report.

These phases were applied to the research as below.

1. Familiarisation with data

The researcher read each transcript several times and made notes and observations. During the familiarisation phase, the researcher began to identify and record interesting pieces of data.

2. Generating initial codes

The study employed a deductive approach. To enable this, the researcher compiled a list of codes from the literature review. These codes are concepts which were expected to be surfaced in the interviews, based on the theory and conceptual framework of team grit (see Appendix two for interview code list). The researcher used the code list to identify relevant data in the transcripts. Where codes emerged that were not already in the code list, these were added to the list. In addition, the researcher used in vivo coding where verbatim phrases in the transcripts were deemed to capture the essence of meaning.

3. Search for themes

The researcher extracted key themes from the coding, guided by the research questions on team grit and the conceptual framework. During this phase, certain themes were collated, and

others discarded where they were deemed less relevant. In this phase the researcher looked to ascertain the level of support for the proposed framework of team grit and look for support across the data set of any additional dimensions. The result of this phase was a consolidated list of interrelated themes.

4. Review potential themes

The researcher checked the data on two levels: firstly, that the themes fit at the level of the coded data, capturing the most important data within the codes, and secondly, that the themes fit the broader data set. This process resulted in a final set of themes.

5. Define and name themes

In this phase the researcher defined and described the themes and their interrelationships, weaving these insights into an overarching narrative. This resulted in a revision to the original conceptual framework of team grit. The revised framework reflects the deeper insights that the interviews produced.

6. Produce the report

Braun and Clarke (2006) state that the report should be developed across all phases, but it is at the end that it is refined and finalised, referring to literature if warranted. The researcher revisited the literature in the light of the outcomes of the qualitative phase and embedded the new insights in extant theory. The resultant report articulated a richer construct of team grit than what had been proposed prior to the focus groups.

3.3.4.1 Validating the qualitative analysis

Several analytical techniques are recommended for analysing data in the process of thematic analysis (Castleberry & Nolen, 2018). This research used several of these techniques to ensure rigour in the analytical process and enhance the validity of the findings.

Memoing was used extensively during the data analysis process, beginning with notes taken during the focus groups by the researcher who conducted the focus groups herself. The sessions were recorded on a voice recorder when the group was held in-person, and via the MS Teams recording feature where the sessions were held virtually. The researcher made notes during the focus groups. These were typically observations on team interactions and dynamics, such as the order in which people responded, and the dominance of particular individuals. Other observations included gestures made by participants, pausing, and vocalising like laughs or groans. The researcher also noted the mood or tone of the interviews, and identified how humour was used and the closeness that existed between members. Interactions between participants such as physical touch, and glances between them, were informative regarding the nature of their interactions.

After conducting the focus groups, the memos were revisited and expanded upon, and the researcher analysed and interpreted the flow and events of the focus groups against a theoretical backdrop of the proposed model of team grit. After transcription, these memos were consulted to inform the coding process, given that coding in this study was largely deductive and based on the conceptual model that had been developed through the literature review.

Memoing continued to be important after the coding was completed, and the analytical process focused on the identification of themes. A detailed analytical process was undertaken to identify themes. Many themes were identified, and then structured into a hierarchy, with some themes becoming sub-themes of others. Examples include humour and the venting of frustrations, which were both categorised to the overarching theme of connectedness. Other identified themes were deprioritised, such as the theme of team leadership, as the analysis showed that leadership was not discussed much across the focus groups and this was aligned to the conceptual model of team grit developed in the literature review, as well as research indicating that leadership is more relevant for organisational-level constructs (Stoverink et al., 2020). Leadership was therefore noted as a future area of study in relation to team grit. The memos were developed further in the theming process, and included diagrams linking themes to each other, and quotes from the focus groups that explicated a particular theme. The thematic map was developed in this process which linked the themes identified in the focus groups with the literature review. Both the coding and theming processes were recursive processes, in which the researcher repeatedly went back to consult the transcripts, the recordings, and the memos in order to identify codes and themes.

Peer debriefing was used to improve the rigour in the data analysis and help to validate the analytical findings. The researcher consulted two peers within the university on the qualitative data analysis process and findings, including the codes, the coding categorisation, the themes extracted, and the memo notes made. These interactions were helpful in refining the thinking around the themes.

All the above-mentioned processes served to increase rigour in the analysis and strengthen the validity of the resultant findings.

3.4 Phase 2: Quantitative Phase Scale development

This section discusses the methodology adopted to develop and validate the team grit scale. This phase follows the prior qualitative research phase in which the dimensions of team grit were derived. Table 3.3 lays out the process followed in this study. DeVellis's steps for the construction of a new scale were used as a guide to inform the approach to scale

development. They are as follows: (1) Determine clearly what it is you want to measure, (2) Generate an item pool, (3) Determine the format for measurement, (4) Have the initial item pool reviewed by experts, (5) Consider inclusion of validation items, (6) Administer items to a development sample, (7) Evaluate the items, and (8) Optimise scale length (DeVellis, 2003). Each of the key steps is explained in greater detail below.

Table 3.3 Scale development process employed in this research

Step	Description
1. Item generation (Generated 56 items)	Literature review, team focus groups. Development of the conceptual model of team grit, identified construct components
2. Refinement of item list by panel of experts (Reduced the item list from 56 to 48 items)	Six experts (academics and practitioners) reviewed and critiqued the item list using Google Forms online survey tool. This was out of a total of 11 experts who were approached to participate in the review.
3. Pilot study	Conduct a small study with five respondents using Survey Monkey online tool
4. Wave one data collection (Reduced the items from 48 to 25 items, 4 factor solution)	Distributed survey via LinkedIn with link to Survey Monkey – 258 responses collected of which 205 were usable Statistical techniques used: • Bartlett's test and Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy test • Exploratory factor analysis • Reliability assessment using Cronbach's Alpha
5. Wave two data collection (Item reduction, purification and refinement of the measure; Reduced the items from 25 to 14 items; Demonstrated support for a 4-factor solution)	Survey distributed to two organisations: a global Consulting firm and a global Engineering consultancy, with link to Survey Monkey – 314 responses collected of which 236 were usable Statistical techniques used: • Bartlett's test and Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy test • Exploratory factor analysis • Reliability assessment using Cronbach's Alpha
6. Wave three data collection (Item reduction, purification and refinement of the measure; Reduced items from 14 to 8 items, and a one-factor solution)	Survey distributed within the United States of America via Cint, global panel research organisation – 326 responses collected of which 269 were usable. Additional scales were included in the item list to determine discriminant validity (vs individual grit) and nomological validity. EFA conducted Statistical techniques used: • Bartlett's test and Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy test • Exploratory factor analysis • Reliability assessment using Cronbach's Alpha

7. Wave four data collection (Confirmation of 8 item, one- factor measure; Invariance testing)	Survey distributed within the United Kingdom via Cint, global panel research organisation – 234 responses collected of which 228 were usable.
	• Confirmatory Factor Analysis:
	  o Fit indices (Chi-square, RMSEA, ECVI, CFI, TLI, NFI, GFI, AGFI)
	  o Modification indices
	  o Squared multiple correlations
	  o Standardised residuals
	• Composite reliability
	• Discriminant validity
	• Structural Equation Modelling (SEM)

Total number of respondents across phases	In total, the following numbers of responses were collected: • 10 team focus groups held • 6 expert reviewers • 5 pilot survey responses • 1132 survey responses collected (Waves 1,2,3,4) • 938 survey responses usable (Waves 1,2,3,4)

3.4.1 Determine what to measure

The endpoint of the qualitative phase formed the starting point for the scale development process, by defining the construct of team grit and developing a conceptual model which described the construct. This is necessary, as a poorly defined construct may lead to the exclusion of scale items that are core to the construct or the inclusion of items that may be only tangentially related to the construct (Worthington & Whittaker, 2006).

3.4.2 Develop item pool

With the construct of team grit well-defined and the dimensions clearly expressed, the next step was to develop a pool of items that tapped the construct. The objective here is to develop a comprehensive set of items that adequately reflect the dimensions of team grit such that the subsequent statistical processes will yield a set of underlying factors that reflect the construct dimensions (Worthington & Whittaker, 2006).

DeVellis (2003) suggests that the item pool should contain 3-4 times more items than the final scale and assumes the principle that the bigger the pool, the better (2003). Internal consistency reliability is a function of the strength of the correlation between items, as well as the number of items within the scale, but given that the correlation cannot be determined at this stage of the scale development, a larger pool reduces the risk of internal consistency being poor.

It is accepted practice to draw items from existing scales where these are relevant to the construct under study, or to write new items (DeVellis, 2003). Both approaches were employed in the present study. This study drew items from three extant scales: the 8-item Grit-S scale which measures individual grit (Duckworth & Quinn, 2009); the 'adaptability to situations' items within the Triarchic Model of Grit Scale, TMGS. Scale development research by Datu, Yuen and Chen (2017) confirmed the Grit-S factors (Perseverance of Effort and Consistency of Interests) but identified adaptability to situations as a third factor; and the Passion scale (Sigmundsson et al., 2020), which was included to increase the emphasis on passion, in response to criticism that passion, despite being a core component of the grit definition, is under-represented in the Grit-S scale (Jachimowicz et al., 2018).

In addition to the inclusion of items from extant scales, new items were written. These were drawn from literature, the focus groups and thematic analysis. Several items were added to the existing grit dimensions already in existence. However, the interviews identified the possibility of an additional element as a component of team grit: team connectedness. This has been supported by recent studies in which organisational and team grit have been conceptualised (Lee & Duckworth, 2018; Luning et al., 2022; Bernardy & Antoni, 2021.). As a result, Team Connectedness items were drafted and included in the item pool.

All three of the existing scales mentioned above were designed to measure individual-level constructs. For the purposes of this study, they were adapted to measure collective constructs, using a referent-shift consensus approach (Chan, 1998), which is an accepted approach to measure group-level constructs (Wallace et al., 2016). This approach is applied where the construct at the individual level is taken to be isomorphic with the construct at the collective level, and the construct is translated from the individual to the collective by adapting the individual measure through changing the referent from "I" to "We". Therefore, instead of rating themselves, the individual, scale respondents rated their team, which is the unit of analysis for this research. Consequently, all items in the item pool use 'we' and 'our' as the referent as opposed to 'I' and 'my". Additionally, where original scales were negatively worded, these were reversed prior to being re-written with the referent changed to the plural, to improve the validity of scale responses and avoid the risk of systematic error in the scale (Hinkin, 1995). This affected the Consistency of Interests items of the Grit scale, and each was reworded in the positive, as seen in the table in Appendix three. The table lays out the items that were generated for expert reviewers to review. It identifies where each item was drawn from – whether from extant scales, literature or the focus groups. As the table demonstrates, the original item list comprised the following number of items: sixteen items expected to tap Consistency of Interests, fifteen items for Perseverance of Effort, twelve for Adaptability and thirteen for Connectedness. The original pool contained a total of fifty-six items.

3.4.3 Review of draft item pool

It is advised to have a group of experts review the pool items to assess item quality (DeVellis, 2003). At the very least, experts should review the content validity of the items, that is, the degree to which the items reflect the content domain that is being measured (Worthington & Whittaker, 2006). The researcher contacted eleven potential reviewers via email, explaining the research objectives and approach, and requesting their participation in the review. Six of the eleven agreed to conduct the review. Table 3.4 summarises the reviewers' roles, country, field of expertise and whether or not they agreed to participate. Taking a lead from extant research on the development of team-level scales, this study had the pool items reviewed by a panel of six experts, made up of human resource and organisational development practitioners as well as academics in the field of grit and team effectiveness (Paulin & Griffin, 2017). In addition to the item-specific feedback given by reviewers, they were also invited to make general comments. For example, one reviewer opined that it would be difficult to psychometrically distinguishing between passion and perseverance, citing that passion is typically a prerequisite for perseverance. Another reviewer proffered an opinion that the survey would succeed in measuring team grit but cautioned against social desirability bias. The researcher composed a detailed briefing document which was emailed to all reviewers. This included the background on the theory of team grit and instructions on how to complete the review, assessing each item for simplicity, clarity, and validity. They were also asked to examine the quality of the scale, which included looking at how long it was, whether the grammar was accurate and whether any items seemed dubious (DeVellis, 2003).

Table 3.4 List of expert reviewers in this research

No.	Expert reviewer role and location	Relevant field of expertise	Willingness to participate
1	Professor, South Africa	Organisational Behaviour	Participated
2	Professor, South Africa	Scale Development and Organisational behaviour	Participated
3	Academic, South Africa	Grit (Individual)	Participated
4	Practitioner, South Africa	Scale development and Organisational Behaviour	Participated
5	Academic, South Africa	Organisational Behaviour	Participated
6	Academic, South Africa	Grit (Individual)	Participated
7	Academic, USA	Organisational Grit	Declined
8	Academic, South Africa	Grit (Individual)	Declined
9	Professor, The Netherlands	Grit (Individual)	Declined
10	Academic, USA	Team scale development	No reply
11	Professor, India	Team scale development	Declined

In addition, reviewers were invited to comment on each item or on the item pool overall. A link to the review survey which was loaded onto Google Forms was inserted into the briefing document. Table 3.5 summarises the review criteria and their descriptions, as given to the reviewers.

Table 3.5 Item review criteria

Criterion	Description
Simplicity	The items need to be simple, and not contain double-barrelled concepts in one item.
Clarity	Written in such a way as to make the meaning of the item clear
Validity	Content validity: the test is fully representative of what it aims to measure. It covers the full domain and not more than the domain that it measures.

After all reviewers had completed their review, the researcher analysed all comments per item, and identified common feedback and responded to the required reviews. Of the 56 items which the reviewers assessed, 11 were deleted, 3 new items were added, and 22 items were reworded to improve their quality. Following the expert review the item pool comprised of 48 items.

3.4.4 Item Measurement

It is also necessary to determine what format the measurement should take (DeVellis, 2003). Several formats are available, but most popular in scale development studies is the Likert scale, with reliability increasing up to a 5-point measure, and tapering off thereafter (Hinkin, 1995). A 5-point Likert measure was used in the development of individual-level scales including the original grit scale, Grit-O (Duckworth et al., 2007), the Grit-S scale (Duckworth & Quinn, 2009), the Triarchic Model of Grit scale (Datu et al., 2017) and the Passion scale (Sigmundsson et al., 2020). The 5-point Likert measure has also been used in several team-level scales, including the team viability scale (Aubé and Rousseau, 2005), the team creativity scale (Gong et al., 2013), the team resilience scale (Sharma & Sharma, 2016) and the team incivility climate scale (Paulin & Griffin, 2017). As a result, this was the chosen format employed in constructing the team grit survey. Echoing the wording employed in the seminal individual grit study (Duckworth et al., 2007), the resultant Likert scale was:

1 - Not at all like my team

2 - Not much like my team

3 - Somewhat like my team

4 - Mostly like my team

5 - Very much like my team

3.4.5 Piloting the draft measure

The items were compiled into a survey, including an introduction, ethical caveats, instructions for completion, as well as demographic and team screening questions. The survey was loaded onto an online survey tool, SurveyMonkey, and pilot respondents were sent a link to complete the survey online. The pilot was conducted with 5 respondents, who were asked to assess the ease of use of the survey and to determine how the Survey Monkey online tool functioned across various access methods – whether using a computer or a mobile phone.

3.4.6 Population and sample

Larger sample sizes are preferred for scale development, as these result in more stable correlations between variables, which will enable the outcomes of the analysis to be replicated (DeVellis, 2003). For the exploratory factor analysis in wave one, sample power analysis was based on the most often used rules of thumb. Worthington and Whittaker (2006) provide guidelines on sample size for scale development. At the top end is the guide that samples of 300 or more respondents are adequate to ensure data reliability. Typically, 150 responses are considered the minimum acceptable sample size (Hinkin, 1995). However, smaller samples (fewer than 150) are acceptable under certain conditions, albeit less than 100 is considered inadequate (Worthington & Whittaker, 2006). Extant scale development studies use sample sizes of 116 (Paulin & Griffin, 2017),152 (Sharma & Sharma, 2016), 158 (Cardon et al., 2013), 270 (Wyszyńska et al., 2017), 350 (Datu et al., 2017), 452 (Goddard, 2002), 667 (Constantin et al., 2012) and 1308 (Duckworth & Quinn, 2009) for the Exploratory Factor Analysis (EFA).

It is common practice within confirmatory factor analysis (CFA) to apply the questionnaire to a new sample (Cardon et al., 2013; Datu et al., 2017; Duckworth et al., 2007; Duckworth & Quinn, 2009; Paulin & Griffin, 2017). It is recommended that CFA should not be undertaken with fewer than 100 participants (Worthington & Whittaker, 2006). CFA sample sizes used in extant studies in the content domain include participant numbers of 146 (Datu et al., 2017), 318 (Constantin et al., 2012), and 357 (Paulin & Griffin, 2017) and 1554 (Duckworth & Quinn, 2009).

The sample sizes which were secured across each of the four waves complied with the recommended size explained above: In wave one of this study, 258 responses were received while 205 were usable after data cleaning. In wave two, 314 were collected and 236 were

usable. In wave three 326 were collected and 269 usable. In wave four 234 were collected and 228 usable. In total 1132 responses were collected and 938 were usable and analysed within the study.

3.4.7 Data collection

3.4.7.1 First wave

In wave one, the researcher collected data through LinkedIn by posting a request for participation and a link to the survey on SurveyMonkey. Snowball sampling was employed to extend the reach of participant recruitment, by requesting those who agreed to participate to send on the participation invitation to others within their network. The approach outlined here is non-probability purposive sampling, a popular approach used in sale development studies (Worthington & Whittaker, 2006). The researcher uploaded the survey to SurveyMonkey, an online research survey tool which is widely used in academic research. The survey contained an introduction to the research, an explanation that participation was voluntary and that responses would be anonymised, demographic and screening questions and the items themselves.

The wave one data was collected using Survey Monkey and distributing a link to the survey to the researcher's contacts on LinkedIn.

Based on the aforementioned rules of thumb, and Tinsley and Tinsley's (1987) suggestion of five to ten respondents per item, a sample size of 240 to 480 respondents would be required. In total, 258 responses were received. Of the total responses, 45 respondents had only answered the demographic questions and not completed the body of the survey, the item list. These cases were removed from the data set. A further eight cases were disqualified where respondents had answered that they had not worked in a team for a minimum of three months, and these cases were removed. Seven cases had missing fields, and these were imputed using SPSS imputation. This left a final number of 205 complete cases in the clean data set.

3.4.7.2 Second wave

Data collection for wave two was completed using the same approach employed in the previous wave, with a survey uploaded to Survey Monkey. The respondents in this wave were employees of two organisations, the first organisation being the Africa business of a global management consultancy, and the second being the South African business of a global engineering consultancy. Leaders in both organisations sent out an email letter to their staff, introducing the research and its objectives, and sharing the link to the SurveyMonkey site. Their letters clearly stipulated that participation was voluntary and anonymous and that respondents were welcome to withdraw from the survey at any stage.

Using Tinsley and Tinsley's (1987) rule of thumb again, the second wave required a sample size adequate for 25 respondents. A sample size of 125 to 250 participants was required.

Analysis began with 314 total responses. Instead of engaging in imputation, incomplete responses were removed in the interests of maintaining high data integrity and upholding the desire to purify the scale in a valid fashion. This resulted in retaining 241 valid cases. Outliers were examined making use of box plots, and it was found that five cases (165, 167, 177, 178, and 225) were persistent outliers across the data set. These were removed accordingly which resulted in retaining 236 responses for wave two analysis.

3.4.7.3 Third wave

The sample for wave three was accessed via an international research panel, using Cint, a global digital insights and research technology company. The wave three sample was from the United States of America. Use of panel data is an approach that has been used in prior scale development research (Baldus et al., 2015). Cint hosts the world's largest consumer network for digital research, which consists of more than 149 million research participants across over 130 countries (www.cint.com). The Cint panel is accessed from within the SurveyMonkey platform. This makes it simple to commission data gathering from within the Cint population, according to the sampling criteria specified by the researcher. The survey contained an upfront introduction section, including a description of the research, instructions for completion, the assurance of anonymity and commentary that participation was voluntary, and that respondents were allowed to withdraw at any stage. Cint adheres to strict ethical standards, including The Council of American Survey Research Organization's ("CASRO") Code of Standards and Ethics for Survey Research, and the ICC/ESOMAR International Code on Market, Opinion and Social Research and Data Analytics.

With 14 items included at the start of the third wave of analysis, the Tinsley and Tinsley (1987) rule of thumb of 70 to 140 participants would be required. However, given that this was also used to establish the nomological validity of the scale, the Daniel Soper *a priori* sample size calculator was used. The anticipated effect size was set at .2, with the desired statistical power level at .8. The model consisted of 5 latent variables and 31 observed variables, and the probability level was set at .05. This suggested a minimum sample size to detect effects of 229 participants, and 233 to confirm the model structure.

The sample consisted of 326 responses from the United States of America. After initial cleaning, 284 remained. As before, the researcher sought to examine outliers. These were assessed using stem-and-leaf diagrams as well as box plot approaches. Through these approaches it was determined that 15 respondents (response numbers 26, 28, 52, 147, 154, 155, 158, 162, 173, 176, 188, 194, 206, 215, and 231) were consistent outliers. The removal

of these 15 data points reduced the sample to 269, this being the final clean data set for the wave three sample and analysis. A post hoc G*Power calculation shows that the sample size of 269 was more than adequate at a medium effect size (f^2 = .015) with a power value of 0.9999673.

Wave three data was used to confirm the final instrument, determine discriminant validity with other scales in the nomological net of team grit, assess predictive validity and test for invariance. The third wave questionnaire consisted of the 14 items which resulted from wave two analysis, measured on a five-point Likert scale. In addition to these items, the researcher added scales that measure constructs within the team grit nomological net. Appendix six specifies the scales that were selected, the items for each scale and the reliability metric for each scale. Four scales were chosen: team goal commitment (Aubé and Rousseau, 2005), team innovation (Mitchell et al., 2022), team psychological safety (Edmondson, 1999), and team work engagement (Costa et al., 2014). It was proposed that team goal commitment and team psychological safety are antecedents of Team Grit, while team innovation and team work engagement are outcomes of Team Grit. These nomological relationships were tested in the analysis of the third wave of data.

3.4.7.4 Fourth wave

In wave four responses were once again collected through the global research panel, Cint. The sample consisted of 234 responses all from the United Kingdom. The data was cleaned, checking that there were no missing values. The data was also examined for outliers. The boxplots showed 6 responses to be multivariate outliers, and these were removed – 160, 203, 206, 212, 218, 222. This resulted in retaining 228 valid observations for analysis. Descriptive statistics were analysed. A post-hoc G*Power calculation of the sample size of 228 respondents at a medium effect size suggests a power value of .994.

3.4.8 Conduct analysis

3.4.8.1 First wave

In wave one of the study the objective was to extract the latent factors in the data through exploratory factor analysis (EFA) and assess the reliability of the scale using Cronbach's alpha. Prior to conducting EFA, several assumptions regarding factorability of the data were tested. The Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy and Bartlett's test of sphericity were applied to assess suitability for exploratory factoring. Item loadings were reviewed and only those with adequate loadings retained. Several approaches can be adopted in determining which factors to retain, but this study assessed the eigenvalues as advised by Worthington and Whittaker (2006).

EFA was undertaken using IBM SPSS statistics package, using principal axis factoring with oblique rotation, this being preferred method for the development of new scales (DeVellis, 2003), which has been used in several scale development studies (Datu et al., 2017; Sharma & Sharma, 2016). The researcher specified a four-factor structure in the EFA, in accordance with the theorised dimensionality of team grit. Giving theory the benefit of the doubt, specifying a four-factor model would guard against under-factoring, which risks losing aspects of the construct (Zwick & Velicer, 1986). Since this would not be the final wave of data gathering, the researcher realised that if this was an error, further waves of data gathering would wash it away. Being guided by literature that suggest that eigenvalues are only accurate at most 50% of the time (Tabachnick & Fidell, 2013), and scree plots only 10% of the time (Hayton et al., 2004), a four-factor solution was specified, rather than adhering to the Eigenvalues and scree plot rules of thumb. Reliability analysis was conducted to ascertain the strength of the associations between attributes, and Cronbach's alpha applied. Several items were removed from the scale based upon their contribution to the factor solution. Through this analysis the item pool was reduced from 48 items to 25, with a four-factor structure.

3.4.8.2 Second wave

A second exploratory factoring (EFA) was done for wave two. The same analytical process was used for the EFA, starting with descriptive statistics and data suitability assessments, followed by principal axis factoring with oblique rotation. Again, a four-factor solution was specified in accordance with the proposed factor structure of team grit. This analysis intended to further reduce and refine the measure. The number of items was reduced from 25 items to 14 items and retained the four-factor structure.

3.4.8.3 Third wave

The wave three study aimed to explore and confirm the factor structure using a new sample. Similar to the first two waves of data collection, the first analysis was to test whether the data could be analysed, followed by EFA, using principal axis factoring and with oblique rotation. Reliability was tested using Cronbach's alpha to assess internal consistency of the 14-item scale after EFA. Unlike waves one and two, a two-factor solution was specified in this study after assessing eigenvalues which provide support for a two factor rather than a four-factor solution. After consulting a parallel analysis a one-factor model emerged as the superior model. It was at this point that the researcher conceded that the theoretical four factor model was not fitting the data and that a one-factor solution was a better fit. The EFA resulted in several iterations of purification leading to the removal of six more items, resulting in an eight item, one-factor solution.

3.4.8.4 Fourth wave

In wave four confirmatory factoring (CFA) was conducted using the 25th version of the SPSS Amos statistical software package. This was done using a new sample, to confirm the one factor, eight item model derived in wave three, and to test for construct validity, model fit and measurement invariance. A CFA model was derived to determine how well the data fit the proposed theoretical model resulting from the EFA in the previous wave. The researcher used item loadings and cross loadings on factors to determine whether items should be deleted or retained in the data. According to Worthington & Whittaker (2006) internal consistency of the instrument scores, as well as the low conceptual consistency with other items on the factor, can also be considered when choosing to delete items. Longer scales are more reliable; therefore, researchers need to trade-off between reliability and brevity (Worthington and Whittaker, 2006). Structural equation modelling is the typical method used to conduct CFA, which aims to identify the best model fit to the data (DeVellis, 2003).

Literature offers no consensus about the preferred indices of model fit (Sharma & Sharma, 2016), and as a result several approaches are seen, suggesting differing cut-off levels. Worthington and Whittaker express a preference for Kline's guidelines (2005), which advise that at a minimum the following fit indices are reported: chi-square test, including degrees of freedom, and significance level; RMSEA, including its 90% confidence interval; Comparative Fit Index; and SRMR. (Worthington & Whittaker, 2006). Multiple goodness of fit indices were consulted in this study. The SEM analysis confirmed the model fit, with the eight items, one factor solution.

3.4.9 Determine nomological validity and measurement invariance

It is not sufficient to develop the scale without determining what the scale's theoretical and empirical links are with other constructs, that is, its relationship with other constructs within its nomological net. Nomological validity assesses whether there is consistency between the relationships among measures and their theoretical predictions (Netemeyer et al., 2003). Nomological validity is determined using correlations between the construct of interest and the measures of other constructs. Nomological validity is a type of predictive validity between constructs within a network of relationships. Nomological validity was tested by proposing the hypothetical relationships between the team grit scale and the scales proposed as antecedents and outcomes of team grit in the literature review – team goal commitment, team psychological safety, team innovation and team work engagement – and testing the correlation between them (Gerbing & Anderson, 1988). Results showed that team goal commitment is an antecedent to team grit, while team innovation and team work engagement are outcomes.

Following the assessment of nomological validity the researcher moved to determine measurement invariance for the scale. Measurement invariance was assessed between the USA-based sample secured in wave three and the UK-based sample from wave four. The purpose of this was to assess invariance between the two samples. Evidence of invariance across two groups will indicate that the measures in the measurement model have the same meaning in more than one group. Testing for invariance in scale development addresses the question of whether the measurement parameters of a measuring instrument are different across two samples. Measurement invariance is assessed in four steps which are increasingly stringent. The steps of measurement invariance are as follows (Putnick & Bornstein, 2016):

1. Configural invariance, which if upheld confirms that the structure of the construct is similar across the different groups.
2. Metric invariance, which, if upheld, confirms that each item in the scale contributes similarly to the latent structure, across the groups.
3. Scalar invariance, which if upheld, confirms metric invariance at the item level.
4. Residual invariance, which if upheld, confirms that the total variance of an item not shared with a factor and the error variance remains similar, across groups.

3.5 Ethical considerations

Ethical concerns are present when data is collected from people. Throughout all waves of data collection, anonymity was maintained during collection and data analysis. Individual consent was secured from each interview participant, as well as the companies that they represented.

For each focus group and prior to approaching team members, the researcher contacted the organisation to secure the consent from leadership to proceed with the discussions. Thereafter, the researcher emailed an invitation and a consent form to each organisation representative. Organisation consent was received in the form of return emails. Team members were invited to participate voluntarily, through an emailed invitation. The researcher moderated each of the focus group discussions. A standardised introduction was voiced over at the start of each interview, specifying the nature and purpose of the interview, and clearly stipulating that participation was voluntary, that responses would be kept confidential and that results would be anonymised and aggregated. Respondents were assured that they could withdraw from the discussion at any point. Respondents consented verbally in the focus group discussion, and across all ten focus groups no respondents chose to withdraw.

To ensure participant anonymity, data was not linked with a participant's name. Instead, a code identifier was used to identify responses in the transcripts. Data was stored in the cloud,

on a computer and on a recording device, and password protected. For the quantitative phase, each survey was prefaced with a declaration assuring the respondent of anonymity and voluntary participation. Where the survey was distributed within an organisation, written consent on the organisation's letterhead was received from the most senior leader in that organisation. In addition, the invitations to participate were emailed by the organisation representative themselves and not by the researcher. In wave three and four the researcher accessed survey responses through Cint. Cint adheres to stringent anonymity protocols and includes the introduction to the research inviting respondents to withdraw at any stage should they wish to do so. The data collected across all phases of this study were stored in a way that protects the participant's identity.

4 Chapter 4: Research Results

This chapter details the results of the qualitative and quantitative data generation processes within the study. This follows the methodology outlined in the previous chapter, in which an initial qualitative phase preceded a quantitative phase in the development of the scale.

4.1 Qualitative analysis

Qualitative analysis played an important role in the development of the initial item pool, by synthesizing the outcomes of the team focus groups with the results of the literature review. This confirmed the themes related to the hypothesised theory of team grit and enabled the initial item pool to be drafted.

Given that team grit had not been well conceptualised as a construct in literature at that point, it was necessary to conduct several focus group discussions with teams, to surface the most relevant factors in gritty teams. A deductive approach was employed, with the interview schedule structured according to the hypothesised components of team grit. Focus groups were held with ten individual teams. Some meetings took place in person while others took place virtually, via the online meeting platforms, MS Teams or Zoom. Even in the in-person focus groups, there were some team members who participated virtually. The teams were selected to participate if they worked under pressure to deliver, and only if they had operated as a team for at least three months. The first condition was imposed so as to assess how teams responded to pressure and challenges, with the assumption that team grit is especially necessary in high pressure environments (Bernardy & Antoni, 2021). The second condition was imposed in response to the theory of team construct emergence, which stipulates that team-level constructs emerge over time (Klein & Kozlowski, 2000). Although literature does not specify what duration is considered a minimum for the emergence of team constructs, the researcher assumed that a three-month duration was adequate for the emergence of team grit. It was not necessary for the group to be operating as a team at the time of the focus group. They were simply asked to answer the questions reflecting on their team in the time that it was in operation.

The section that follows presents a table which provides a description of each team with which a focus group discussion was held (Table 4.1). A discussion follows the table, in which the analysis conducted on the focus group data is presented, according to the themes that were extracted. These themes are named as follows: passion and purpose, perseverance, adaptability, and connectedness. Two additional themes were identified – humour and venting – which were proposed as subcomponents of team connectedness. These are also discussed

in the sections that follow. Each theme is described with reference made to exemplars of that theme, i.e., quotes extracted from the focus groups which demonstrate the relevant theme.

Table 4.1 Overview of focus group sample

Focus group no.	Description of focus group
Focus group 1	The first focus group was with a software development and implementation project team, working in the telecommunications industry. The team had 15 members, of which two thirds were male and one third female. In the group 2 were Black, 2 Indian and the rest White. The team leader was among the focus group participants, a White male. They were skilled technology developers and implementation professionals in a specialised software domain. They were all dedicated to delivering at one client, a telecommunications company headquartered in South Africa but with global reach. Some of the team members were based in other cities and countries and attended the interview by virtual dial-in. The team was comprised of two sub-teams, one responsible for software development and deployment and the other for maintenance of that software. They had had a difficult history of working with a challenging client and were faced with ongoing pressures in the form of budget cuts, deadlines, and clients changing the scope requirements. They were open about their emotional relationships, having had some fiery exchanges in the past but which had led to a deeper honesty and connection between them. They regarded their team as a high-performance team. The members spent time together after work, and humour was evident between them, with some teasing and joking happening between the members during the focus group. They also found value in venting their feelings about their frustrations, which they described as being important and regular, and was visible in the interview itself.
Focus group 2	The second focus group was with a consulting team of a global consulting firm. There were 6 team members, of which only one was female (who was also Indian). Of the group 2 were Indian, 2 Black and 2 White. The team leader was among the focus group participants, a White male. The team had consulted to a telecommunications company. The members had been together for over a year, in which time they had delivered several projects for the same client. Their relationships with the client were strong, even though the client sponsor was considered very demanding and prone to changing his mind on a whim, leading

the team to work over time to deliver. The team spent a lot of time together, typically at the client's premises working on the project, and often after hours, including socially. They had clarity on their purpose to be a high performing team compared to their peers, which they referred to as their 'north star' and they repeated several phrases that they shared, like a 'focus on quality', and 'being the best team'. They prided themselves on uplifting one another so each individuals' goals could be achieved. The had an egalitarian approach, encouraging all members to participate in setting the vision. It was evident that they frequently discussed their team's purpose and functioning. They were considered a very high performing team in their organisation and had achieved several accolades and had seen individuals be promoted due to the work of the team, the latter being something they prized.

Focus group 3

The third focus group was with a consulting team that had worked together for a period of 6 months, designing, and implementing a new operating model for a financial services regulatory body. The work was extremely important for the country and therefore had high pressure attached to delivering successfully. The team comprised two main workstreams which operated somewhat independently but ultimately formed one project team. Six members participated in the focus group, of which 1 was female and 5 were male. Of the 6, 3 were Indian, 2 Black and 1 White (the female). The team leader was among the focus group participants. One member attended the group virtually, dialling in with audio only. The client was extremely demanding and undermining, which left the group feeling a lack of empowerment. They experienced a decline in energy and optimism in the early stage of the project after criticism from the client. The team members credited their leaders for helping to turn around the team mood and enable them to deliver. The team leader's and workstream leaders' ability to roll up their sleeves and work alongside the junior members was cited as necessary to support the team members, improve morale, and help deliver the project. The project was ultimately very successful, winning a global industry award.

Focus group 4

The fourth focus group was with a consulting team of a large global consulting Firm. The team had implemented a human resources software solution at a large bank. The group comprised of 7 team members, of which 3 were female and 4 males. Three were White, 3 Black and 1 Indian. The team leader, a white female, participated in the focus group. The group discussion took place virtually, on MS Teams. The team had worked together over a period of three years; however, they had been deployed as small sub-groups to work with the client for much of

that time and as a result had developed closer ties to the client stakeholders than to each other. There was not much task interdependency and much of their functional delivery was independent of one another. Team members found their own personal goals within the context of the project goal, although there was a sense that the growth in expertise was a valuable endeavour for the group for future opportunities for the team. The discussion was marked by the repeated use of "I" compared to other groups where "we" was used more commonly.

Focus group 5

The fifth focus group was with the consulting team of a large global professional services firm. They had conducted an 8-month long project internally, advising another part of the organisation. The team was made up of 6 members: 3 females and 3 males. All were white except one black female. The project manager, a white female, attended the session. Seven other people were named as team members who did not attend the focus group. It appeared that they had been involved previously but had since rolled off the project. The project had operated in three phases, and at the time of the discussion the team was finalising the last phase, implementation. The session took place virtually, on MS Teams.

Focus group 6

The sixth focus group was with a consulting team of a large global consulting firm. The team had consulted to a non-governmental organisation, planning, and implementing the distribution of oxygen to hospitals during the Covid pandemic. They worked together for three months. There were 7 team members, being 4 males and 3 females. Four were white, 3 were black. The Project Manager, a white male, attended the session. The team members considered their team very effective, exceeding their own targets of the number of hospitals that they distributed oxygen to, by 50%. They were driven by a purpose impressed on them by the project Director that every life saved was a victory, even if they couldn't save all. At the time of the focus group, most people in the team had never met one another.

Focus group 7

The seventh focus group was conducted with the IT (information technology) leadership team of a South African-listed financial services infrastructure company. The team had been together for over a year. The team consisted of 7 members, of which 1 was female (and also black) and 6 were male. 3 were White (including the white male CIO), 2 were Black, 2 were Indian and 1 was Coloured. The meeting was virtual held on MS Teams. The company provides a critical service to the South African economy and as such the IT division plays a key role in delivering this technology infrastructure.

Focus group 8	The eighth focus group was held with the client service team of a medium-sized engineering consultancy operating in South Africa and with some projects in other African countries. The group comprised 7 members, of which the team leader, the CEO, was one. Of the 7, 6 were male and 1 female. 1 was coloured and the rest white. The team members, although all part of the organisation for many months, had only recently been constituted as the client service team. The session was conducted virtually on MS Teams.
Focus group 9	The ninth focus group was held with a project delivery team in an engineering consulting organisation. The team had delivered a large-scale infrastructure build project in a neighbouring country, drawing on several engineering fields, including civil and electrical. Each person in the leadership team represented specific disciplines. Six people attended the session, which was conducted virtually using MS Teams. Of the 6, 4 were male and 2 were female. The team had been successful in delivering a large-scale project, within time and budget, despite several client-induced scope changes. They were clearly proud of their success of the project.
Focus group 10	The tenth focus group was with the sales team of an insurance company. The team comprised of 8 members, of which 4 were female and 4 were male. 4 were white, 2 Indian and 2 Black. The session took place virtually via MS Teams. The team leader was present. The team had been together for 18 months. The team considered themselves highly effective and successful, having grown the book size of the business they managed and having received strong positive feedback from senior leadership over time.

4.1.1 Passion and Purpose

The team focus groups provided strong support for the presence of goal-directed passion in gritty teams. Teams displayed a passionate fervour for their goal, framing it as a purpose to which they were striving. This was particularly so when they considered that their purpose was of higher significance, such as in the case where the team was mandated to distribute oxygen during the Covid pandemic, or where another team's work was important in upholding the infrastructure and functioning of the country's financial system. Comments from team members gave insight into the mechanism by which the factors of team grit operate together: a highly impactful and important purpose for a team fuels the team's perseverance to achieve their purpose. The more important the goal or purpose was to the team members, the more the team was determined to persevere to achieve it. Furthermore, their passion for the goal increased their sense of connectedness. Their impactful purpose was a unifying factor in the

team. In describing the greater importance and wide-reaching impact of their goal, one team member used a sailing metaphor in referring to this goal importance being wind behind the team's sails. It is evident that teams with a powerful sense of purpose are gritty teams that are more able to persevere to achieve their goal.

Table 4.2 Exemplars of passion and purpose

PASSION AND PURPOSE	
Focus group no	Illustrative quote
Focus group 2	"It has always been a team that tries to overachieve**. I think everyone has a sort of higher purpose that they're driving towards**. So, everyone is always striving to make themselves better. And I think that encourages everyone else around them to do the same thing".
Focus group 3	**"The gravitas linked to what it is that we were doing for our client, that had never been done in this country before, and it's only been done about five times globally.** I think that for us was really the goal, was delivering a successful project".
Focus group 4	"…the client component in the sense of **making an impact and feeling that you are valued and you're making …you're adding to their value**".
Focus group 6	"I mean, the first thing comes to mind for me is **fulfilled, that we were doing actual authentic work, and we're all in this together. Like, there was a real outcome there and we were making an impact, on human lives**".
Focus group 6	"I think there was, **there was a bigger goal which was more, more like you're doing, you're doing your part for the country** for more than just like solving a client problem and then stepping away. This was, there was a bigger goal considering the context of Covid, and the fact that, you know, you need things to get done quickly and it translates into lives saved. So, there was there was that wind that was, you know, behind the team's sails that you're doing something for your country as well".
Focus group 6	"So, if this had been a client which was a 'for profit' client and we weren't in a crisis mode, would we have had the same grittiness given the frustrations that we experienced on the project? I mean it's a bit of a counterfactual position but I I don't know, actually, and I wonder whether **that kind of a higher purpose and even the kind of sense of national importance of what we felt we were doing, kind of sustained that grit**, when if we'd had different circumstances, it might not have done".

Focus group 6	In the midst of what was happening, there was some form of solution that was brought in the midst of the chaos and that brought about some hope to people, some light some, some positivity so that's what I'd described the goal. Also for us kind of seeing the impact that this has on on people also brought hope to the team as well.
Focus group 7	"…the importance, not just that this team plays, **the role this team plays not just within the organisation but in the country as a whole. I think we have a big responsibility.** So, perseverance I think for us is not an, it's not an option. It's an imperative".
Focus group 8	"I had to go back to the big goal, you know, just to sort of dig deep and find it, to carry on. For me it's essential…. There's nights and early mornings where I think, jeez, is this worth it? I'm just gonna throw in the towel…**So, I do find myself drawing on the big picture. It's not just about this tender. It's about making impact. You know, we've been working in this space for this client for four years. If we bow out now, it all goes to pot, we have to stay in the game, the big story, we have to stay in the game**. So, I do find myself self-talking like that".

4.1.2 Perseverance

Focus group respondents echoed the importance of perseverance, citing that it was the support from one another to help turn negativity into positive attitudes which helped them to persevere. Team members also felt a drive to be not let their team mates down and therefore quitting was not an option for them. Further, the connectedness within the team also played a role in enabling perseverance. Members commented that they could trust each other to be there to support through the tough times which enabled them to persevere.

Team perseverance is linked to the team's collective efficacy, defined as "the shared belief in a team that they will succeed in executing their tasks" (Bandura, 1997, as cited in Bernardy & Antoni, 2021, p.72). The link between team efficacy and team perseverance was identified in the focus group. One focus group team member clearly linked their team's self-belief with their perseverance, citing that "when you mention perseverance, that's what stuck in my mind as in the team's self-belief that we can achieve anything that we put our minds to". Bernardy and Antoni (2021) suggest that team efficacy and team perseverance operate in an iterative manner, whereby collective efficacy facilitates team perseverance, and the team's perseverance strengthens their team efficacy. The team's shared passion for their goal was also linked to their perseverance by focus group participants, with comments like "we were

able to do that [persevere through a late night of long work] because everyone had a shared alignment or goal'.

Perseverance is also connected to the importance of the collective goal. As seen in the previous section around passion and purpose, the more important a goal is for the team members, the greater likelihood that they will persevere to achieve it. Respondents commented that because they had participated in shaping the goal (vision, strategy, or purpose) they were more invested in it collectively and driven to pursue it. Where that goal had a higher order purpose, they commented that it felt like a big responsibility to succeed, and therefore giving up was "not an option, but an imperative".

Table 4.3 Exemplars of perseverance

PERSEVERANCE	
Focus group no	Illustrative quote
Focus group 2	There were many nights when we were all late at night, ordered food, only starting work at say nine o'clock in the evening to finish off the next morning or whatever, **but we're able to do that because, again, everyone had a shared alignment or goal. That was a function of us creating this amazing environment to work in. And I'd say, perseverance is a natural outcome of that.**
Focus group 2	I just know that I think for me, one of the biggest things is that I would never want to let anyone in this team down. So, I will go to the end of the earth, like **never quit because quitting lets the team down. It doesn't matter what's thrown in, it's just keep going.**
Focus group 2	**Everybody participated in the vision and the strategy of what you're trying to achieve, and everybody has a role to play. So, because that happens in the beginning, then perseverance becomes a natural thing** that happens across the board, because then you feel as though your input into whatever needs to be done is as much as your responsibility as your seniors, because you feel as though my considerations, my viewpoint, my contribution was valued from breaking ground to as we are building along. So even in the tough moments where we have to work late into the night, you don't mind it because you're on the byline, you are part and parcel to the delivery. So, I

would say, that for me is what, I would say where perseverance has shone through.

Focus group 5: So, the notion of needing to just persevere and trust that there is there's light at the end of the tunnel even though we don't know that light is on the left or on the right side of the tunnel. But there is light at the end of the tunnel. I think the team …**that ability to trust ourselves also as a team and knowing that when you call out to any one of the team members for, for whatever support, that somebody will put up their hand, and they'll come in and work with you throughout, you know, the long hours and so on and so forth**, even though they really didn't have to they could have just said sorry man I've got another got another thing that I need to attend to. That for me just also helps to to just keep going and keep sane, and even though it was quite difficult.

Focus group 6: I noticed that with the positivity within the team and even though sometimes things get frustrating, **the support and the laughter made it easier for the team members to want to show up for the team. So it didn't become draggy. Even in times when there was a lot that needed to get done you still had the drive, the motivation, and the will to want to do more and give more.** And the check in calls later in the afternoon where we share a couple of laughs would also lighten up the mood, and if you were in a stressed mode, it'd kind of gets you happy and excited and jittery again. And when you started to pick up on work again, you'd have the right attitude, and that frustration would have subsided quite significantly. **So that helped a lot in driving us and motivating us to continue to put in the work.**

Focus group 7: If I can refer to the earlier comment about you know just the importance, not just that this team plays the role this team plays not just within the organisation but in the country as a whole**, I think we have a big responsibility. So, perseverance I think for us is not an, it's not an option. It's an imperative**.

Focus group 7: Now, you, we talk about individual self-belief, and then you talk about a team self-belief, I think, perseverance for me, obviously both, but **if you look at this team, and the self-belief that this team has, in order to, obviously, reach, or pursue that purpose, is tremendous. And I think that when you mention perseverance, that's what stuck in my mind as in the team's self-belief that we can achieve anything that we put our minds to.**

Focus group 8	In terms of perseverance, I think it's especially within the team. It's for me a type of peer pressure. So, so looking at the guys around you and the team working with you and seeing the perseverance is definitely a motivator, going forward. So, yeah, I think that that's a positive thing in the team. We have a lot of goal orientated people, and driving, and **sometimes you when you get that down spot. There's always a looking, looking at, at your team members and seeing seeing them chasing the goal. So I think that's that's that's one of the things that that motivates me to keep on going**.
Focus group 9	But instead**, that perseverance to keep working hard keep putting in the effort was was was absolutely inextricably linked to our success**. And we did so, the team really persevered through hard times when the client was making bad choices or giving us a difficult time or giving us vague instructions blah blah blah.. the list goes on of of what made it challenging. And it was those challenges that we had to keep persevering and persisting to make it through so we definitely had to.

4.1.3 Adaptability

Gritty teams develop a competence in coping with ambiguity and uncertainty and are able to adapt to changes that are imposed on them. These external forces and the need to adapt does not deter them from the pursuit of their goals. In gritty teams the members draw closer together in adapting, as a way to support one another to both adapt and to persevere. As one team member put it, they “deal with it as a collective”.

Table 4.4 Exemplars of adaptability

ADAPTABILITY	
Focus group no.	Illustrative quote
Focus group 2	It's about how well can you adapt, as well, from a capability perspective, internally, for you to continuously be successful in the future. It's a very difficult client. When I say difficult client, even though we've got a fantastic relationship, because of that, the client has an added expectation on the type of quality of the output there, or the type of recommendation, type of solution we are now trying to propose, **which means ambiguity and uncertainty are high, but also ability to be responsive to that change is much higher.**

Focus group 4	90% of the time when the client was driving us insane because they kept changing their minds. This person doesn't like that, then you must be their consultant be professional, not get absorbed into their politics, and that was, I think, mission one. I think it's a theme that began at the very beginning with us saying we don't want to go to the client, but **because we see the need within our individual team, as we're bringing revenue, being utilized and let's let's let's suck it up and let's let's work, and I think that was theme we used for every single situation of work we were put in.** And I think in a personal regard I think that 100% allowed me to grow at an exponential rate,
Focus group 6	I think there was often times where you thought you were doing one solution. ... **You kind of have to be ready for the direction to change**. I came in a bit later in in phase two. So, I think we were a bit more aligned on where we were going, what was happening and there was less adaptability, But I think having spoken to the guys about you know, how they got to where we were going**, I think they had to be completely adaptable to the changing scope**,
Focus group 7	And I think the way that this team handled that transition into lockdown, as well as all of the other challenges and things that came with it, both personally and professionally**. If there's one thing in this team - they stepped up and we adapted to what was happening out there; And we dealt with it as a collective, and that adaptability to still keep the markets open, keep the markets flowing, is testament of just how well this team can adapt to, you know, a left turn, or down the road**.
Focus group 10	I've just found that each year we seemed to, we had to adapt, and I think we as a team did extremely well, whether it's been Covid or the company has decided to change the goals of profitability or the lines of business that we're looking at, I **just found that we constantly adapt all the time. It's something we do very well.**

4.1.4 Connectedness

Team connectedness emerged as an extremely important factor for team grit. Connectedness within the team is displayed in several ways. The members feel supported by one another and are confident that the other team members will stand up for them and look out for them. This is expressed in comments such as “everyone has each other’s backs”. Connectedness is

about a high degree of trust between members. It is also noticeable that team members are determined not to let one another down. This is typically expressed in the context of the pursuit of the team goal. Team members note that other team members determination to persevere spurs them on to persevere too so that the collective goal can be achieved. This is a sense of honouring the efforts of the other and matching one another's efforts. Team members express confidence in one another's commitment to persevere. The members put in similar levels of effort to help each other. They also encourage one another to persevere through difficult times, and to adapt to changing circumstances. In the grittiest teams, team members are united in their sense of purpose and believe in the importance thereof. Individual goals and objectives are still present within the highly cohesive team. However, these are aligned to the teams overarching goal (Lee & Duckworth, 2018). The members within gritty teams value one another and feel valued by one another, and they like to spend time together. Table 4.5 contains quotes from several focus groups which exemplify team connectedness, specifically the elements of trust and support between team members.

Table 4.5 Exemplars of connectedness - trust and support

CONNECTEDNESS	
Focus group no	Illustrative quote on trust and support in the team
Focus group 1	I think, at the end of the day, there's so many personalities within the team, we might not all get along or be friends in the long run or agree. We'll never agree on everything, every time. **It's knowing that everyone around the table has each other's backs.** You, you want to know that if you are in the front lines in front of the customer, and you know that there's a beating coming, that you have your team with you. I think that that's important.
Focus group 2	consulting is a high pressure environment where you're under a lot of pressure and stress and you question your own abilities and so on, and I think that this team is managed to create such a culture where we, like Y said, **we've got each other's back so you feel a lot more confident coming into work, you feel like that… it's just this big, an ecosystem of support around each other as well, so you're never on your own, you never hung out to dry** and we know when to put our heads down work.
Focus group 2	I just now I know that I think for me, one of the biggest things that personal grit linked to teams, is the **I would never want to let anyone in this team down.**

	So, I will go to the end of the earth, like never quit because quitting lets the team down. It doesn't matter what's thrown in, it's just keep going.
Focus group 3	And you noted when people are like put down, it's really hard for them to deliver quality work. And I think that was, so my approach was very kind of, Okay, let's build this team up team spirit, you know, Kumbaya type vibe, and then at one point a question my, my approach, and is this actually going to work, because maybe they just need a kick up, you know, to actually get things going. But I stuck with my approach. And I think at the end of the day, that's exactly what the junior, junior guys needed**. They needed to feel part of a team. So, so I think emotion was a huge part of it, because, if they felt comfortable within the team, and felt valued, you could see it in their work and the effort that they put in**
Focus group 5	So the notion of needing to just persevere and trust that there is there's light at the end of the tunnel even though we don't know that light is on the left or on the right side of the tunnel. But there is light at the end of the tunnel. I think the team …**that ability to trust ourselves also as a team and knowing that when you call out to any one of the team members for, for whatever support, that somebody will put up their hand, and they'll come in and work with you throughout, you know, the long hours** and so on and so forth, even though they really didn't have to they could have just said sorry man I've got another got another thing that I need to attend to''. That for me just also helps to to just keep going and keep sane, and even though it was quite difficult
Focus group 6	where your team is dealing with external factors that are sometimes you know beyond you and very frustrating, but I like to think that at all times, **when I was feeling frustrated, I was always supported and encouraged by the team**. So that was probably the most the most common feeling there.
Focus group 6	I think just that positivity helps drive you and keep you motivated. I think if you, if you're working in a team where you don't have that positive environment, putting in some longer hours becomes a lot harder. So I **think it makes it a lot easier, at least from my perspective to just keep going, knowing that there is that, you know, the positive team environment and that we're all in this together**.
Focus group 7	I think we're very open minded, but I think the exercises that we did very early in the year that build **that trust is what has been the foundation because you're operating in a safe environment** when we're in this team. I think that that's quite a big one for me

Focus group 10	I do agree I think us **understanding, knowing more about each other, coming together as a team, on a, on a personal and emotional level**, does help with the goal. Absolutely.

Two additional elements of team connectedness were observed during the focus groups. These were the presence of humour within the team and the activity of venting. These are explored further in the sections below and the exemplar tables which follow.

4.1.4.1 Humour in the team

Gritty teams use humour. Humour in the team strengthens the bond between members. When times are tough, they joke around, and they comment that 'having a laugh' helps to ease tension and stress. Gritty teams poke gentle fun at each other. The humour is not mean-spirited and is understood by the recipient of the teasing to be positive and familiar. Humour is a coping mechanism to relieve the stresses within the team. It also energises the team, which aids in perseverance. But humour is also as glue, uniting team members into a tighter, more cohesive team. Humour counteracts negative emotions within the team. In an environment of uncertainty, humour is the mechanism which turns negative emotions into positive ones and enables team members to persevere in pursuit of their goal.

Table 4.6 Exemplars of connectedness - humour

CONNECTEDNESS - HUMOUR	
Focus group no.	Illustrative quote
Focus group 5	I think … something that shone for me for this team is like we kept our sense of humour. Like, I remember like F would just walk in there and we just like have a laugh because there's, there's that level of ridiculousness where it just becomes funny, and it helps you cope. So, I think the sense of humour of this team was excellent. I mean H is funny as hell. In his own sense, the guys would also tell you that. **So, I think sense of humour helps you like get through the rocky times and it actually makes you resilient.**
Focus group 6	At the end of the day **we would always find something to laugh about which, you know, made us, well me personally as an intern, it made me feel very good about joining the team, I felt very comfortable.** And with that, it also made me want to do more for the team.

Focus group 6	I noticed that with the positivity within the team and even though sometimes things get frustrating, the support and the laughter made it easier for the team members to want to show up for the team. So it was, it didn't become dragging, even in times when there was a lot that needed to get done, you still had the drive, the motivation, and the will to want to do more and give in more. And the check in calls later in the afternoon where we share a couple of laughs would also lighten up the mood, and if you were in a stressed mode, it'd kind of gets you happy and excited and jittery again. And when you started to pick up on work again, you'd have the right attitude, and that frustration would have subsided quite significantly. So that helped a lot in driving us and motivating us to continue to put in the work.
Focus group 7	I think that **humour is used to kind of just, you know, keep things a little light under those stressful circumstances which then allows for you to feel like you're part of a collective** which is that, glue.
Focus group 7	**I agree with the comment on using humour as a coping mechanism**. But I have to also say that the individuals that make up this team, just in nature, you know, like to see the lighter side of things as well, and are very humorous in their own special way. **We laugh a lot. Sometimes with each other, sometimes at each other and I think that's part of the glue that pulls this team together.**
Focus group 7	One of the things around humour. **So, humour basically, if you look at the essence of it, it increases energy levels.** And I think that, where we also use it as, as I mentioned your, your first cup of coffee, trying to get the energy levels going and throughout this conversation or the beginning of this conversation we mentioned, negative emotions. **And in my view of, well humour reduces those negative emotions, within the team.**
Focus group 9	Well, I think everyone would agree that this light hearted humour, played a big role in positive emotion. So very often when, **when we are down and, and we don't know actually what's the next step, little joke from K would lift the spirits and everyone is laughing. And we can carry on again.**
Focus group 10	I think the element, not just of having humour but being able to take humour has been quite important in the team dynamic that we have that

	we can all be upset for a few things but sometimes we do bounce back, and we have a relatively thick skin.

4.1.4.2 Venting in the team

A second important element which seems closely related to connectedness is the practice of venting. Venting is the practice of verbally airing one's frustrations to another. Venting is not the same as confronting and addressing frustrations between team members, rather it is the discussion of concerns that are outside the relationships between the team members. Team members typically vent about their frustrations with matters related to their work, including people outside the team.

Team members sometime refer to letting off steam. Venting emerges as an important team mechanism to reduce negative emotions, particularly during difficult times. Venting enables team members to feel more connected with each other. In gritty teams venting is not directed at each other but at circumstances or people outside of the team. Team members report that after they have had a vent of their feelings, they feel calmer and more able to tackle difficult work requirements again.

Table 4.7 Exemplars of connectedness - venting

CONNECTEDNESS - VENTING	
Focus group no	Illustrative quote
Focus group 1	You need somebody to vent with. So you would need some some partner or some some companion to just, 'Can I have five minutes quick smoke break with you and chat with you?' . And you go upstairs and you you talk [rubbish] together. Even though they don't understand this because they are new or they don't they don't understand your perspective**. But you just want to vent. Because when you're back at your seat, you have to get the get the job done. You don't want to carry that kind of negative emotion, you have to let it out**.
Focus group 3	I think with the miscommunication, misalignment, there was a lot of frustration. And it's very easy to be sort of snappy towards either the people, you're actually working with, the team, or with the client. But it's just a matter of, you know, controlling that and making sure that, **as a team, you have venting-out sessions where you either go out for a drink on a Thursday or the like, just to make sure that you know,**

	whatever, emotions are high, you sort of don't let it out in the workplace, but you have some sort of an outlet.
Focus group 8	What I have realized is that **it's important to recognize when someone is venting. Like, they're not actually asking you to help solve a problem.** It helps when other people recognize that, or you just tell people that you need to vent. You vent, and that's it.
Focus group 10	… especially when you're sort of having a bad day, something's going wrong. Sometimes I'll just pick up the phone and chat to my colleague and I'll feel better after that, you know. Well, in the office it was easy to make that happen. Now you've physically got to like to call him and hope he's not on another call because I need to speak to him now. **Not necessarily work particularly, but just to vent and let off some steam, and he'll say something weird and I'll laugh and I'll feel better about it.**

As seen in the above analysis, the focus groups served to confirm the proposed themes underlying team grit. Furthermore, codes and quotes that were identified during the thematic analysis were used to compile draft scale items. The draft item pool was compiled with items identified through the focus groups, as well as items drafted from extant scales (and adapted, where relevant). In total, 56 items were written. These are presented in Appendix three, which identifies the source for each of the items in the draft item pool.

4.1.5 Reviewing the draft item pool

The draft item pool was then reviewed by the domain experts who provided feedback and suggestions for improvement. Table 4.8 summarises their feedback and the actions taken by the researcher in response. The team connectedness element was termed 'cohesion' at the time that the expert review of the draft items occurred. References to connectedness have been left in the feedback below, as this is how it was received form the reviewers.

Table 4.8 Synthesised reviewer feedback

#	Item	Feedback from reviewers and action taken
	Passion	
1	Once we have set our goal, we keep focused on it	Feedback: Reviewers suggested a change to the wording to make the meaning clearer. There was also some concern that this item could overlap with the Perseverance factor. Action: The item was updated to read "Once we have set our goal, we keep our focus on it".

2	Our team has been obsessed with a certain idea or project and not lost interest in it	Feedback: Recommendation to simplify the item and state the whole item in the positive. Action: Item re-worded to read “Our team has been obsessed with a certain project and remained interested in it”.
3	Even if a project takes more than a few months to complete, we remain focused on it	Feedback: Concerns that this could overlap with perseverance. Comfort with the wording. Action: Item left unchanged
4	New ideas and projects seldom distract us from previous ones	Feedback: Reviewers recommended to drop either ‘projects or ‘ideas’, and to remove the word ‘seldom’, to simplify the item Action: Item re-worded to “New ideas don’t distract us from previous ones”.
5	Our team is really passionate about our purpose	Feedback: Some concerns that this item may be redundant as it is a ‘super item’, directly describing the factor itself. Action: Item removed.
6	As a team we would like to commit a lot of time to become good in achieving our goal	Feedback: Concern that the sentence structure was complicated and too wordy and recommended that words be removed to simplify it. Action: Reworded to “As a team we commit a lot of time to become good in the area of our goal”.
7	We think we could be expert in the area of our team goal	Feedback: Recommended that the word ‘think’ be changed to ‘strive’ and ‘expert’ to ‘experts’. Action: Item reworded to “We strive to be experts in the area of our team goal”.
8	Our team has enough passion to become very good in the area we focus on	Feedback: Item considered simple, clear and valid. No changes recommended. Action: Item left unchanged.
9	We work hard enough to fulfil our team goals	Feedback: Concern that the word ‘enough’ creates complexity. In addition, some reviewers noted that this item could overlap with Perseverance items. Action: Reworded the item to ‘We work hard to fulfil our team goals’.
10	We have a burning passion for the work our team does	Feedback: Item considered simple, clear, and valid. No changes recommended. Action: Item left unchanged.
11	As a team we spend a lot of time on the work we like	Feedback: Reviewers were concerned about social desirability bias in the use of the word ‘like’. Action: Reworded item to ‘As a team we spend a lot of time on the work we see as important’.

12	Our shared passion is important for the team	Feedback: Reviewers questioned whether any respondent would disagree, i.e., if this was too obvious a statement. Recommended changes that focused the passion on the goal. Item reworded to 'A shared desire to achieve our goal is important for our team's success'.
13	We are passionate about our team goal	Feedback: Item viewed as repetitive with previous items Action: Item removed.
14	Our team members feel a sense of connection to the team goal	Feedback: Suggested that 'a sense of connection to' be replaced with 'connected to', in order to simplify the item. Action: Item reworded to 'Our team members feel connected to the team goal'.
15	We feel that our goal makes a meaningful difference	Feedback: Recommended that the element of achievement of the goal should be brought out in the item. Also, concern expressed that the word difference could be misunderstood, i.e., difference to what? Action: Item reworded to 'We believe that achieving our goal will make a meaningful impact'.
16	Our team members are emotionally invested in achieving our purpose	Feedback: Some concern that the item was complex, in particular the phrase 'emotionally invested', and also a concern that this item was repetitive. Action: Item removed.
17	We feel proud of the work our team does	Feedback: In response to the feedback on item 16. Action: New item developed in response to the feedback on item 16
	Perseverance of Effort	
1	Our team is a hard-working team	Feedback: recommendation that a temporal dynamic is introduced to indicate perseverance. Also, some concern of an overlap with Passion. Action: Item reworded to 'Our team keeps working hard'.
2	Our team finishes whatever we begin	Feedback: Item considered simple, clear and valid. No changes recommended. Action: Item left unchanged.
3	We are a diligent team	Feedback: Item considered simple, clear and valid. No changes recommended. Action: Item left unchanged.
4	Setbacks don't discourage our team.	Feedback: Item considered simple, clear and valid. No changes recommended. Action: Item left unchanged.

5	Our team perseveres through tough times to work towards our goal	Feedback: Item considered simple, clear and valid. No changes recommended. Action: Item left unchanged.
6	Giving up is not an option for this team	Feedback: The item seen as overlapping with 'Our goal is much too important to give up on'. Reviewers recommended removing one of them. Action: This item was removed
7	Our goal is much too important to give up on	Feedback: Item considered simple, clear and valid. No changes recommended. Action: Item left unchanged.
8	We keep persevering towards our goal over many months	Feedback: Item considered simple, clear and valid. No changes recommended. Action: Item left unchanged.
9	The importance of our goal motivates us to persevere	Feedback: Item considered simple, clear and valid. No changes recommended. Although reviewers noted a conceptual overlap with Passion. Action: Item left unchanged.
10	We are inspired to persevere individually because of the perseverance of the team	Feedback: Support for the item although one reviewer questioned its wordy-ness. Action: A minor change made to the item wording, to 'We are inspired to persevere individually because of the perseverance of our team'.
11	We encourage each other to persevere	Feedback: Item considered simple, clear and valid. No changes recommended. Action: Item left unchanged.
12	We keep persevering towards our goal despite experiencing many frustrations as a team	Feedback: Item considered simple, clear and valid. No changes recommended. Action: Item left unchanged.
13	The sense that we're in this together makes it easier to persevere	Feedback: Item considered simple, clear and valid. No changes recommended. Action: Item left unchanged.
14	We persevere because we do not want to let down the team	Feedback: Consensus that the item was simple and clear, but some concern about its validity, with one comment questioning whether the issue being measured was a precursor to perseverance, and another noting a conceptual overlap with team connectedness. Action: Item reworded to 'We don't want to let down our team in achieving our goal'

15	We deal with challenges by looking for solutions as a team	Feedback: Concern expressed that the item focuses on team problem solving, rather than perseverance. One researcher noted a conceptual overlap with team connectedness. Action: Item reworded to increase focus on perseverance. The wording was revised to 'We deal with obstacles to achieving our goals by looking for solutions as a team'.
	Adaptability	
1	Our team appreciates new opportunities that come about for us	Feedback: Reviewers were mostly comfortable with the simplicity and clarity of the item but questioned the validity, noting that the item as written suggested opportunism, which is not inherent in team grit. They recommended changes to focus the item on responding to specific opportunities. Action: Item revised to 'Our team appreciates opportunities for us to improve our skills'.
2	Changing our plans or strategies is important to achieve our long-term team goals	Feedback: Reviewers recommended that the item be rephrased to focus on the willingness to adapt when necessary. Action: Item reworded to 'Being willing to adapt our plans and strategies is important to achieve our long-term goals'.
3	Changes at work motivate our team to work harder	Feedback: Some concern around overlap with passion. Action: Item left unchanged.
4	Our team is able to cope with the changing circumstances at work	Feedback: Item considered simple, clear and valid. No changes recommended. Action: Item left unchanged.
5	We are constantly adapting our roles in the team	Feedback: Concerns around the word 'constantly' which suggests team instability and random changes. Proposed that changes reflect the team's willingness to change roles. Action: Item reworded to '' We are willing to adapt our roles in the team to achieve our goals'.
6	We are constantly adapting to external changes	Feedback: Recommended wording changes that highlight the team competence, rather than suggesting a state which may not apply to a given team. Action: Item reworded to 'We are successful in adapting to external changes'.
7	Our team members adapt to changing circumstances in the team	Feedback: Criticised for being too similar to the preceding items. Action: Item removed.
8	As a team we have to be highly adaptive in order to achieve our goal	Feedback: Small change recommended (from 'we have to be '' to 'we are able to be') to reflect the team's competence rather than a required state.

		Action: Item reworded to ‘’ As a team we are able to be highly adaptive in order to achieve our goal’.
9	We believe in our team’s ability to grow through hard work	Feedback: Item considered simple, clear and valid. No changes recommended. Action: Item left unchanged.
10	Our team is willing to learn when things change	Feedback: Item considered simple, clear and valid. No changes recommended. Action: Item left unchanged.
11	As a team, we have a desire to learn	Feedback: Criticised for being too similar to preceding items. Action: Item removed.
12	We constantly look for ways to improve as a team	Feedback: Item considered simple, clear and valid. No changes recommended. Action: Item left unchanged.
	Connectedness	
1	We trust one another in our team	Feedback: Item considered simple, clear and valid. No changes recommended. Action: Item left unchanged.
2	The bond between us has grown stronger over the time we worked as a team	Feedback: Item considered simple, clear and valid, with only a minor grammar change recommended. Action: Item changed to ‘The bond between us has grown stronger over the time we have worked together as a team’.
3	Our team members grow closer when we spend social time together	Feedback: Reviewers suggested that the word ‘social’ was unnecessary as teams may not spend time together socially. Action: Item reworded to ‘Our team members grow closer when we spend time together’.
4	Team members look out for each other when they need assistance	Feedback: This item was too similar to item 6 and the recommendation was that it should be removed. Action: Item was removed.
5	In our team we encourage one another's individual successes	Feedback: Reviewers suggested that ‘celebrate’ should replace the word ’encourage’. Action: Item reworded to ‘In our team we celebrate one another's individual successes’.
6	We feel supported by each other	Feedback: Considered repetitive Action: Item removed
7	It is important to us that we are a cohesive team	Feedback: Reviewers were concerned that the word ‘connectedness’ could be understood differently by respondents. Action: Item was removed

8	We use certain expressions and terminology that are unique to our team	Feedback: Reviewers had mixed views, with some strongly in support of this item and one reviewer with some concern around content validity, suggesting that highly cohesive teams may score low on this item. Action: Item retained and wording unchanged
9	The team members' individual strengths are valued in the team	Feedback: Item considered simple, clear and valid. No changes recommended. Action: Item left unchanged.
10	Humour in the team strengthens the bond between us	Feedback: Item considered simple, clear, and valid. No changes recommended. Action: Item left unchanged.
11	Laughing at our challenges together helps us to persevere through tough times	Feedback: Concern expressed around the interpretation of the word 'laughing' suggesting that this could be construed as negative or positive. Recommendation was to remove the item. Action: Item was removed.
12	Our team vents our frustrations to get rid of negative emotions	Feedback: Most reviewers took issue with this item, suggesting that for some teams venting could reduce rather than increase connectedness, and could be seen as a negative. Action: Item was removed
13	We can be more effective after we have had a good vent of our feelings	Feedback: Reviewers cited validity concerns, with a view that venting could be both negative and positive and concern that a respondent was being asked to give an opinion on a hypothetical situation. Action: Item was removed
14	We enjoy working together in our team	Feedback: Comments made by reviewers on the importance of positive affect between team members Action: New item developed
15	We support each other in tough times	Feedback: Comments made by reviewers on the importance of positive affect between team members Action: New item developed

4.1.6 Piloting the draft measure

The review by experts concluded in a draft set of 48 items, which were subsequently piloted within the target population. The respondents all reported that the survey functioned well and that they had no concerns with the wording of the items. Two respondents suggested small changes to the introductory letter, to reduce its length and simplify wording. These changes were implemented.

4.2 First wave: Exploratory factor analysis

4.2.1 Data collection and sample overview

The wave one sample was comprised of 95 females, 109 males and one respondent who did not provide their gender (*M* = 1.53, *SD* =.500). Of the sample, 34% fell within the age range of 45-54 years, followed by 35-44 years (26%) and 55-64 years (24%). Figure 4.1 depicts the age distribution of the sample for the range of 5 categories (*M* =4.82, *SD* = 1.072). Respondents represented 13 different countries. The dominant country of residence was South Africa (82%), with the United Kingdom being the second (10%), and Australia being the third (2%). The rest of the sample was distributed evenly across 10 countries: Botswana, Germany, Israel, Kenya, Netherlands, Nigeria, Qatar, Swaziland, Switzerland, USA.

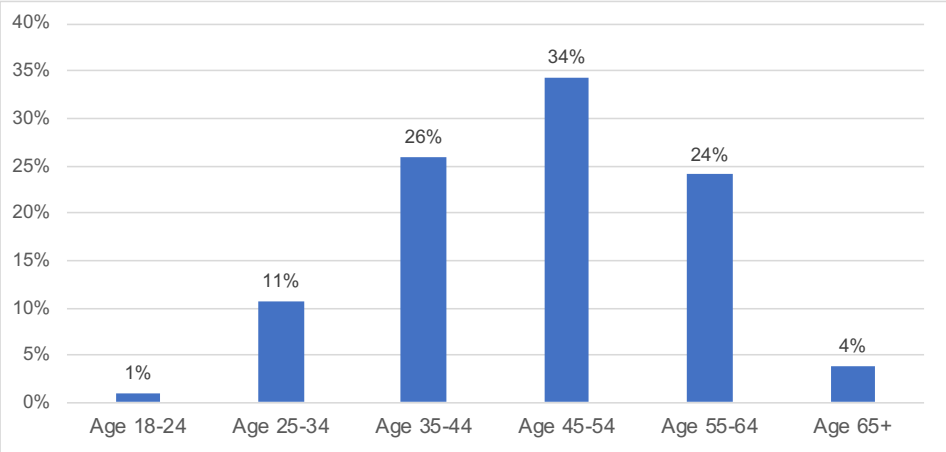

Figure 4.1: Age distribution of wave one sample

In terms of industry representation, financial services, professional services, and consulting were most represented, with financial services being the biggest industry category among the sample, at 28%. The 'other' category was the second biggest after financial services, and included education, the pet industry, automotive and property, amongst others. Figure 4.2 presents the industry breakdown of the wave one sample. The great majority of respondents responded that their team worked under pressure (93%), and an even higher number reported that their team was required to deliver against deadlines (95%).

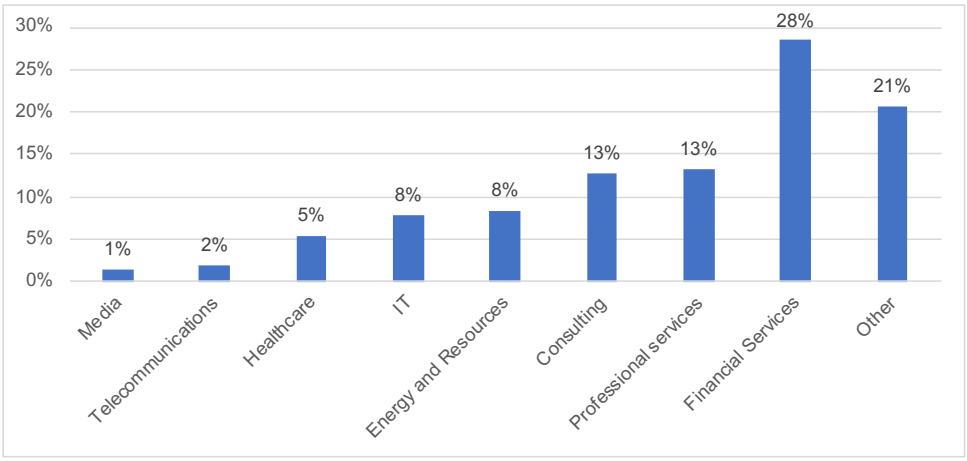

Figure 4.2: Industries represented by wave one sample

4.2.2 Exploratory factor analysis

The first step was to confirm that the sample was adequate for factor analysis by applying the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy and Bartlett's test of sphericity. For KMO, a value close to one is considered adequate, but preferably above 0.6. Bartlett's significance test is required to be less than 0.05 for factor analysis to be suitable (DeVellis, 2003). Therefore, a value for KMO close to 1 and Bartlett's significance close to 0 suggest that the data is adequate, and it is appropriate to proceed with factor analysis. The KMO value of 0.949 and Bartlett's significance of 0.000 (χ^2 (1128) =7552.02, p<.001), as seen in Table 4.9 confirmed that the data showed adequate correlation and as such it was acceptable to continue with factor analysis.

Table 4.9 KMO and Bartlett's test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0,949
Bartlett's Test of Sphericity	Approx. Chi-Square	7552,023
	df	1128
	Sig.	0,000

Having determined that factorability of the data was feasible, the first factor analysis commenced. The aim was to reduce the number of items, identify the latent variables in the data, and achieve parsimony in the scale (Hinkin et al., 1997). The factoring approach used was principal axis factoring with direct oblimin (oblique) rotation, to achieve a simple factor solution. Principal axis factoring is considered preferable to principal components analysis for scale development, as it is more successful in identifying latent factors in the data (Worthington & Whittaker, 2006). A four-factor solution was specified in accordance with the

proposed theory of team grit. The total variance explained by the four-factor solution was 58.666%, as per Table 4.10. Standard practice requires consideration of factors with eigenvalues greater than one (Everett, 1983). This supports the four factors extracted in the analysis. However, a further method to identify the number of factors to retain is to use a scree plot, and to cut off the number of factors at the elbow bend in the gradient of the slope.

Table 4.10 Variance and Eigenvalues for the wave one sample

Factor	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total
1	21.940	45.709	45.709	21.521	44.835	44.835	11.714
2	2.628	5.475	51.184	2.190	4.562	49.397	16.493
3	2.006	4.178	55.362	1.556	3.242	52.639	12.563
4	1.586	3.303	58.666	1.137	2.368	55.007	12.604

Although the scree plot in Figure 4.3 showed a sizeable first factor, the gradient of the line plateaued slightly after the fourth factor in the diagram, and this supported the extraction of four factors in accordance with the proposed team grit theory.

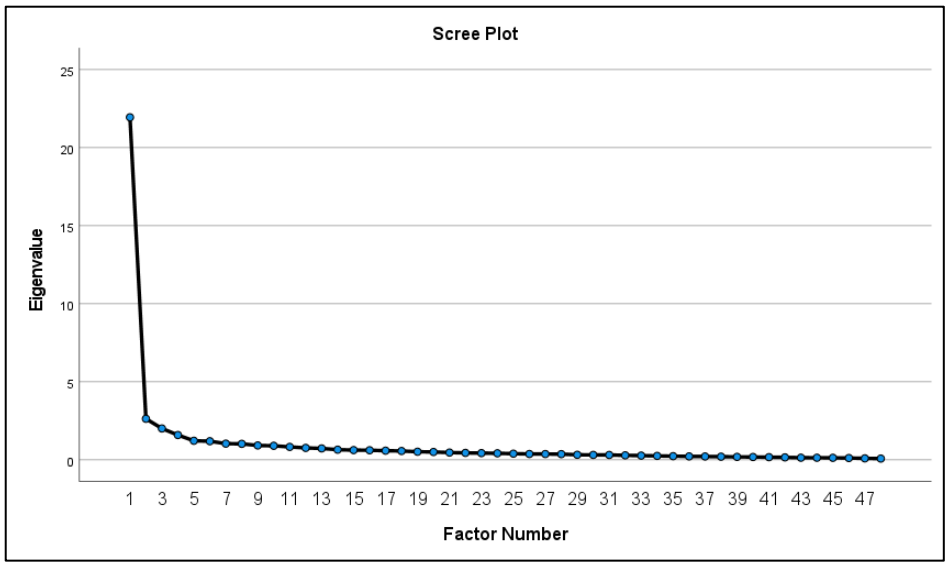

Figure 4.3: Scree plot for wave one

The researcher then sought further confirmation of the factor structure by examining the pattern matrix and the item loadings on each factor. Table 4.11 depicts the pattern matrix for the 48 items with the loadings of each item across the four factors. Twenty-three of the items

had factor loadings less than the recommended minimum cut-off of 0.5. These 23 were removed from the item list to purify the scale, leaving 25 items retained for further scale purification. The factor loadings for these 25 retained items are emboldened and shaded in the table below.

Table 4.11 Pattern matrix for wave one

#	Item	Factor			
		1	2	3	4
1	Once we have set our goal, we keep our focus on it	**0,521**	-0,135	-0,007	0,184
2	Our team has been obsessed with a certain project and remained interested in it	0,226	-0,010	-0,139	0,480
3	Even if a project takes more than a few months to complete, we remain focused on it	0,350	0,030	0,137	0,386
4	New ideas don't distract us from previous ones	0,230	-0,066	-0,061	0,213
5	As a team we commit a lot of time to become good in the area of our goal	**0,594**	-0,091	0,021	0,095
6	We strive to be experts in the area of our team goal	0,445	-0,092	0,083	0,176
7	Our team has enough passion to become very good in the area that we focus on	0,329	-0,234	0,065	0,295
8	We work hard to fulfil our team goals	0,454	-0,062	0,101	0,321
9	We have a burning passion for the work our team does	0,248	-0,264	0,001	0,394
10	As a team we spend a lot of time on the work we see as important	0,317	-0,346	-0,011	0,179
11	A shared desire to achieve our goals is important for our team's success	0,165	-0,219	0,106	0,454
12	Our team members feel connected to the team goal	0,145	-0,332	0,111	0,413
13	We believe that achieving our goal will make a meaningful impact	0,055	-0,186	-0,049	**0,601**
14	We feel proud of the work our team does	0,313	-0,297	0,030	0,300
15	Our team keeps working hard	0,408	-0,096	0,314	0,061
16	Our team finishes whatever we begin	**0,660**	-0,026	0,126	-0,034
17	We are a diligent team	**0,628**	-0,089	0,236	-0,008
18	Setbacks don't discourage our team	0,304	0,157	0,467	0,231

#	Item	Factor			
		1	2	3	4
19	Our team perseveres through tough times to work towards our goal	0,202	0,024	0,456	0,361
20	Our goal is much too important to give up on	-0,067	0,000	0,177	**0,772**
21	We keep persevering towards our goal over many months	0,015	0,026	0,241	**0,615**
22	The importance of our goal motivates us to persevere	-0,083	-0,211	0,279	**0,594**
23	We are inspired to persevere individually because of the perseverance of our team	0,230	-0,359	0,169	0,236
24	We encourage each other to persevere	0,047	**-0,506**	0,229	0,160
25	We keep persevering towards our goal despite experiencing many frustrations as a team	0,008	-0,163	0,097	0,384
26	The sense that we're in this together makes it easier to persevere	0,217	**-0,505**	0,158	0,093
27	We don’t want to let down our team in achieving our goal	0,292	-0,486	0,095	0,090
28	We deal with obstacles to achieving our goals by looking for solutions as a team	0,281	-0,251	0,305	0,068
29	Our team appreciates opportunities for us to improve our skills	0,190	-0,433	0,345	-0,166
30	Being willing to adapt our plans and strategies is important to achieve our long-term goals	0,182	-0,181	0,391	-0,055
31	Changes at work motivate our team to work harder	-0,159	-0,239	0,442	0,132
32	Our team is able to cope with the changing circumstances at work	0,045	-0,042	**0,770**	-0,061
33	We are willing to adapt our roles in the team to achieve our goals	-0,125	-0,115	**0,587**	0,157
34	We are successful in adapting to external changes	0,057	-0,013	**0,711**	0,106
35	As a team we are able to be highly adaptive in order to achieve our goal	0,128	-0,051	**0,699**	0,063
36	We believe in our team's ability to grow through hard work	0,174	-0,238	0,342	0,204
37	Our team is willing to learn when things change	0,145	-0,379	0,459	-0,058
38	We constantly look for ways to improve as a team	0,003	**-0,578**	0,253	0,037
39	We trust one another in our team	0,195	**-0,701**	0,057	-0,066
40	The bond between us has grown stronger over the time we have worked together as a team	0,019	**-0,783**	0,033	0,018
41	Our team members grow closer when we spend time together	-0,033	**-0,701**	-0,044	0,127

#	Item	Factor			
		1	2	3	4
42	In our team we celebrate one another's individual successes	0,034	**-0,755**	0,051	0,047
43	We encourage one another	0,046	**-0,817**	0,090	-0,012
44	We use certain expressions that are unique to our team	-0,204	**-0,567**	0,038	0,075
45	The team members' individual strengths are valued in our team	-0,045	**-0,765**	0,003	0,151
46	Humour in the team strengthens the bond between us	0,069	**-0,718**	-0,007	-0,036
47	We enjoy working together in our team	0,225	**-0,750**	-0,003	0,016
48	We support each other in tough times	0,233	**-0,568**	0,092	0,099

With the scale having been purified through the first factor analysis, the process was re-run using the retained 25 items. Sample adequacy was assessed, as before, using KMO and Bartlett's tests. Both tests confirmed that the sample was acceptable for factoring, with the KMO value at 0.938 which was well over the preferred minimum of 0.6, and Bartlett's test significant at 0.000, below the recommended 0.05 threshold (Bartlett, 1937). Principal axis factoring was once again conducted, with a direct oblimin rotation, and a four-factor solution was specified in accordance with the theoretical hypothesis. The total variance explained by the four factors was 67.448%, as noted in Table 4.12. This showed an improvement on the variance explained by the original item list (which had been 58.666%).

Table 4.12 Variance and Eigenvalues for the purified wave one sample

Factor	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total
1	12,314	49,258	49,258	11,955	47,820	47,820	10,253
2	1,875	7,498	56,756	1,507	6,030	53,850	6,701
3	1,410	5,641	62,397	0,979	3,916	57,765	5,453
4	1,263	5,051	67,448	0,904	3,618	61,383	6,393

Extraction Method: Principal Axis Factoring.

The pattern matrix for the retained items supported the four-factor solution. Each item loaded on a single factor, with standardised regression weights (factor loadings) exceeding the recommended threshold of 0.5 and without any cross-loadings occurring. Table 4.13 depicts the pattern matrix for the 25 retained items.

Table 4.13 Pattern matrix for 25 retained items

#	Item	Factor			
		1	2	3	4
1	Once we have set our goal, we keep our focus on it	0.127	-0.007	**0.532**	0.185
2	As a team we commit a lot of time to become good in the area of our goal	0.102	-0.034	**0.556**	0.174
3	Our team finishes whatever we begin	0.003	0.114	**0.701**	0.001
4	We are a diligent team	0.068	0.231	**0.626**	0.051
5	We believe that achieving our goal will make a meaningful impact	0.150	-0.049	0.138	**0.548**
6	Our goal is much too important to give up on	-0.017	0.055	0.021	**0.853**
7	We keep persevering towards our goal over many months	0.013	0.148	0.091	**0.585**
8	The importance of our goal motivates us to persevere	0.188	0.213	0.011	**0.611**
9	Our team is able to cope with the changing circumstances at work	0.100	**0.632**	0.055	0.001
10	We are willing to adapt our roles in the team to achieve our goals	0.116	**0.611**	-0.079	0.121
11	We are successful in adapting to external changes	-0.012	**0.795**	0.068	0.091
12	As a team we are able to be highly adaptive in order to achieve our goal	0.039	**0.804**	0.116	0.023
13	The sense that we're in this together makes it easier to persevere	**0.506**	0.152	0.253	0.063
14	We constantly look for ways to improve as a team	**0.576**	0.213	-0.010	0.068
15	We trust one another in our team	**0.730**	0.040	0.216	-0.086
16	The bond between us has grown stronger over the time we have worked together as a team	**0.829**	0.013	-0.001	-0.003
17	Our team members grow closer when we spend time together	**0.709**	-0.080	-0.046	0.162
18	In our team we celebrate one another's individual successes	**0.728**	0.016	0.081	0.090
19	We encourage one another	**0.830**	0.066	0.049	0.003
20	We use certain expressions that are unique to our team	**0.523**	0.054	-0.152	0.067
21	The team members' individual strengths are valued in our team	**0.752**	0.020	-0.030	0.137
22	Humour in the team strengthens the bond between us	**0.723**	0.036	0.038	-0.058
23	We enjoy working together in our team	**0.747**	0.049	0.228	-0.021
24	We support each other in tough times	**0.568**	0.089	0.299	0.065
25	We encourage each other to persevere	**0.530**	0.178	0.106	0.125

Finally, the reliability of the purified instrument needed to be assessed. Internal consistency is an important measure of reliability of the instrument and is usually determined for each factor

individually as well as for the scale overall. Reliability assessments for the 25-item purified measure returned very strong results, as depicted in Table 4.14. All the alpha values exceed the prescribed minimum level of 0.7 (Nunally, 1978), both at the individual factor level as well as for the scale overall.

Table 4.14 Internal consistency reliability after wave one purification

Factor	Cronbach's Alpha coefficient	No of items
1	0.947	13
2	0.866	4
3	0.852	4
4	0.818	4
Total scale items	0.955	25

The item-total correlation statistics were also consulted to identify if there were any items whose inclusion in the measure were reducing the overall scale reliability. The analysis showed that only one of the items, if removed, would enhance the overall reliability of the scale. This item was 'We use certain expressions that are unique to our team'. Removal of this item would result in an overall scale alpha score of 0.956, an improvement of only 0.001 on the current total scale Cronbach score. Given the marginality of this improvement and the strong reliability level of the overall scale it was decided not to remove this item but to move forward with the 25 items in the purified scale.

The factor correlation matrix in Table 4.15 demonstrated that the factors were related to one another but not so much as to be overlapping factors.

Table 4.15 Factor correlation matrix for the wave one measure

Factor	1	2	3	4
1	-			
2	0.504	-		
3	0.422	0.381	-	
4	0.514	0.438	0.378	-

Extraction Method: Principal Axis Factoring.

Rotation Method: Oblimin with Kaiser Normalization.

After the above analysis, 25 items were retained across four factors. This purified scale is shown in Table 4.16.

Table 4.16 Purified scale at the end of the exploratory factor analysis

Factor 1	1	The sense that we're in this together makes it easier to persevere
	2	We constantly look for ways to improve as a team
	3	We trust one another in our team
	4	The bond between us has grown stronger over the time we have worked together as a team
	5	Our team members grow closer when we spend time together
	6	In our team we celebrate one another's individual successes
	7	We encourage one another
	8	We use certain expressions that are unique to our team
	9	The team members' individual strengths are valued in our team
	10	Humour in the team strengthens the bond between us
	11	We enjoy working together in our team
	12	We support each other in tough times
	13	We encourage each other to persevere
Factor 2	1	Our team is able to cope with the changing circumstances at work
	2	We are willing to adapt our roles in the team to achieve our goals
	3	We are successful in adapting to external changes
	4	As a team we are able to be highly adaptive in order to achieve our goal
Factor 3	1	Once we have set our goal, we keep our focus on it
	2	As a team we commit a lot of time to become good in the area of our goal
	3	Our team finishes whatever we begin
	4	We are a diligent team
Factor 4	1	We believe that achieving our goal will make a meaningful impact
	2	Our goal is much too important to give up on
	3	We keep persevering towards our goal over many months
	4	The importance of our goal motivates us to persevere

4.3 Second wave: Exploratory factor analysis

The purpose of the wave two study was to further purify the scale, determining the factor structure and items. In addition, the intention was to confirm the structure by developing a structural model to fit the data.

4.3.1 Data collection and sample overview

As per the previous chapter, the sample consisted of 236 responses after the data was cleaned and outliers removed.

As before, descriptive statistics were analysed, notably gender, age, country, and whether the respondent's team had operated under high pressure and against deadlines. It was noted that all respondents worked in the consulting industry. Of the 236 respondents, 100 were female (42.37%), 135 were male (57.2%) and 1 was non-binary (0.42%) (*M* = 1.58, *SD* =.503). The age breakdown was skewed to a younger profile than the wave one sample, with the largest category being age 25 to 34, representing 41% of the total sample. Figure 4.4 depicts the age distribution of the sample for the range of 5 categories (*M*= 3.82, *SD* = 1.138). The sample represented 12 different countries. The biggest country representation was South Africa, with 201 respondents selecting this as their country of residence (85%). The remaining 35 respondents were distributed across 11 countries (Botswana, Ghana, India, Kenya, Mozambique, Namibia, Nigeria, the Russian Federation, Tanzania, Uganda, and the UAE). 94% of the sample reported that their team often worked under pressure and all respondents noted that their team had deadlines to deliver against.

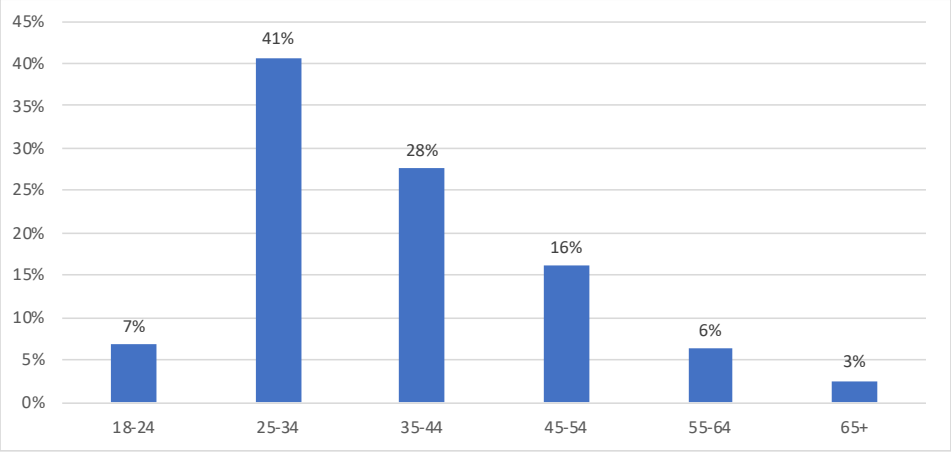

Figure 4.4: Age distribution of wave two sample

4.3.2 Exploratory factor analysis

The exploratory factoring in the wave one survey had reduced the scale from 48 items to 25 items and had shown support for a four-factor solution. An exploratory factor analysis was

performed on the second sample using the 25 items remaining from wave 1. The sampling adequacy was confirmed as seen in Table 4.17, with KMO of 0.946 exceeding the threshold of 0.6 and the Bartlett's p-value significant at 0.000, below the 0.05 upper threshold (χ^2 (300) = 3852.07 p = 0.000).

Table 4.17 KMO and Bartlett's tests

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.946
Bartlett's Test of Sphericity	Approx. Chi-Square	3852.066
	df	300
	Sig.	.000

Initial factoring commenced to determine the factor structure and model integrity. The researcher employed a principal axis factoring method with oblimin rotation on the 25 items. Four factors were specified in accordance with wave one findings and theoretical indications. The initial solution accounted for 65,087% of variance as reflected in Table 4.18.

Table 4.18 Total variance explained

Factor	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total
1	11.551	46.206	46.206	11.149	44.594	44.594	8.972
2	2.557	10.229	56.434	2.168	8.671	53.265	5.057
3	1.226	4.904	61.339	.824	3.296	56.561	6.995
4	.937	3.748	65.087	.485	1.939	58.500	6.048

Extraction Method: Principal Axis Factoring.

The rotated pattern matrix is presented in Table 4.19. No significant cross-loading was noted. The researcher applied the cut-off of 0.5 as the factor loading level, however rounding was permitted which meant that items with loadings of 0.462 and above were included. This was allowed to ensure that no one factor had fewer than three items, which is the recommended minimum number of variables per factor (Watkins, 2018). Table 4.19 presents the factor loadings and those items that were deemed to be at an acceptable level are shaded. On this

basis, three items were deemed to have insufficient loadings and were removed. These were the following items:

- As a team we commit a lot of time to become good in the area of our goal (item 2)
- We keep persevering towards our goal over many months (item 7)
- We constantly look for ways to improve as a team (item 15)

This left 22 items across four factors, where 12 items loaded on factor one, 3 items on factor two, 4 items on factor three, and 3 items on factor four.

Table 4.19 Pattern matrix for wave two

#	Item	Factor			
		1	2	3	4
1	Once we have set our goal, we keep our focus on it	.110	**.472**	-.132	.158
2	As a team we commit a lot of time to become good in the area of our goal	.189	.308	-.082	.384
3	We believe that achieving our goal will make a meaningful impact	.093	.052	-.062	**.648**
4	We are a diligent team	.246	**.541**	-.165	.035
5	Our team finishes whatever we begin	-.006	**.663**	-.067	.048
6	Our goal is much too important to give up on	-.063	.364	-.089	**.462**
7	We keep persevering towards our goal over many months	.036	.436	-.201	.207
8	The importance of our goal motivates us to persevere	.040	.080	-.034	**.673**
9	We encourage each other to persevere	**.475**	.064	-.144	.231
10	The sense that we're in this together makes it easier to persevere	**.462**	-.035	-.313	.187
11	Our team is able to cope with the changing circumstances at work	.076	.046	**-.669**	.017
12	We are willing to adapt our roles in the team to achieve our goals	.075	.041	**-.689**	.027
13	We are successful in adapting to external changes	.011	.078	**-.761**	.011
14	As a team we are able to be highly adaptive in order to achieve our goal	-.021	.079	**-.789**	.077
15	We constantly look for ways to improve as a team	.327	.005	-.216	.311
16	We trust one another in our team	**.570**	.122	-.200	-.072
17	The bond between us has grown stronger over the time we have worked together as a team	**.873**	.060	.042	-.021
18	Our team members grow closer when we spend time together	**.751**	.165	.058	-.005
19	In our team we celebrate one another's individual successes	**.834**	-.104	.008	.031

20	We encourage one another	**.781**	-.040	-.080	.071
21	We use certain expressions that are unique to our team	**.483**	-.089	-.014	.200
22	The team members' individual strengths are valued in our team	**.548**	.034	-.131	.184
23	Humour in the team strengthens the bond between us	**.794**	-.096	-.068	-.029
24	We enjoy working together in our team	**.767**	.183	-.003	-.017
25	We support each other in tough times	**.723**	.151	-.038	.010

Following the removal of the three items, the analysis was re-run with the retained 22 items. KMO and Bartlett's tests confirmed ($\chi^2(231)=3367.739$, $p<.001$) that the sample was adequate for factoring (Table 4.20), and total variance explained by the four factors increased to 66.808% (Table 4.21) compared to 65.087% prior to the removal of the three items.

Table 4.20 KMO and Bartlett's tests

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.938
Bartlett's Test of Sphericity	Approx. Chi-Square	3367.739
	df	231
	Sig.	.000

Table 4.21 Total variance explained

Factor	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total
1	10.274	46.699	46.699	9.883	44.925	44.925	8.319
2	2.357	10.713	57.412	1.976	8.982	53.907	5.969
3	1.166	5.299	62.711	.763	3.468	57.376	4.735
4	.901	4.097	66.808	.463	2.103	59.478	4.111

The revised rotated pattern matrix is shown in Table 4.22. No cross loadings were noted. The researcher once again chose to round up factor loading levels below 0.5 in order to retain a minimum of three items per factor (Bollen,1989). This resulted in items with factor loadings from 0.461 being retained. As a result, all 22 items were deemed to load acceptably. These are highlighted in Table 4.22.

Table 4.22 Re-run pattern matrix for wave two

#	Item	Factor			
		1	2	3	4
1	Once we have set our goal, we keep our focus on it	.114	.147	.142	**-.461**
2	We believe that achieving our goal will make a meaningful impact	.138	.077	**.571**	-.069
3	We are a diligent team	.236	.152	.029	**-.587**
4	Our team finishes whatever we begin	-.023	.074	.106	**-.619**
5	Our goal is much too important to give up on	-.054	.078	**.518**	-.331
6	The importance of our goal motivates us to persevere	.062	.029	**.746**	-.015
7	We encourage each other to persevere	**.491**	.144	.202	-.082
8	The sense that we're in this together makes it easier to persevere	**.483**	.308	.167	.021
9	Our team is able to cope with the changing circumstances at work	.084	**.662**	.044	-.035
10	We are willing to adapt our roles in the team to achieve our goals	.087	**.661**	.033	-.072
11	We are successful in adapting to external changes	.023	**.750**	.009	-.097
12	As a team we are able to be highly adaptive in order to achieve our goal	-.006	**.780**	.097	-.071
13	We trust one another in our team	**.565**	.188	-.035	-.101
14	The bond between us has grown stronger over the time we have worked together as a team	**.869**	-.044	-.008	-.051
15	Our team members grow closer when we spend time together	**.747**	-.065	-.004	-.175
16	In our team we celebrate one another's individual successes	**.843**	-.011	.020	.097
17	We encourage one another	**.793**	.075	.061	.043
18	We use certain expressions that are unique to our team	**.500**	.017	.155	.067
19	The team members' individual strengths are valued in our team	**.559**	.127	.203	-.013
20	Humour in the team strengthens the bond between us	**.804**	.064	-.069	.065
21	We enjoy working together in our team	**.763**	.000	-.002	-.178
22	We support each other in tough times	**.719**	.034	.027	-.142

It was then necessary to assess the reliability of the four-factor, 22 item measure. One way to do this is to conduct an inter-item correlation test to assess the internal consistency of the items in the instrument. A high level of internal consistency confirms that the composite score may be interpreted as a measure of the construct (Henson, 2001). However, if inter-item correlation is too high this suggests lack of discriminant validity, i.e., the items are too similar

and overlap in what they are measuring. Average inter-item correlations should range from 0.15 to 0.5 to be acceptable (Clark & Watson, 2019). When calculating the inter-item and average inter-item correlations for the 22 items in the scale, seven items had average inter-item scores above 0.5, suggesting that these items overlapped in what they were measuring (see appendix five). Retaining these items with high average inter-item correlations would undermine discriminant validity and risk the scale being regarded as 'impure'. As a result, the seven items were removed, and 15 items were retained.

The seven items that were removed were the following:

- We encourage each other to persevere (item 7)
- The sense that we're in this together makes it easier to persevere (item 8)
- The bond between us has grown stronger over the time we have worked together as a team (item 14)
- We encourage one another (item 17)
- The team members' individual strengths are valued in our team (item 19)
- We enjoy working together in our team (item 21)
- We support each other in tough times (item 22)

At this stage it was necessary to ascertain whether the removal of these seven items had disrupted the factor structure or assisted in scale purification. Consequently, the analysis was run again, using principal axis factoring and direct oblimin rotation and specifying a four-factor solution. The item "We trust one another in our team" loaded poorer than the other items, at 0.41, and it was removed. This left 14 items across four factors, where two larger factors each had 4 items loaded onto them while two smaller factors each had 3 items loaded onto them. The factor loadings were all above the 0.5 threshold and no cross loadings were evident. For this final set of outputs, the Bartlett's and KMO test results were good ($\chi^2(91) = 1620.33$, $p<.001$), meeting the required levels (i.e., KMO above 0.6 and Bartlett's p-value below 0.05, as seen in Table 4.23).

Table 4.23 KMO and Bartlett's tests

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.			.898
Bartlett's Test of Sphericity	Approx. Chi-Square		1620.326
	df		91
	Sig.		<.001

At this stage the four factors explained close to 71% of the total variance (Table 4.24) and a scree plot visually supported a four-factor solution (Figure 4.5).

Table 4.24 Total variance explained by purified scale in wave two

Factor	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total
1	6.136	43.831	43.831	5.740	41.000	41.000	4.373
2	1.754	12.528	56.359	1.381	9.865	50.865	3.399
3	1.140	8.143	64.502	.740	5.287	56.151	3.503
4	.866	6.188	70.690	.415	2.965	59.117	3.463

The four-factor solution became more evident as, by the fifth factor, the gradient had flattened on the scree plot.

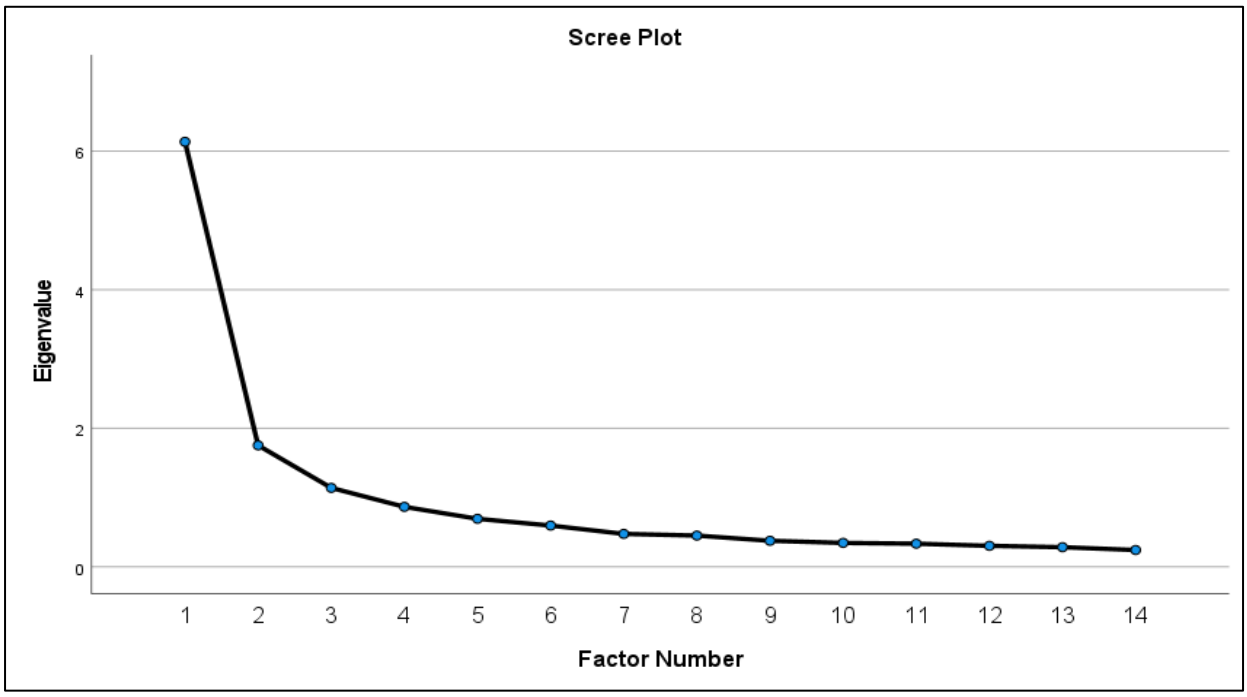

Figure 4.5: Scree plot after wave two purification

The four factor, 14-item solution appears in Table 4.25, the pattern matrix. Factor loadings were high for all items (above .500), with no cross loadings evident.

Table 4.25 Pattern matrix after wave two purification

#	Item	Factor			
		1	2	3	4
1	Once we have set our goal, we keep our focus on it	.133	.071	.111	-.512
2	We believe that achieving our goal will make a meaningful impact	.074	.114	.639	-.015
3	We are a diligent team	.162	.177	.034	-.605
4	Our team finishes whatever we begin	.040	-.043	.082	-.655
5	Our goal is much too important to give up on	.069	-.053	.589	-.251
6	The importance of our goal motivates us to persevere	.054	.037	.690	-.020
7	Our team is able to cope with the changing circumstances at work	.682	.034	.072	-.005
8	We are willing to adapt our roles in the team to achieve our goals	.678	.063	.050	-.038
9	We are successful in adapting to external changes	.765	.025	-.016	-.089
10	As a team we are able to be highly adaptive in order to achieve our goal	.811	-.006	.060	-.055
11	Our team members grow closer when we spend time together	-.034	.684	.043	-.224
12	In our team we celebrate one another's individual successes	.026	.816	.034	.022
13	We use certain expressions that are unique to our team	.033	.536	.154	.036
14	Humour in the team strengthens the bond between us	.106	.839	-.081	.012

Before the four-factor 14-item measure could be accepted as the purified instrument for the wave two study, it was necessary to consider the factor correlation and internal consistency reliability of the scale. Factor correlation analysis was conducted, and the results depicted in the factor correlation matrix, Table 4.26. A value of 1 indicates perfect correlation while a value of 0 indicates that no correlation exists. The matrix returned results between .276 and .542, indicating that all factors are correlated with one another and shared common meaning (in this case related to the construct of team grit). However, they were not perfectly correlated which would suggest that any is redundant.

Table 4.26 Factor correlation matrix for wave two

Factor	1	2	3	4
1 – “Adaptability”	1.000	.393	.496	-.542
2 – “Connectedness”	.393	1.000	.355	-.276
3 – “Goal passion”	.496	.355	1.000	-.533
4 – “Goal completion”	-.542	-.276	-.533	1.000

Note: The above names were the tentative names ascribed to the factors at this stage

Finally, the internal consistency reliability of the scale was assessed for each factor and the overall scale. This was assessed using Cronbach’s alpha coefficient. Table 4.27 indicates that the Cronbach’s alpha coefficient for the four factors and the overall scale were well above the recommended minimum of 0.7 (Nunally, 1978). This signifies that each item was adding substantial value without any one item being redundant. When viewing the item-total reliability statistics (Table 4.28) it was evident that one item, if removed, would increase the overall reliability of the scale. This item, ‘We use certain expressions that are unique to our team’, would improve the overall scale Cronbach’s alpha from 0.893 to 0.894. The decision was taken to retain this item for two reasons: this item was one of only four items tapping the ‘Connectedness’ latent factor, and the overall scale reliability level was high, and it was not necessary to seek to improve this, and finally there would be no substantial change to the scale if any of the items were removed.

Table 4.27 Internal consistency reliability for factors and scale

Factor #	Cronbach’s Alpha	Number of items
1	0.871	4
2	0.836	4
3	0.782	3
4	0.767	3
Overall scale	0.893	14

Table 4.28 Item-total reliability statistics

#	Item	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
1	Once we have set our goal, we keep our focus on it	52.50	55.204	.573	.887
2	We are a diligent team	52.45	53.772	.669	.883
3	Our team finishes whatever we begin	52.42	55.614	.481	.890

4	We believe that achieving our goal will make a meaningful impact	52.42	54.458	.582	.886
5	Our goal is much too important to give up on	52.55	54.351	.584	.886
6	The importance of our goal motivates us to persevere	52.70	53.963	.545	.887
7	Our team is able to cope with the changing circumstances at work	52.64	54.291	.596	.886
8	We are willing to adapt our roles in the team to achieve our goals	52.66	53.094	.618	.884
9	We are successful in adapting to external changes	52.66	53.222	.648	.883
10	As a team we are able to be highly adaptive in order to achieve our goal	52.70	52.712	.686	.882
11	Our team members grow closer when we spend time together	52.68	52.406	.625	.884
12	In our team we celebrate one another's individual successes	52.81	51.621	.570	.887
13	We use certain expressions that are unique to our team	53.40	51.935	.481	.894
14	Humour in the team strengthens the bond between us	52.61	52.060	.574	.887

The scale purification process during the EFA had resulted in a four-factor, 14-item solution which loaded strongly, and which had good internal consistency reliability. This concluded wave two.

4.4 Third wave: Exploratory factor analysis

The purpose of the wave three study was to purify the scale using a new sample. In addition, the nomological net for team grit was developed during this study, to position team grit within a network of related constructs.

4.4.1 Data collection and sample overview

The sample comprised of 269 respondents, all from the United States. Once again, descriptive statistics were analysed. The age distribution of the sample for the range of 5 categories was *M*= 3.52, *SD* = .904. The gender distribution of the sample for the range of four categories was *M*=1.52, *SD* = .500. All respondents were older than 18 years and had worked in a team for a period of three months or more. Figure 4.6 depicts the industries that the respondents worked within. The ‘other’ category was the largest at 21% of the sample (which included

transportation, security, and manufacturing), followed by IT/software development (19%), education (17%) and consumer products/retail (13%).

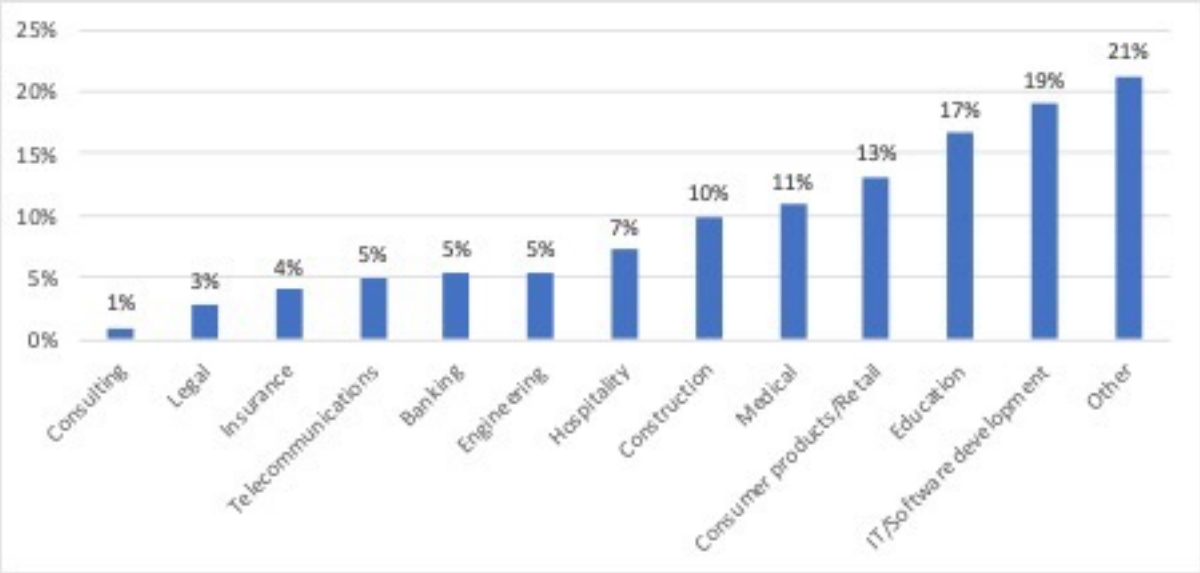

Figure 4.6: Industry breakdown for wave three respondents

4.4.2 Exploratory factor analysis

For wave three it was necessary to run another EFA on the new data as the factor structure may have been altered by the removal of items in the wave two purification process. The wave two study had seen the item pool reduce from 25 items to 14 items across the various waves of purification. Given the substantive reduction in items in the prior wave, it was believed that a further exploratory factoring would increase rigour in the process of scale development. It was first necessary to assess the suitability of the sample for factorability. This was done through KMO and Bartlett's tests. Both tests returned good results, as Table 4.29 presents, indicating that the data was suitable for factor analysis.

Table 4.29 KMO and Bartlett's for wave three

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.943
Bartlett's Test of Sphericity	Approx. Chi-Square	1780.728
	df	91
	Sig.	.000

EFA was undertaken with a principal axis factoring and direct oblimin approach and specifying a four-factor solution. Sixty-seven percent of the variance was explained in the four-factor

solution (Table 4.30). However, the result showed that only one of the factors reflected an eigenvalue above 1, although the second factor was close to 1, at a value of 0.931. The eigenvalues distribution and the scree plot (Figure 4.7) both challenged the assumption of a four-factor solution.

Table 4.30 Total variance explained wave three

Factor	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total
1	6.901	49.291	49.291	6.459	46.135	46.135	4.985
2	.931	6.650	55.942	.452	3.231	49.366	1.173
3	.819	5.847	61.788	.358	2.558	51.924	5.306
4	.789	5.634	67.422	.283	2.018	53.942	4.661
5	.639	4.564	71.986				
6	.597	4.267	76.253				
7	.567	4.051	80.304				
8	.500	3.575	83.879				
9	.472	3.375	87.254				
10	.444	3.172	90.425				
11	.398	2.846	93.271				
12	.369	2.638	95.909				
13	.306	2.189	98.098				
14	.266	1.902	100.000				

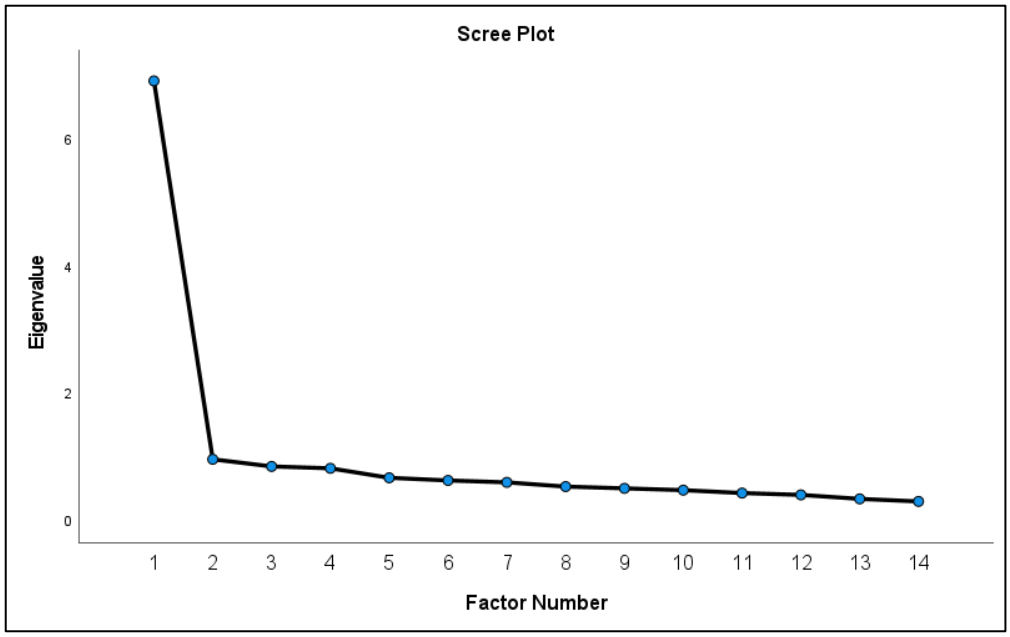

Figure 4.7: Scree plot wave three

Nonetheless, a four-factor solution was specified with the outputs as per the pattern matrix in Table 4.31. This was done in adherence to the theory that the researcher had espoused, that the team grit construct was comprised of four factors. Up until this point all prior analysis had supported the four-factor structure and this needed to be tested further before a reduced factor structure was accepted.

Table 4.31 Pattern matrix with four factors wave three

#	Item	Factor			
		1	2	3	4
1	We are a diligent team	-.082	.163	**-.636**	-.114
2	The importance of our goal motivates us to persevere	-.133	-.192	**-1.113**	.100
3	We are successful in adapting to external changes	**.462**	.380	.087	-.064
4	As a team we are able to be highly adaptive in order to achieve our goal	**.515**	.000	-.296	-.098
5	Our team members grow closer when we spend time together	-.269	**.870**	-.133	-.042
6	Once we have set our goal, we keep our focus on it	**.549**	.024	-.065	-.095
7	Our team finishes whatever we begin	.405	-.264	-.409	-.429
8	Our goal is much too important to give up on	-.141	-.064	**-.928**	.019

9	Our team is able to cope with the changing circumstances at work	**.711**	.219	.264	-.143
10	We are willing to adapt our roles in the team to achieve our goals	**.981**	-.216	.061	.136
11	In our team we celebrate one another's individual successes	-.029	**.966**	.170	.148
12	We use certain expressions that are unique to our team	.066	**.474**	-.115	.349
13	We believe that achieving our goal will make a meaningful impact	.141	.047	**-.565**	.088
14	Humour in the team strengthens the bond between us	.112	**.470**	.091	-.136

The results of the EFA as shown in the pattern matrix yielded unsatisfactory results. Some items cross-loaded on several factors, while the fourth factor had very few items loading on it. In addition, the scree plot (Figure 4.7) did not support a four-factor solution. The researcher at this stage considered whether the one factor solution suggested by the eigenvalues and scree plot should be accepted and the theoretical argument abandoned. A parallel analysis was consulted to aid this decision. Some researchers recommend the use of parallel analysis to determine the number of factors to retain in factor analysis (Worthington & Whittaker, 2006). In this method a comparison is made between the analysed data and a randomly ordered data set. Table 4.32 presents the actual and generated eigenvalue data. According to the norm only factors that score higher than the parallel analysis indication should be retained. Adhering to this norm the parallel analysis suggested that only one factor should be retained.

Table 4.32 Parallel analysis wave three

Component or Factor	Eigenvalue (Actual data)	Mean Eigenvalue (parallel data)	Percentile Eigenvalue (parallel data)
1	6.901	1.405573	1.488134
2	.931	1.306606	1.365946
3	.819	1.237557	1.302061
4	.789	1.167996	1.219309
5	.639	1.115699	1.157662
6	.597	1.061252	1.104148
7	.567	1.007244	1.043875
8	.500	0.962089	1.001687

This was the point that the researcher conceded that the data was not going to fit the presupposed four-factor structure. However, despite the indications that a one factor solution may be preferred, the researcher selected to retain the second factor given that the second Eigenvalue was so close to 1.0 (.931). In order to further purify the scale, the EFA was re-run specifying a two-factor solution. The resultant pattern matrix is shown in Table 4.33. The factor loadings at acceptable level (above 0.47) are in bold type and shaded.

Table 4.33 Pattern matrix for wave three purified scale

#	Item	Factor	
		1	2
1	We are a diligent team	**.553**	.222
2	The importance of our goal motivates us to persevere	.444	.334
3	We are successful in adapting to external changes	**.521**	.267
4	As a team we are able to be highly adaptive in order to achieve our goal	**.713**	.142
5	Our team members grow closer when we spend time together	.297	**.474**
6	Once we have set our goal, we keep our focus on it	**.584**	.090
7	Our team finishes whatever we begin	**.983**	-.305
8	Our goal is much too important to give up on	.453	.287
9	Our team is able to cope with the changing circumstances at work	**.607**	.101
10	We are willing to adapt our roles in the team to achieve our goals	.446	.204
11	In our team we celebrate one another's individual successes	.102	**.648**
12	We use certain expressions that are unique to our team	-.114	**.697**
13	We believe that achieving our goal will make a meaningful impact	.392	.361
14	Humour in the team strengthens the bond between us	.369	.173

The researcher then examined the retained items to see if they made conceptual sense. When viewing the items at face value against the two-factor solution it was evident that a theme of connectedness emerged as a clear factor with the three connectedness items logically clustered together (Factor 2 in Table 4.33). The remaining items all clustered together on one large factor as per the Eigenvalues and scree plot (Factor 1 in Table 4.33). The researcher applied a threshold of 0.5 in determining which items to retain, but allowed rounding up of factor loadings which enabled the inclusion of the item “Our team members grow closer when we spend time together”, which otherwise would have left only 2 items on the smaller factor, below the recommended minimum number of items per factor (Watkins, 2018). One other exception was permitted – the retention of the item “humour in the team strengthens the bond between us. Although this item only loaded at 0.369, the researcher felt that the presence of humour in teams had been a unique finding in the qualitative interview phase, and chose to

retain this at this stage, with a view to testing whether it would remain after further purifications. This resulted in 10 items being retained, while the following four items were removed:

- The importance of our goal motivates us to persevere (item 2 in Table 4.33)
- Our goal is much too important to give up on (item 8)
- We are willing to adapt our roles in the team to achieve our goals (item 10)
- We believe that our goal will make a meaningful impact (item 13)

The result explained 58% of variance and the items appeared as per Table 4.34, with those items which had adequate loadings bolded and shaded. Two items still loaded poorly ("we are successful in adapting to external changes" and "humour in the team strengthens the bond between us") and cross-loaded too much, i.e., where items load at 0.32 or higher on two or more factors (Worthington & Whittaker, 2006). These items were removed.

Table 4.34 Pattern matrix for purified scale wave three

#	Item	Factor	
		1	2
1	We are a diligent team	**.528**	.236
2	We are successful in adapting to external changes	.461	.348
3	As a team we are able to be highly adaptive in order to achieve our goal	**.644**	.195
4	Our team members grow closer when we spend time together	.234	**.551**
5	Once we have set our goal, we keep our focus on it	**.551**	.124
6	Our team finishes whatever we begin	**.992**	-.297
7	Our team is able to cope with the changing circumstances at work	**.569**	.161
8	In our team we celebrate one another's individual successes	-.052	**.814**
9	We use certain expressions that are unique to our team	-.089	**.617**
10	Humour in the team strengthens the bond between us	.320	.240

After removing the two problematic items the analysis was re-run, with the remaining eight items, without specifying a number of factors. The KMO and Bartlett's tests returned good results (Table 4.35), and the resultant model returned a single factor, with an eigenvalue above 1 (at 4.199), whereas the next eigenvalue fell below the threshold, at .932. The single factor explained 52.5% of the variance (Table 4.36). The scree plot further confirmed a one-factor structure (Figure 4.8).

Table 4.35 KMO and Bartlett's tests

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.893
Bartlett's Test of Sphericity	Approx. Chi-Square	854.294
	df	28
	Sig.	<,001

Table 4.36 Total variance explained in one-factor solution

Total Variance Explained							
Factor	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total
1	4.199	52.493	52.493	3.740	46.747	46.747	3.460
2	.923	11.533	64.026	.427	5.336	52.082	3.185
3	.637	7.965	71.991				
4	.581	7.265	79.256				
5	.543	6.783	86.039				
6	.417	5.207	91.246				
7	.375	4.690	95.936				
8	.325	4.064	100.000				

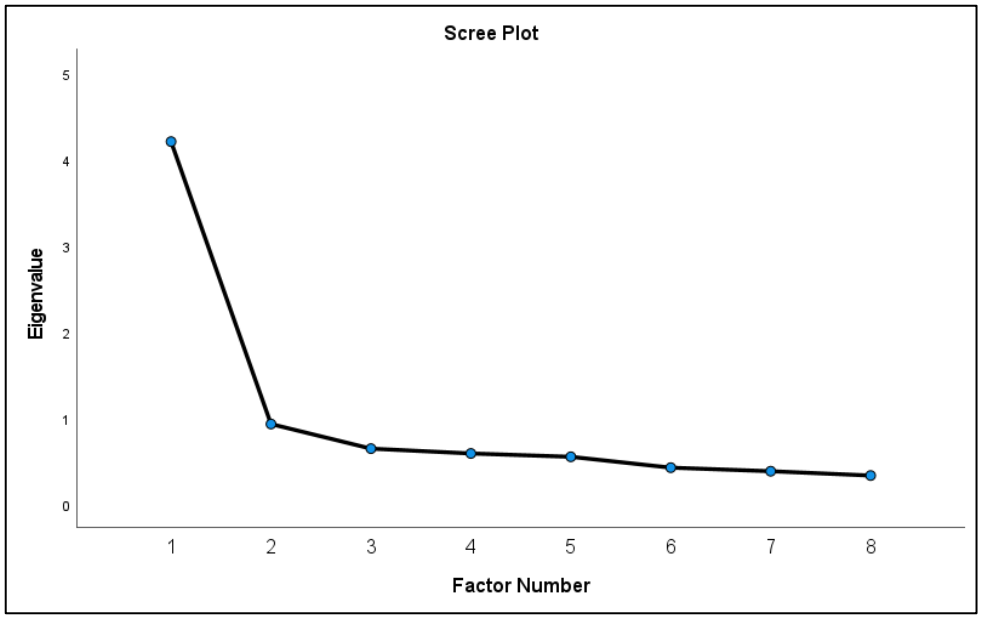

Figure 4.8: Scree plot showing one-factor solution

The resultant pattern matrix, as depicted in Table 4.37, shows the one-factor and eight-item solution. All items had acceptable factor loadings. At this point in the scale development process the purification had resulted in a scale combining elements of diligence, goal focus, goal completion, and adaptability, connectedness, camaraderie, and closeness.

Table 4.37 Purified scale pattern matrix for 8-item, one-factor solution

#	Item	Factor
1	Once we have set our goal, we keep our focus on it	.638
2	We are a diligent team	.737
3	Our team finishes whatever we begin	.659
4	Our team is able to cope with the changing circumstances at work	.689
5	As a team we are able to be highly adaptive in order to achieve our goal	.798
6	Our team members grow closer when we spend time together	.736
7	In our team we celebrate one another's individual successes	.656
8	We use certain expressions that are unique to our team	.467

Average inter-item correlations were assessed which demonstrated that the items were correlated but not so closely correlated as to be redundant. Only the item “As a team we are able to be highly adaptive in order to achieve our goal” scored at 0.52, slightly above the desired threshold of 0.5. However, this was retained due to its theoretical importance, in reflecting the ability of the team to adapt in their pursuit of their shared goal.

Cronbach's alpha (internal consistency) for the overall eight-item scale was calculated to be .862. This shows good internal consistency of the eight items, The item-total statistics were also considered, which showed that one item, if deleted, would increase the overall reliability of the scale. This item was "We use certain expressions that are unique to our team', which, if deleted would improve the scale Cronbach alpha to .870. The researcher chose to retain this item in the scale as the overall scale reliability was already good at .862 and the removal of the item would not substantially improve the overall reliability.

Table 4.38 Reliability statistics

Factor	Cronbach's Alpha	N of Items
Total scale	.862	8

Table 4.39 Item-total statistics

Item #	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared multiple correlation	Cronbach's Alpha if Item Deleted
1	28.58	23.707	.587	.370	.848
2	28.56	22.777	.672	.500	.839
3	28.41	23.943	.586	.447	.848
4	28.63	22.824	.632	.453	.843
5	28.65	21.983	.719	.566	.833
6	28.74	21.859	.685	.502	.836
7	28.70	21.934	.622	.426	.844
8	28.97	22.869	.444	.241	.870

Table 4.40 depicts the final purified scale.

Table 4.40 Final purified scale

Item #	Item
TG1	Once we have set our goal, we keep our focus on it
TG2	We are a diligent team
TG3	Our team finishes whatever we begin
TG4	Our team is able to cope with the changing circumstances at work
TG5	As a team we are able to be highly adaptive in order to achieve our goal
TG6	Our team members grow closer when we spend time together
TG7	In our team we celebrate one another's individual successes
TG8	We use certain expressions that are unique to our team

During the third study, the analysis suggested a refinement from a four factor, 14 item scale to a one-factor, eight-item scale. It was at this point that the researcher conceded that the theoretical four-factor model did not fit the data and that a one-factor solution was a better fit.

4.5 Fourth wave: Confirmatory factor analysis

4.5.1 Data collection and sample overview

The sample for wave four consisted of 228 United Kingdom-based respondents. All respondents in wave four were over the age of 18 and had worked in a team for more than three months. The age distribution of the sample across 5 categories was *M* = 2.99, *SD* = .669. The gender distribution was *M* = 1.39, *SD* = .489. They represented many different industries, with 19% and 18% from IT/Software development and Banking, respectively. Figure 4.9 presents the industry breakdown.

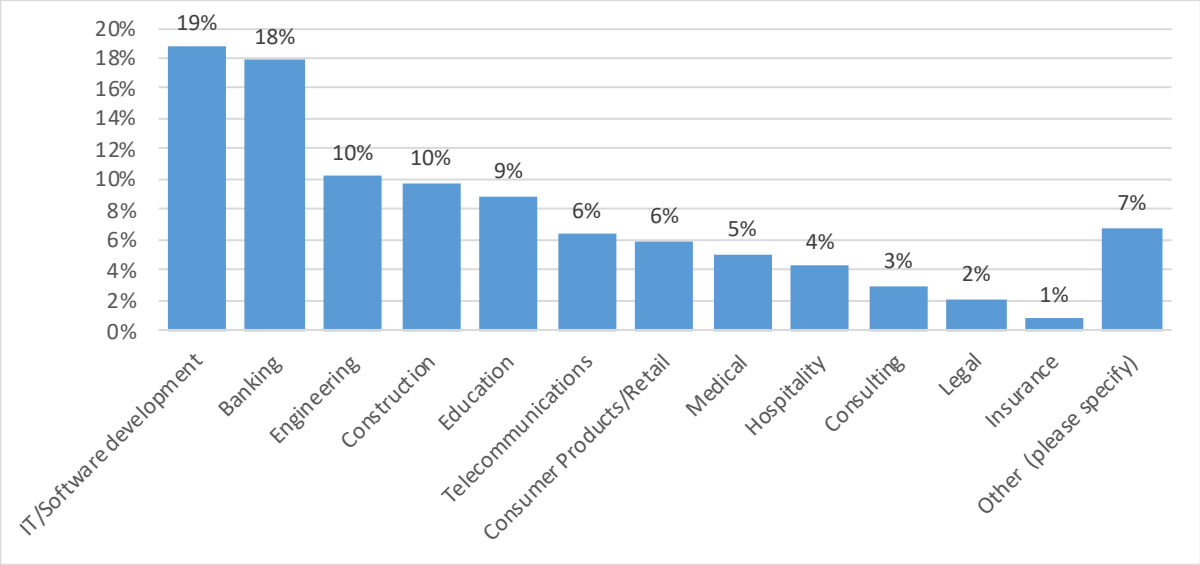

Figure 4.9: Industry breakdown for wave four respondents

The intent for the wave four survey was to confirm the factor structure using a new sample, and to assess the invariance of the scale across different samples, in this case different geographical samples, by comparing wave 3 and wave 4 data. It was not necessary to conduct exploratory factoring in wave 4, instead confirmation of the one-factor, 8-item model was sought through confirmatory factor analysis, CFA.

Table 4.41 Descriptive statistics for wave four data

Item	N	Mean		Std deviation	Skewness	Kurtosis
	Statistic	Statistic	Std. Error	Statistic	Statistic	Statistic
TG1 Once we have set our goal, we keep our focus on it	228	4.10	.065	.984	-1.202	1.228
TG2 We are a diligent team	228	4.13	.058	.876	-.776	.049
TG3 Our team finishes whatever we begin	228	4.06	.063	.944	-.939	.650
TG4 Our team is able to cope with the changing circumstances at work	228	4.15	.059	.898	-.888	.204
TG5 As a team we are able to be highly adaptive in order to achieve our goal	228	4.05	.063	.958	-1.006	.846
TG6 Our team members grow closer when we spend time together	228	4.04	.064	.970	-1.082	1.061
TG7 In our team we celebrate one another's individual successes	228	4.01	.065	.980	-.783	-.118
TG8 We use certain expressions that are unique to our team	228	3.89	.073	1.097	-.924	.329
N Valid N	228					

Table 4.42 reports the skewness and kurtosis of the sample for wave four, showing that the data in the sample was negatively skewed. The critical ratio indicates non normality of the data. For medium-sized samples (50 < n < 300), one rejects the null hypothesis at absolute z-value over 3.29, which corresponds with an alpha level of 0.05. In this case the critical ratio value is 13.417, demonstrating non normality. For two of the items, ‘Once we have set our goal, we keep our focus on it as well as ‘Our team members grow closer when we spend time together' the skewness value exceeded 1. However, for both items the critical ratio of the skewness was less than 8.0, indicating that the items were acceptable. SPSS Amos is able to run analysis for skewed data above 1.0 and since the sample for wave four was bigger than 200, it was appropriate to continue with the maximum likelihood estimates. For added

certainty, a Bollen-Stine bootstrap procedure (Bollen & Stine, 1992) was run (n=2000) which confirmed the suitability of the data for confirmatory factoring.

Table 4.42 Assessment of normality

Item	min	max	Skewness	Critical ratio	Kurtosis	Critical ratio
TG1 Once we have set our goal, we keep our focus on it	1	5	-1.194	-7.361	1.175	3.621
TG2 We are a diligent team	1	5	-.771	-4.752	.022	.068
TG3 Our team finishes whatever we begin	1	5	-.932	-5.748	.609	1.878
TG4 Our team is able to cope with the changing circumstances at work	1	5	-.882	-5.440	.173	.534
TG5 As a team we are able to be highly adaptive in order to achieve our goal	1	5	-.999	-6.160	.801	2.469
TG6 Our team members grow closer when we spend time together	1	5	-1.075	-6.625	1.012	3.118
TG7 In our team we celebrate one another's individual successes	1	5	-.778	-4.793	-.142	-.436
TG8 We use certain expressions that are unique to our team	1	5	-.918	-5.658	.296	.911
Multivariate					22.480	13.417

4.5.2 Confirmation of the factor structure

Having arrived at the eight-item, one-factor model through the exploratory factor analysis in the previous wave, CFA was now undertaken to assess the model fit. Table 4.43 summarises the goodness of fit indices, showing that the model fit the data well across all measures. In addition, standardised regression weights were above .5 for all items, and there were no cross-loadings of items on different factors. This provided support for the one-factor solution.

Table 4.43 Goodness of fit indices

Test name	Recommended levels	Findings	Result
Chi-square	Insignificant at 0.05	p = 0.011; df = 19 Chi-square = 35.865	Good fit
Chi-square fit/degrees of freedom (CMIN/DF)	Below 5.0; some suggest below 2.0 (Byrne, 2016)	1.888	Excellent fit
Root mean square error of approximation (RMSEA)	Below 0.07	.063	Good fit

Standardised mean square residual (SRMR)	Below 0.08	.024	Excellent fit
Tucker-Lewis index (TLI)	Greater than 0.80	.971	Excellent fit
Comparative fit index (CFI)	Greater than 0.95	.981	Excellent fit
Normed fit index (NFI)	Greater than 0.95	.960	Excellent fit
Incremental fit index (IFI)	Greater than 0.90 (Bollen, 1989)	.981	Excellent fit
ECVI	Default model result should be less than saturated model. Lower Figures are preferable.	Default model = .314 Saturated model = .330	Good fit/ Parsimonious

4.5.3 Construct validity

Further tests on the data demonstrated construct validity of the team grit measure. Construct validity is the determination that a test which is purporting to measure a particular construct is in fact measuring that construct. It is comprised of convergent validity, and discriminant validity. Convergent validity is the degree of internal consistency between measures. Discriminant validity indicates that two measures that are not meant to be associated are not associated.

In measuring convergent validity, the key measures are Average Variance Explained (AVE), Composite reliability (CR) and Cronbach's alpha. The recommended threshold for AVE is a minimum of 0,5 which indicates that the factor structure accounts for more variance than error does (Ab Hamid et al., 2017). For composite reliability, scores above 0.7 are recommended. Table 4.44 shows that the composite reliability, at .919 was excellent, and the AVE at .588 was good. These results showed that the eight-item scale had very good convergent and discriminant validity. Moreover, as previously noted, the Cronbach's alpha for the scale was .862, also indicating good construct validity.

Table 4.44 Convergent validity

AVE	.588
CR	.920

The path diagram is depicted in Figure 4.10 and the standardised regression weights estimates in Table 4.45. The model fit indices confirmed the one-factor structure. The factor

loadings were all at acceptable levels, above the .5 threshold and without any cross loadings between items. Even the consistent low performing item, TG8 ('We use certain expressions that are unique to our team'), now loaded well onto the team grit latent factor at .533.

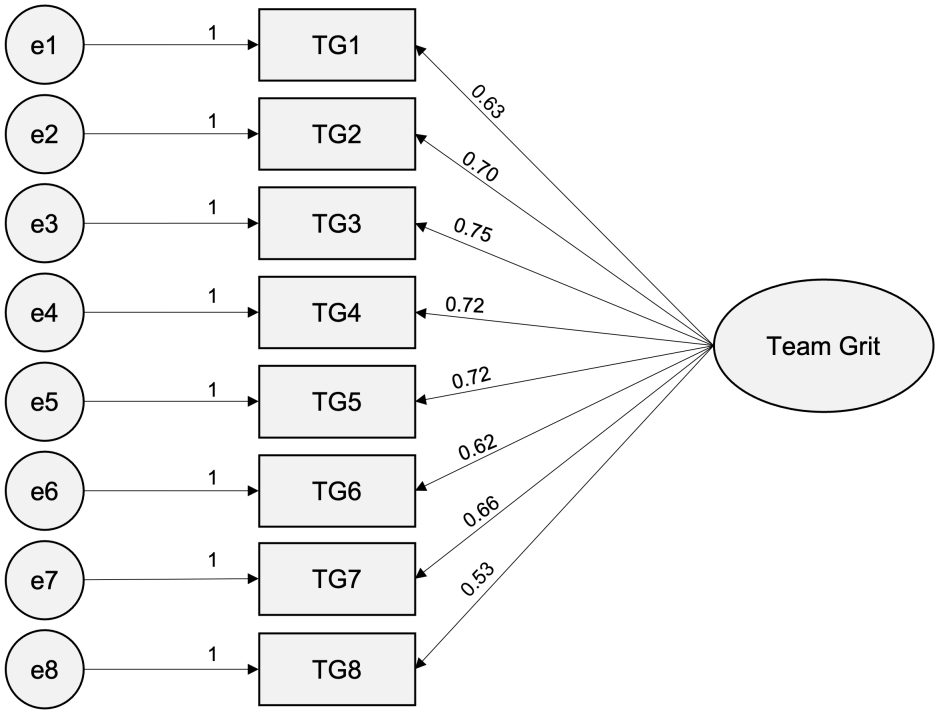

Figure 4.10: Wave four path diagram

Table 4.45: Standardised regression weights

Item	β
TG1 Once we have set our goal, we keep our focus on it	.631
TG2 We are a diligent team	.701
TG3 Our team finishes whatever we begin	.750
TG4 Our team is able to cope with the changing circumstances at work	.723
TG5 As a team we are able to be highly adaptive in order to achieve our goal	.720
TG6 Our team members grow closer when we spend time together	.622
TG7 In our team we celebrate one another's individual successes	.660
TG8 We use certain expressions that are unique to our team	.533

All values significant at 1% level of significance

The analysis indicated strong support for a single factor solution. This confirmed that the eight-item, single-factor solution was an acceptable and preferred model, with adequate validity and reliability as evidenced by the various tests conducted. Later in the study further tests of

validity would be conducted to determine invariance of this factor structure across different samples.

The next steps were two-fold: firstly, to demonstrate that individual grit and team grit were distinct from one another, and secondly to construct the measurement model which would provide support for the relationships within the proposed nomological net.

4.5.4 Distinguishing team grit from individual grit

Having established the one-factor, eight-item team grit scale, the next step was to test its construct-level discriminant validity, to demonstrate that it was distinct from other similar constructs, specifically showing that team grit is distinct from grit. This was to address one of the research questions of this research: How is team grit distinct from grit? Grit is measured by the GRIT-S scale, developed by Duckworth and Quinn (2009). The scale consists of two factors, consistency of interest and perseverance of effort. The scale items are included in appendix six. Note that items that are expressed in the negative, that is, the consistency of interest items, were reverse scored prior to analysis.

The data set was analysed to identify the latent factors that were present in the data. The analysis method employed was Principal Component Analysis (PCA), with varimax rotation. PCA is a dimension-reduction technique used to identify dimensions in the data. PCA is used when determining how data clusters together, rather than presupposing a set of factors and attempting to validate a reflective measure, which is the approach in factor analysis. PCA was an appropriate analysis technique given the combination of scales used in the wave three study. The rotated component matrix is presented in Table 4.47. It represents the Pearson correlations between items and components and shows the loading of each item across each component. Factor loadings above 0.5 are recommended. The analysis confirmed the factor structures of both individual grit and team grit and supported the distinction between the two. Each factor loaded discretely and independently, without any low loadings and without significant cross-loadings, defined as where items load at 0.32 on two or more components (Worthington & Whittaker, 2006). This confirmed that the two scales are distinct measures, measuring different constructs and that their factors hold discriminant validities.

Table 4.46 Discriminating team grit from individual grit - rotated component matrix

Items	Components		
	1	2	3
TG1	**.618**	-.011	.337
TG2	**.737**	.042	.264
TG3	**.623**	-.006	.363

TG4	**.739**	-.055	.112
TG5	**.765**	-.074	.272
TG6	**.760**	-.115	.152
TG7	**.695**	-.129	.153
TG8	**.560**	-.407	-.099
IG1	-.123	**.833**	.024
IG2	-.065	**.844**	-.046
IG3	-.059	**.808**	-.055
IG4	-.038	**.857**	-.004
IG5	.168	.023	**.752**
IG6	.220	.051	**.734**
IG7	.214	-.034	**.762**
IG8	.206	-.094	**.638**

N = 228; TG, team grit; IG, individual grit

The next step was to compare the Team Grit scale to the constituent factors within the Grit-S scale. This was done using the HTMT ratio. The first analysis was comparing the first factor of individual grit, consistency of interest (coded IG1), with the team grit scale. The correlation matrix is shown in Table 4.47.

Table 4.47 Correlation between team grit and grit consistency of interest (IG1)

	TG1	TG2	TG3	TG4	TG5	TG6	TG7	TG8	IG1a	IG1b	IG1c	IG1d
TG1	–											
TG2	.468	–										
TG3	.498	.532	–									
TG4	.456	.434	.514	–								
TG5	.487	.607	.550	.605	–							
TG6	.415	.577	.450	.455	.570	–						
TG7	.409	.453	.332	.447	.501	.573	–					
TG8	.305	.343	.195	.328	.319	.396	.415	–				
IG1a	-.096	-.055	-.100	-.104	-.165	-.170	-.168	-.382	–			
IG1b	-.092	-.055	-.104	-.108	-.161	-.140	-.115	-.300	.650	–		
IG1c	-.080	-.042	-.094	-.122	-.094	-.149	-.171	-.280	.549	.611	–	
IG1d	-.012	.001	-.035	-.108	-.111	-.141	-.130	-.322	.641	.633	.610	–

N = 228; TG, team grit; IG1, individual grit consistency of interest

The shaded section of Table 4.48 shows the correlation coefficients measuring the strength of relationship between team grit and grit consistency of interests. The values are low, identifying little relationship between the items. In addition, the resultant HTMT ratio between team grit and individual grit's consistency of interests was extremely low, at 0.249, compared to the upper limit of 0.85. This confirmed that these two constructs have very little similarity between one another and discriminant validity between them is high. Similar analysis was conducted to compare the second factor of individual grit, perseverance of effort (coded IG2), with team grit. The correlation matrix is shown in Table 4.48.

Table 4.48 Correlation between team grit and grit perseverance of effort (IG2)

	TG1	TG2	TG3	TG4	TG5	TG6	TG7	TG8	IG2a	IG2b	IG2c	IG2d
TG1	-											
TG2	.468	-										
TG3	.498	.532	-									
TG4	.456	.434	.514	-								
TG5	.487	.607	.550	.605	-							
TG6	.415	.577	.450	.455	.570	-						
TG7	.409	.453	.332	.447	.501	.573	-					
TG8	.305	.343	.195	.328	.319	.396	.415	-				
IG2a	.401	.309	**.440**	.240	.304	.277	.286	.059	-			
IG2b	.304	.319	.261	.270	.324	.262	.285	.127	.375	-		
IG2c	.306	.360	.317	.252	.351	.346	.279	.153	.517	.397	-	
IG2d	.330	.324	.335	.188	.374	.219	.253	.075	.404	.388	.523	-

N = 228; TG, team grit; IG2, individual grit perseverance of effort

The correlation coefficients are much higher than for the analysis of consistency of interests, with values as high as .440 for the correlation between TG3 and IG2a. The discriminant validity between team grit and grit's perseverance of effort factor was assessed by examining the HTMT ratio. The resultant HTMT ratio value was .631, which confirmed that the two factors are distinct. However, when compared to the HTMT ratio between team grit and consistency of interests of .249, it is evident that perseverance of effort and team grit are more closely related than team grit and consistency of interests. The above analysis concluded that team grit is distinct from individual grit.

4.6 Determining nomological validity

Nomological validity refers to the degree to which predictions in a formal theoretical network, known as a nomological net, are confirmed (Hagger et al., 2017, p.1). Nomological validity indicates whether the scale demonstrates the relationships that theory or prior research purport to exist. In the case of team grit, both theory and prior research are limited. Despite

the limited theoretical and empirical domain, this study proposed certain relationships between team grit and other constructs and tested these in a nomological net. Team psychological safety and individual grit were proposed as antecedents to team grit. Team innovation and team work engagement were proposed as outcomes of team grit.

The constructs and their respective measures were as follows:

1. As antecedents to team grit: Team psychological safety, which was operationalised using Edmondson's seven-item scale (1999); and team goal commitment, which was operationalised using Aubé and Rousseau's 3-item scale (2005).
2. As outcomes of team grit: Team innovation, which was operationalised using a four-item measure developed by Mitchell and colleagues (2022); and team work engagement, which was operationalised using the nine-item measure, TWES-9, developed by Costa and colleagues (2014).

All data for nomological validity were collected during wave three of the study by including the items from the above four scales in the questionnaire which was completed by 269 USA residents. The proposed model consisted of the following hypotheses:

H1: Team psychological safety will significantly predict team grit

H2: Team goal commitment will significantly predict team grit

H3: Team grit will significantly predict team innovation

H4: Team grit will significantly predict team work engagement

Table 4.49 Descriptive statistics for scales in the nom net

Measure	Mean	*Range*	*α*	Number of items	1	2	3	4	5
1. Team Grit	4.093	.569	.868	8					
2. Team psychological safety	3.639	1.074	.648	7	.403**				
3. Team goal commitment	4.456	.119	.845	3	.675**	.394**			
4. Team innovation	3.937	.167	.883	4	.744**	.367**	.551**		
5. Team work engagement	3.990	.836	.904	9	.691**	.330*	.559**	.712**	
6. Individual grit	3.621	3.00	.694	8	.055	334**	173**	-.021	-.016

N = 269; ** *p* < .01 level

The model was specified for the above-mentioned relationships using SPSS Amos module, and constraining error pairs to improve model fit, resulting in the standardised regression weight estimates displayed in Table 4.50 and the model fit indices in Table 4.51.

All four relationships demonstrated good regression weights (above .50) and indicated good predictive validity. The regression weights for team psychological safety and team goal commitment were .679 and .608, respectively. Similarly, the two proposed outcomes held strong predictive validity: team grit predicted team innovation with a regression weight of .844 while team work engagement at .793. Although these levels were pleasing, there was one area in which the model disappointed. Specifically, for team psychological safety, a few of the individual items loaded very poorly on the latent construct (-.087 for TPS5, -.037 for TPS3 and -.064 for TPS1). This seemed to be negatively affecting the overall model fit which showed mixed results, as seen in Table 4.51.

Table 4.50: Standardised regression weights for the relationships for model 1 (including team psychological safety)

	Model 1		
Variables	*β*	*SE*	CR
Team psychological safety	.679	.075	7.997
Team goal commitment	.608	.069	8.626
Team innovation	.844	.100	11.275
Team work engagement	.793	.097	9.938

All values significant at 1% level of significance

Table 4.51 Model fit indices for model 1 (including team psychological safety)

Goodness of fit measure	Recommended levels	Findings	Result
Chi-square	Insignificant at 0.05		Not relied upon due to sample size sensitivity
Chi-square fit/degrees of freedom (CMIN/DF)	Below 5.0; some suggest below 2.0 (Byrne, 2016)	1.966	Excellent fit
Root mean square error of approximation (RMSEA)	Below 0.07	0.060	Good fit
Standardised mean square residual (SRMR)	Below 0.08	0.107	Poor fit

Tucker-Lewis index (TLI)	Greater than 0.80	0.904	Excellent fit
Comparative fit index (CFI)	Greater than 0.95	0.917	Poor fit
Normed fit index (NFI)	Greater than 0.95	0.847	Poor fit
Incremental fit index (IFI)	Greater than 0.90 (Bollen, 1989)	0.918	Good fit
ECVI	Default model result should be less than saturated model.	Default model = 3.657 Saturated model = 3.701	Good fit

The goodness of fit results were mixed, and a second model was specified, this time removing team psychological safety. This now tested one antecedent, team goal commitment, and two outcomes, team innovation and team work engagement.

The revised measurement model was constructed in SPSS Amos, with the result as seen in Figure 4.11. As can be seen, team goal commitment and team psychological safety were constructed as antecedent to team grit, suggesting that they will 'give rise' to team grit. In turn, team grit is constructed as 'giving rise' to team innovation and also to team work engagement, which are both set as outcomes.

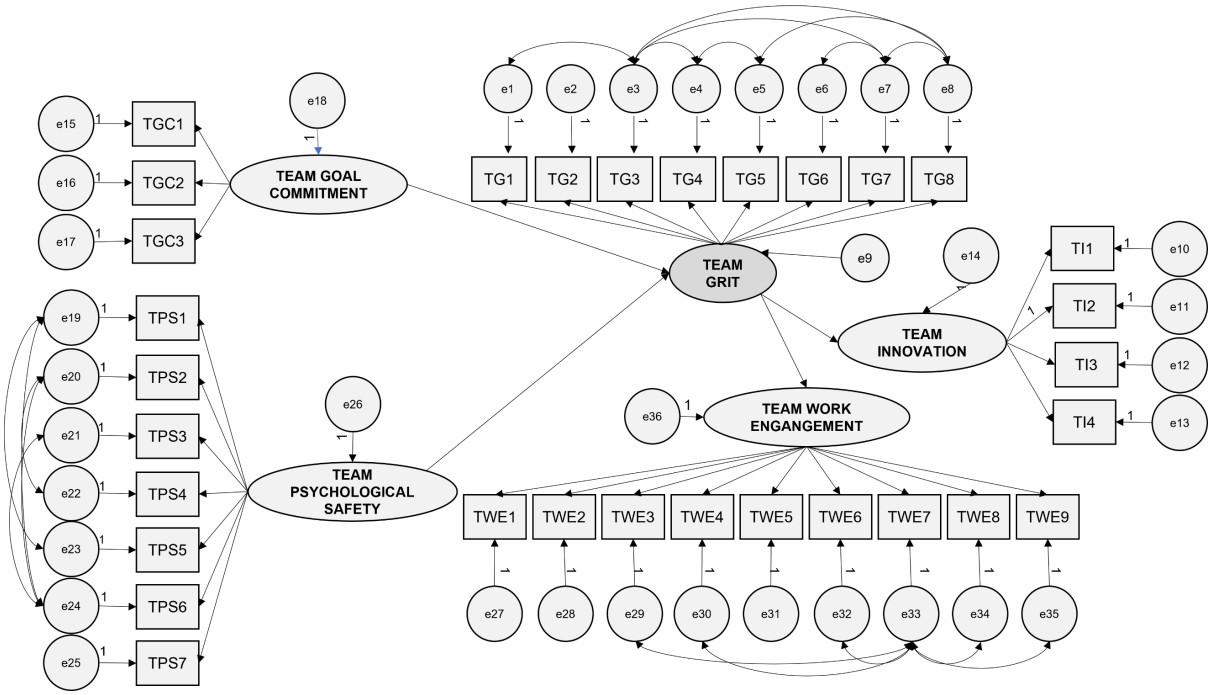

Figure 4.11: Measurement model for determination of nomological validity

The data from the various scales were assigned to the measurement model and are presented in Table 4.52 as the standardised regression weights for model 2.

Table 4.52: Standardised regression weights for the relationships for model 2 (excluding team psychological safety)

		Model 2	
Variables	*β*	*SE*	CR
Team psychological safety			
Team goal commitment	.800	.075	11.388
Team innovation	.858	.069	13.760
Team work engagement	.811	.100	11.594

All values significant at 1% level of significance

The second model showed strong and high predictive validity for each of the three construct relationships. Team goal commitment predicted team grit with a regression weight of .800, while team grit predicted team innovation and team work engagement with values of .858 and .811, respectively. In addition, the underlying item-latent construct weights were all above threshold levels. The second model offered good fit, as is demonstrated by the fit indices in Table 4.53.

Table 4.53 Model fit indices for second model (excluding team psychological safety)

Goodness of fit measure	Recommended levels	Findings	Result
Chi-square	Insignificant at .05	p = .000 Chi-square= 499.194; Df=236	Not relied upon due to sample size sensitivity
Chi-square fit/degrees of freedom (CMIN/DF)	Below 5.0; some suggest below 2.0 (Byrne, 2016)	2.115	Good fit
Root mean square error of approximation (RMSEA)	Below .07	.065	Good fit
Standardised mean square residual (SRMR)	Below .08	.060	Excellent fit
Tucker-Lewis index (TLI)	Greater than .80	.919	Excellent fit
Comparative fit index (CFI)	Greater than .95	.931	Borderline fit
Normed fit index (NFI)	Greater than .95	.877	Poor fit

Incremental fit index (IFI)	Greater than .90 (Bollen, 1989)	.931	Good fit
ECVI	Default model result should be less than saturated model. Lower Figures are preferable.	Default model = 2.519 Saturated model = 2.418	Poor fit

Both models showed acceptable fit, and both showed strong predictive relationships within a nomological net. It is noted that the second model without team psychological safety had better model fit. However, the researcher assumed that the reason for the poorer model fit for model 1 was mostly due to the low loadings of the underlying TPS scale. The predictive relationship between team psychological safety and team grit was very strong, in fact stronger than the predictive relationship between team goal commitment and team grit. As a result, the researcher chose to confirm the first model, including team psychological safety. This made conceptual sense, and is also supported by extant hypothesised relationships within the team grit domain (Bernardy & Antoni, 2021).

In conclusion, the analysis showed that team grit operates within a nomological net where team psychological safety and team goal commitment are antecedents to team grit, and team innovation and team work engagement are outcomes. The strongest predictive relationship is between team grit and team innovation, which supports the theoretical study conducted on team grit, which hypothesises that team grit will lead to innovation (Bernardy & Antoni, 2021). In conclusion, the study showed that team grit operates within a nomological net, the four hypothesised relationships were confirmed, and nomological validity was upheld.

4.7 Determining measurement invariance

Measurement invariance reflects the equivalence of a construct across groups or time periods (Putnick & Bornstein, 2016). Non-invariance means that the construct holds different meaning for different groups, or different meaning for the same group across different time frames.

The purpose of assessing measurement invariance in this study was to ascertain whether the team grit scale held the same meaning for wave three and wave four samples, i.e., the samples from the United States of America and the United Kingdom, respectively. The assertion was that the scale could be assumed to have wide application if it was found to be invariant across different political, economic, social, and cultural contexts. The eight-items

retained from wave three were overlaid against the wave four sample, using Amos. The findings from the various invariance tests are presented in Table 4.54 and discussed.

The first step in determining invariance is to determine configural invariance, equivalence of model form (Putnick & Bornstein, 2016). The starting point was for both samples to undergo a basic CFA to ensure that they had similarly acceptable fit for the single-factor eight-item solution. The resultant fit indices showed acceptable levels across key metrics. The CFI (.989), RMSEA (.034) and SRMR (.019) results all fell within the threshold parameters (Hooper et al., 2008) thereby confirming the model fit at configural level.

The next step was to determine whether metric invariance, or factor loading equivalence, was upheld (Putnick & Bornstein, 2016). The factor loadings were constrained to be equal across wave 3 and wave 4 data, after which the constrained model was compared with the configural model. Chen (2007) has recommended a combination of AFIs at certain cut-off levels for metric invariance. These are maximum changes of -.01 in CFI (this study achieved -.004), plus a .015 change in RMSEA (.002 in the study) or a change of .030 in SRMR (.008 in the study). Consequently, all these thresholds were met in the study. All the above provided evidence that metric invariance was upheld.

Next, scalar invariance was sought, which is the equivalence of item intercepts (Putnick & Bornstein, 2016). This is tested by constraining item intercepts to be equivalent across the two groups and comparing the means between the groups. In two case the fit indices provided evidence of model fit: ∆SRMR = .002 fell within the range of up to .010; ∆RMSEA = .008 was within the range of up to .015; while ∆CFI = -.011. fell very slightly outside the limit of .010 (Chen, 2007). This provided almost complete support for scalar invariance.

As full scalar invariance was marginally missed for change in CFI, a partial scalar invariance test was undertaken. The constraints of two of the intercepts were statistically relaxed, which resulted in the model invariance being upheld for partial scalar invariance, with ∆RMSEA = -.003; ∆SRMR= -.002; ∆CFI = .004 (Chen, 2007).

Residual invariance is the equivalence of the items' residuals or unique variances (Putnick & Bornstein, 2016). The key metrics were in line with Chen's recommendations for invariance (2007), including a ∆CFI of -.007, ∆RMSEA of .002, and ∆SRMR of .007. Each of the three indices fell within the acceptable levels, and therefore residual invariance was upheld.

Based on the analysis model invariance was upheld across configural, metric, scalar, partial scalar and residual levels.

Table 4.54 Determining measurement invariance for the team grit instrument

Invariance level	χ^2	$\Delta\chi^2$	CMIN/df <5 or <2	CFI ≥ 0.95 (Hu & Bentler, 1999)	ΔCFI <0.01 Cheung & Reunsvold 2002	RMSEA <0.07 (Hooper et al., 2008)	ΔRMSEA <.015 (Chen, 2007)	SRMR <0.05 (Byrne, 1998)	ΔSRMR <.30 metric <.10 scalar & residual (Chen, 2007)	Result
Configural	52.492		1,573	0,989		0,034		0,019		Model upheld
Metric	67.173	14.681	1,638	0,985	-0.004*	0,036	0,002*	0,027	0,008*	Model upheld
Scalar	91.728	24.555	1,952	0,974	-0.011	0,044	0,008*	0,029	0,002*	Model upheld
Partial scalar	81.697	-10.031	1,815	0,978	0.004*	0,041	-0,003*	0,027	-0,002*	Model upheld
Residual	102.889	21.192	1,906	0,971	-0.007*	0,043	0,002*	0,034	0,007*	Model upheld

N=497; *indicates acceptable to excellent fit based on suggested cut-off points (Chen, 2007; Cheung & Rensvold, 2002)

4.8 Final instrument

The final instrument presents team grit as a unidimensional but multifaceted state, in which the team diligently pursues achieving their goals, adapting as needed in this pursuit, and with a close, supportive bond between them, with distinctive, unique characteristics.

Table 4.55 Final measure for Team Grit

Number	Item
TG1	Once we have set our goal, we keep our focus on it
TG2	We are a diligent team
TG3	Our team finishes whatever we begin
TG4	Our team is able to cope with the changing circumstances at work
TG5	As a team we are able to be highly adaptive in order to achieve our goal
TG6	Our team members grow closer when we spend time together
TG7	In our team we celebrate one another's individual successes
TG8	We use certain expressions that are unique to our team

4.9 Conclusion

The current chapter presented the findings of the study. The study began with specification of the domain of team grit, informed by the literature review and ten focus groups held with workplace teams. The result was a draft item pool which was subsequently reviewed by scholars who are experts in the domain and methodology employed, and which was revised following their inputs. Prior to commencing the first quantitative study the survey was tested with a small pilot sample to assess ease of use and functionality. The chapter has discussed how the data were collected over four waves and statistical analyses were conducted with a total of 938 respondents from many different countries. The scale was iteratively purified and refined, resulting in a simple eight-item, one-factor measure. The instrument demonstrates good reliability and validity. Validity was evidenced in internal consistency validity, discriminant validity and nomological validity, where support was found for the instrument's relationships to both antecedent and outcome constructs in a prespecified nomological web. Lastly, the instrument upheld measurement invariance. The next chapter is focused on a discussion of the findings and results.

5 Chapter 5: Discussion

5.1 Introduction

This study has advanced scholarship in the nascent field of team grit. Through this research, team grit has been defined and explicated, and its dimensionality has been determined empirically. Furthermore, the construct has been operationalised within a network of theoretically related constructs, as well as shown to be distinct from its individual counterpart, 'grit'. These contributions are pioneering in this nascent domain, which have expanded the team grit theory. The pinnacle of the research, though, was the development and validation of a measure, the team grit scale. This research is the first dedicated effort to develop an instrument to measure grit in teams and the first empirical study into team grit.

The construct of team-level grit was not well developed prior to this study, with very few articles having been published on the construct, and no extant empirical studies. As such, the construct of team grit had to be explicated, by drawing on the individual grit literature as well as literature and studies on the emergence of team constructs. To further explore team grit, an exploratory qualitative phase of research was conducted to complement the literature review. This phase helped to develop an understanding of team grit and propose the dimensions of the construct. With the construct better defined the scale development waves commenced. Over four survey waves, three exploratory factor analyses and one confirmatory factor analyses were conducted, and the resultant scale was found to be valid through nomological validity and measurement invariance.

In this chapter the team grit scale with its eight items and higher order factor of team grit is discussed with reference to how it relates to theory. Thereafter the discussion centres on concepts that are associated with team grit, plus concepts that were not retained in the team grit scale over the process of its development. Finally, the study limitations are detailed.

5.2 Interpretation of the scale

Following a rigorous statistical scale development process, one factor was extracted to measure team grit, across eight items. This scale reflects some aspects of individual level grit, with an emphasis on goal-focused perseverance (Duckworth et al., 2007) as well as adaptability (Datu et al., 2017). Extant conceptual and theoretical explications on team grit posit very similar characteristics of team grit (Bernardy & Antoni, 2021; Lee & Duckworth, 2018). The scale retains similarities to the extant individual grit scales, both the Grit-S (Duckworth & Quinn, 2009) and the TMGS (Datu et al., 2017). In fact, some of the items are drawn from the Grit-S scale, with the referent changed from "I" to "We" (Chan, 1998; Wallace et al., 2016). Appendix seven presents the waves of purification in which an original 48 items

were refined down to the final eight items. It is interesting that through four waves of refinement, three of Duckworth and Quinn's original scale items (2009), albeit adapted for a collective context, were retained in the final team grit scale. The scale reflects the gritty team's unwavering pursuit of their goal. They have a high degree of competence and commitment in persisting to achieve their goal. The goal becomes something of a 'north star' for the team, orienting them and aligning their interests and passions. The adaptive quality of the gritty team speaks to their ability to respond to externally imposed changes, whilst still persevering. This quality is important in the ever-changing work and social environments that teams operate in. The gritty team is also able to adapt their strategies in the pursuit of their goals, when they hit challenges, obstacles, or plateaus (Bernardy & Antoni, 2021). These gritty teams keep their focus on the ultimate, superordinate goal, while being able to adapt and change their short-term intermediate goals, and in so doing they continue to persevere (Duckworth & Gross, 2014; Jordan et al., 2019).

Three of the items reflect the close bond that the team has which is essential to their success in achieving their goals. These are 'Our team members grow closer when we spend time together', 'In our team we celebrate one another's individual successes', and We use certain expressions that are unique to our team'. In a gritty team the members find a sense of identity in relationship to one another. In the concept of using expressions that are unique to them there is a sense of a club or secret society, where bonds are deepened through traditions that are only known and understood by the members. This is similar to the "band of brothers" concept which typifies the resilient team (Morgan et al., 2015, p.98). In the gritty team, members know that the other team members have 'got their backs', and they celebrate one another. Trust levels are high. Spending time together is important to the team and as they do this, they become even closer. Although known by different names, this sense of team focused, shared commitment to the goal pursuit has been identified by several theorists. Sharma and Sharma (2016) and McEwen & Boyd (2018) both include a similar construct within their team resilience scales. And in their theorising about collective grit this 'in-it-togetherness' is referred to as mutual trust (Lee & Duckworth, 2018), mutual encouragement (Bernardy & Antoni, 2021) and team unity (Luning et al., 2022). This is essentially mutual encouragement towards their goals and a sense that because they are in it together, they will not fail but will persevere and succeed. This supportive aspect of team grit fuels the team's perseverance in pursuit of their goal. Team members' interactions with one another are key to the development of team perseverance within team grit. When facing stagnation or obstacles in progressing towards their goals the team members motivate one another to keep going (Bernardy & Antoni, 2021).

5.2.1 An evaluation of the psychometric properties of the team grit scale

As discussed early in this study, the grit scale has not been without contention, notably regarding its factor structure, and psychometric reliability and validity. The team grit scale needs to be evaluated in the light of the prior concerns regarding individual grit. Studies have criticised the grit measure for its low reliability and inconsistent predictive results (Credé et al., 2017), and poor generalisability (Datu et al., 2016). The scale's predictive power lies with the perseverance facet (Credé et al., 2017), rather than with consistency of interests (CI), or even with the scale overall. Although CI is posited to measure impassioned committed interest in a goal, at face value the items do not appear to tap passion (Jachimowicz et al., 2018). Moreover, all the items in the CI subscale are negatively worded, leading some researchers to suppose that this has created confusion and reduced the scale's validity as a result (Jachimowicz et al., 2018). The grit scale has also been shown to be a poor predictor of performance in collectivistic cultures, largely due to the CI factor, which has poor predictive validity in these cultures (Datu et al., 2016). The triarchic model of grit scale (Datu et al., 2017) recognises a third factor to the measurement of grit, adaptability to situations, which is crucial to grit in these societies, and which has strong correlations with perseverance, but little correlation with CI in these cultures.

A team-level construct is conceptually distinct from an individual-level construct. Thus, the scale developed to measure the former will not be replicate the dimensions of the scale developed to measure the latter. It is not surprising, therefore, that the team grit scale contains facets which do not appear at the individual grit level or within individual grit measures. The team grit scale is a uni-dimensional instrument with eight items, that tap elements of perseverance, diligence, committed goal completion, adaptability to situations while in the pursuit of the goal, a close bond of togetherness, enabling team members to get through tough times and push towards the goal, with trust, celebration of one another and an 'inner circle'-like shared, secret language.

Although the team grit construct was conceptualised to include a deep passionate belief in the team's goal - even framing it as a higher purpose - the items that were included to tap passion in the initial item pool (Sigmundsson et al., 2020) eventually fell away by the end of the purification process. As a result, the passion aspect of individual grit is absent from the team grit scale. One key aspect of the team grit conceptualisation and scale is the aspect of connectedness, the team's close bond of 'in in together-ness', a undeniable support for one another in the pursuit of the goal, despite adversities or setbacks. Connectedness was one of the most prominent findings in the qualitative research phase of this research, with this dimension repeatedly and passionately discussed by participants. The study has argued for it

conceptually and also pointed to growing conceptualisation of connectedness-like elements being mentioned and posited in team-based literature (Bernardy & Antoni, 2021; Bowers et al.,2017; Lee & Duckworth, 2018; Luning et al., 2022; Morgan et al., 2015), and similar constructs appearing in team-based measures (McEwen & Boyd, 2018; Sharma & Sharma, 2016).

Following much debate and criticism targeted at the factor structure of the grit scale, Duckworth and colleagues have cautioned that the factor structure of an instrument must not overshadow the conceptual considerations thereof. This research resonates with that caution, and invites scholars to enter into the discussion around team grit, conceptually and empirically. The team grit scale provides scholars with a measurement tool to further explore this exciting domain.

5.2.2 Team grit and the team grit scale in cross cultural environments

One of the arguments made in this research in support of a team grit domain, was that research into collectivist cultures is showing how these relational cultures foster a more connected, socially contextual type of grit at the individual level (Datu et al., 2017; Datu et al., 2018). This happens as gritty individuals align their goals with those of others, and adapt their strategies to align with changes in their surroundings. What might this mean for team grit, where relational interpersonal dynamics and aligned goals are core to the definition? It may be that team grit will have greater validity in collectivistic cultures than in individualistic ones. The team grit scale was shown to have measurement invariance across samples in different geographical regions, and this was upheld across all levels of invariance. This suggests that the team grit construct may be applicable cross-culturally, and that the scale may be valid across geographies. Given the greater likelihood for collectivistic cultures to operate in relation to others and with goals aligned to others, it is possible that team grit will have greater predictive power in these regions. This should be tested through future research.

5.3 Concepts associated with team grit

Following the purification of the team grit instrument it was necessary to establish a nomological net, as part of the validation of the scale. In this process, relationships between team grit and other constructs were hypothesised, and then confirmed through statistical regression. Team psychological safety and team goal commitment were proposed as antecedents to team grit, while team innovation and team work engagement were hypothesised as outcomes. All relationships in the nomological net were empirically supported.

The researcher was pleased that team psychological safety was confirmed to be an antecedent to team grit, through the nomological validity. Team psychological safety is defined as “shared belief held by members of a team that the team is safe for interpersonal risk taking” (Edmondson, 1999, p.354). Studies in this domain have found positive relationships between team psychological safety and innovation and creativity (Bernardy & Antoni, 2021; Bradley et al., 2012; Mehmood et al., 2021), and team psychological safety and team resilience (Stoverink et al., 2020). Team psychological safety has been linked to team grit, with researchers positing that it may function to strengthen team grit as the team members feel safe and able to take risks without fear of sanction from one another (Bernardy & Antoni, 2021). It makes sense conceptually that team psychological safety would be related to team grit, as both constructs share aspects of team support, mutual trust and encouragement. Moreover, this study showed a relationship between team grit and team innovation. Extant studies have pointed to the relationship between the three constructs of team psychological safety, team grit and team innovation Bernardy & Antoni, 2021).

Team goal commitment was confirmed as an antecedent to team grit. Studies have proposed the relationship between team grit and their commitment to their goal, with a focus on how the goal hierarchy is organised (Bernardy & Antoni, 2021; Lee & Duckworth, 2018). Specifically, gritty teams are posited to have overarching higher order goals and several smaller lower order goals, which team members are willing to change or adapt in order to stay true to their pursuit of the superordinate goal (Duckworth & Gross, 2014; Jordan et al., 2019). Goal commitment is therefore closely related to team grit notably to the teams adaptability in the face of obstacles, in order to persevere towards their goal.

Team innovation was confirmed as an outcome of team grit. Bernardy and Antoni (2021) proposed a relationship between team grit and team innovation, whereby the goal focus yet lower-order goal adaptability of the gritty teams makes them conducive to innovation outcomes. They also posit that team psychological safety plays a role in intensifying team grit. An empirical study by Gu and colleagues (2013) has several parallels with team grit and found positive relationships between R&D team’s social networks and innovation, their mutual trust and innovation, and their goal focus and innovation. They also found team psychological safety to be a mediating factor (Gu et al., 2013).

One of the research questions posed in this study was, “How is team grit different from individual grit?” This relationship was not hypothesised and tested in the nomological net. Instead, discriminant validity between the two constructs directly was assessed, and was confirmed. The results showed that the two constructs are indeed quite distinct from one another. Discriminant validity was upheld at the level between team grit and individual grit, as

well as between team grit and the two underlying factors of individual grit. As far as the latter is concerned, team grit was found to be more closely related to the 'perseverance of effort' factor, rather than the 'consistency of interests' factor of individual grit. At face value the obvious difference between them is the importance placed on the team's connectedness and mutual support in the pursuit of their goal. This quality is not relevant in the individual grit construct. The support that team members give one another is what enables them to persevere towards their goal even through the toughest times, and with encouragement, to keep focused on the goal. Several studies suggest that individual-level constructs give risk to the team level construct, through a process of affective emergence (Bernardy & Antoni, 2021; Stoverink et al., 2020). With this in mind, future research should consider the role that individual grit plays in the development of team-level grit.

5.4 Concepts not retained in the scale

Through the literature review and theoretical framework of this study the researcher argued for the inclusion of passion in the team grit construct. This was a response to criticism of the individual grit construct, that the two-factor Grit-S scale actually only measures one of these factors, 'perseverance of effort', and that the 'consistency of interests' factor does not have predictive validity (Credé et al., 2017; Datu et al., 2016). Recently, scholars have argued that the inconsistent results in grit studies are due to the passion dimension not being adequately represented by the scale items, and they have contended that the two factors of grit actually tap the same latent factor, perseverance (Jachimowicz et al., 2018). The researcher of this study set out to correct this perceived imbalance in ensuring that passion was adequately represented in the draft item pool. These were drawn from literature on work-related passion (Sigmundsson et al., 2020). However, following the four waves of scale purification and validation studies, the passion emphasis had fallen away, and the resultant scale focuses more heavily on perseverance. In the focus groups the researcher was struck by how teams with a greater sense of their purpose and with an obvious passionate interest in their goal had higher energy and were able to persevere even when the work itself was dull. Making an impact and achieving a goal beyond oneself and beyond the team seems to be an important aspect of team grit and was surprising (even somewhat disappointing) that passion was not more represented in the team grit scale. It is possible that the way that the researcher conceptualised passion, as inclusive of a higher order purpose, is not adequately describing the strong emotive elements of the team goal pursuit. It is also possible that the passion variable is an antecedent of team grit, and not core to what constitutes this construct. This will offer an avenue for future research as described in the next chapter.

Two other related constructs emerged repeatedly in the focus groups, without being prompted or solicited, and, as such the researcher expected these elements to be more prominent in final team grit scale. The first of these was the team's use of humour, and second, the venting of their frustrations. Both were themed as part of the connectedness dimension in the analysis as they seemed to be mechanisms through which team bonding was increased. Although several items were included in the scale to tap these constructs, they ultimately fell away through the scale purification process. It is possible that both of these are processes which moderate the strength of team grit, and future research in this area is recommended.

5.5 Limitations of the study

The aim of the study was not to examine how team grit might change over time. However, future research is recommended in this direction. This study was cross sectional, that is, respondents were only surveyed once, and at a point in time. The study could not determine whether grit is different at different points in the lifespan of a team, i.e., one which had worked together for years as opposed to one which was just starting out as a team. A longitudinal study may be able to capture changes in team grit over time. This is particularly relevant because time passing is an important dimension in the emergence of team constructs (Klein & Kozlowski, 2000). Future research should look to assess team grit at different points in time using a longitudinal study.

This study drew respondents from several countries in the world, with waves of data gathered from South Africa, the USA, and the UK, but some respondents in waves one and two were based outside of these major countries. The scale showed excellent measurement invariance across groups, when comparing the samples from the UK and USA. In fact, all four levels of measurement invariance were upheld which is considered by many researchers to be difficult to achieve (Putnick & Bornstein, 2016). Nonetheless, the scale was researched and developed in English, within largely English-speaking countries and it is possible that cultural and language bias may be present in the items. Future research should look at the applicability of the team grit scale in different cultural and language environments to assess its potential for broad utility. This is especially relevant when considering whether the team grit scale may function differently in collectivistic as opposed to individualistic cultures. The invariance test conducted delivered very pleasing results as mentioned. However, it can be argued that the cultural differences between the two samples – the US and the UK – are not particularly pronounced and should invariance have been conducted across distinctly individualistic versus distinctly collectivistic cultures, a different outcome may have been achieved. Future research is advised in this area, particularly in the light of the work of Datu

into grit cross-culturally and the importance of adaptability in collectivistic cultures (Datu et al., 2016; Datu et al., 2018).

The nomological validity of the scale was upheld, demonstrating that team grit operates in relation to four other team-level constructs, However, there are undoubtedly many more constructs that operate in relation to team grit, either as antecedents, outcomes or as related constructs. It is a limitation of this study that it did not thoroughly theorise the ecosystem of possible relationships but provided a limited explication of proposed relationships. It is therefore a limitation of the study that it did not empirically confirm more relationships. As mentioned in section 2.6, several other constructs are likely part of the nomological net. It remains for future researchers to build on the nomological network as the team grit domain expands.

6 Chapter 6: Study contributions and suggestions for future research

6.1 Introduction

This final chapter provides a succinct synopsis of the study objectives and its findings; the contributions that the study has made practically, methodologically, and theoretically; and recommendations for future research in the domain of team grit and its related constructs.

6.2 Study objectives and key findings

As seen in chapter 1, the purpose of the study was to determine what team grit is and how it can be measured. The study posed several questions: What is team grit?; How is team grit different from individual grit?; How best can team grit be measured and psychometrically operationalised?; and, How does team grit fit into a net of team constructs?

The study has made several important findings. Firstly, it has found that team grit exists as a unidimensional construct. Secondly, the study found that team grit is different to individual grit, largely in the absence of the collective character of the construct. Whereas gritty individuals draw on their personal grit to persevere towards their goals, in the team it is the supportive team grit that enables this. Furthermore, analysis showed that team grit is more closely related to the 'perseverance of effort' factor of grit, and unrelated to the 'consistency of interests' factor. The study found the team's passion for their goal to be less important to team grit than the team's perseverance towards it, a finding that echoes researchers in the individual grit domain who have contended that perseverance is more important to grit than passion is (Credé et al., 2017). The third finding is that team grit can be measured using the one-factor, eight-item team grit scale, developed through the study. The scale is reliable and valid, demonstrating discriminant and convergent validity, nomological validity and upholding invariance across geographies. Fourthly, team grit operates within a nomological network of related constructs. Team psychological safety and team goal commitment are predictors of team grit, while team grit leads to team innovation as well as to team work engagement. These findings enrich the domain of teams in general and team grit in particular. Given the utility of the newly developed team grit scale it is hoped that future scholars will use the scale to expand these domains.

6.3 Contribution

6.3.1 Practical contribution

This study makes a practical contribution by developing a measure of team grit which, given its demonstrated validity including measurement invariance, will have wide applicability in in

organisational contexts. Teams have become “the building blocks of modern organisational designs” (Mathieu et al., 2017, p.460), and any mechanism that can be employed to improve team functioning will have wide reaching impact in organisations. Many teams look to improve their performance, their effectiveness, and other outcomes. As has already been shown team grit will drive innovation and increased work engagement. This will be beneficial not only to the individuals within the teams concerned but certainly to their leaders and organisational bosses, for whom improved team outcomes will likely translate into improved organisational outcomes too. Teams in business will benefit from understanding what their grit level is and look at ways to increase it. Taking the team grit test is how they can assess themselves.

Organisations that are looking to improve team functioning could use the team grit scale to assess the impact of team interventions, measuring teams grit before and after the interventions are made. Human capital professionals working within or consulting to businesses will find value in applying the team grit scale to measure the teams that they work with.

One domain where team grit has already been hypothesised to be relevant is in the healthcare field (Lee & Duckworth, 2018). Healthcare teams work under immense pressure, especially those in surgical and care settings. The Covid-19 pandemic only increased the already taxing load that healthcare professionals experience, and many studies on grit have focused on the pressure in healthcare and the hope that grit brings to alleviate some of this and find ways to manage it (Schimschal et al., 2021; Stoffel & Cain, 2018). The team grit scale provides the opportunity to improve understanding of grit in healthcare teams and to measure it, including as part of interventions designed to manage the risks of burnout and other risks.

6.3.2 Methodological contribution

The methodological contribution of this study is the scale itself; a valid and parsimonious measure of a construct that itself has not been extensively explicated before and has not been measured in the past (see Table 4.61 for the final scale). The methodology was highly rigorous, employing focus groups, four waves of quantitative data gathering, across three countries. The scale was shown to have high reliability, convergent and discriminant validity, including nomological validity and measurement invariance across all four invariance levels.

The research was structured as a mixed methods study, where a qualitative phase preceded the waves of quantitative data gathering and analysis. Despite the recognition by some scholars that this is the preferred approach to scale development (Zhou, 2019), it has not been employed in the majority of scale development studies reviewed. Because of this, this study

delivered a higher level of methodological rigour than many previous scale development studies. Ten focus groups were held with teams, which provided rich insight into the nature and functioning of team grit, which provides a valuable contribution to the domain literature.

6.3.3 Theoretical contribution

This study has made theoretical contributions to the individual grit literature, the literature around teams and team effectiveness, and, most prominently, to the theory and domain of team grit. The findings of this research extend studies of individual grit (Duckworth et al. 2007) to the collective, identifying grit at the team-level, and extend the existing theory of team grit (Bernardy & Antoni, 2021), by providing empirical support for some aspects of the team grit theory, while conceptualising and confirming several other aspects.

This study is the first to provide empirical support for the existence of team grit. It has shown that team grit is not the same as individual grit. The two constructs were shown to be discriminant, and even though there are some conceptual overlaps between the constructs, they are conceptually distinct. Both contain aspects of committed perseverance towards their goals, and an ability to adapt in the face of obstacles and setbacks, in order to continue to pursue their goals. Both constructs have an aspect of positive affect; there is a positivity towards their goal that inspires them to persevere. However, team grit differs from individual grit fundamentally in the fact that it exists between members in a group. The interdependence of members of a group binds them to one another through their shared goal. More than this connection, however, team grit contains a critical ingredient, the connectedness of the team members. This quality is the dynamic state of mutual support and encouragement as they forge ahead towards their goals. Identifying connectedness as a component of team grit is a key theoretical contribution in how a team-level construct functions. Without connectedness as defined in team grit, there could not be team grit. This contribution may well extend beyond the team grit domain into other team-level constructs.

Team grit emerges through team processes, including the interactions between team members (Morgeson & Hoffman, 1999), and the emotions being ‘caught’ between them through emotional contagion (Barsade & Gibson, 1999). The grit of the individuals in the team plays a role in the development of team grit. However, the whole is greater than the sum of the parts. Certain conditions enable team grit to develop. This study has shown that the presence of team psychological safety is key to the development of team grit. Team members that feel that their team is safe for risk taking (Edmondson, 1999) are more likely to take risks, be willing to try, even if risking failure, and are better equipped to have a positive, optimistic attitude towards setbacks and obstacles, in the pursuit of their goal. Team grit will be

developed more readily in teams that have high levels of commitment to their shared goals, as they all pull in the same direction with passionate commitment. The study has confirmed what Bernardy and Antoni (2021) postulated, that teams higher in grit will be more innovative teams, as the energy and positivity about their goal fuels them to persevere, try, and try again, and find creative ways to reach their goals. Team grit also leads to greater team work engagement, as team members feel a deep sense of connection to their team (through connectedness and shared purpose), and have positive interest in the work they do, that is, the goals they are striving towards.

Furthermore, the study located team grit in the work organisational context, building on the growing, but still limited, literature around grit in work environments (Jordan et al., 2019). Previous studies on grit focused largely on the domains of academic achievement, school and universities, and healthcare, with a relatively recent move to understand grit in the work environment (Ion et al., 2017; Jordan et al., 2019; Southwick et al., 2019; Suzuki et al., 2015).

The research makes a theoretical contribution, having substantially advanced the domain of team grit, a new theoretical construct. Now equipped with an instrument to measure it, the theory of team grit can be substantially developed, as is seen by the extensive recommendations for further development next section.

6.4 Recommendations for future research

This research developed a scale for a construct that before now was largely unconceptualised. Certainly, no empirical studies had been done in the domain of team grit and no scale was available to enable such research. As a result, there is an extensive field of opportunity available to researchers who wish to explore this domain and contribute to its growth. Several recommendations for future research have been identified in the preceding section and will be mentioned briefly here.

The team grit scale has been shown to exist in a nomological net, with team psychological safety and team goal commitment as antecedents, and team work engagement and innovation as outcomes. Using the team grit scale, the researcher encourages scholars within these domains to assess the relationships of team grit with these constructs, and their sub dimensions. Literature abounds with positive team outcomes, such as performance and effectiveness, which may now be studied in relation to team grit, and the strength of the relationships better measured.

This study found team innovation to be an outcome of team grit. This is an exciting finding which confirms the previous conceptualisation in literature (Bernardy & Antoni, 2021). The

field of innovation is a burgeoning field and the practical application of this could be substantial. Businesses are evaluating ways to innovate existing processes and product ranges, and to inculcate innovative ways of work. Team grit may be an important team-level trait to develop in order to increase team innovation outcomes. Research is also recommended into relationships between team grit and team innovation including the role of team psychological safety. Team psychological safety may operate as an antecedent (Stoverink et al., 2020) or it may be a moderator of team grit, acting to enlarge team grit (Bernardy & Antoni, 2021).

Conceptual studies have proposed that individual grit may lead to team grit (Bernardy & Antoni, 2021), even recommending that organisations hire gritty individuals to increase team-level grit, although recognising that this in itself is not enough to be assured of a gritty organisation (Lee & Duckworth, 2018). This research found these two constructs to be empirically distinct, and discriminant validity was demonstrated between them. However, future research is recommended to further study the relationship between the two.

Leadership plays less of a role in the development of team constructs than it does for organisation-level constructs (Stoverink et al., 2020).This is because, at the team level, the construct emerges through the exchanges and interactions between team members and is less affected by the team leadership. It was notable that, other than two exceptions, the team leader was not mentioned by focus group members when asked about their team functioning. Future research could explore what role the team leader plays in the grit of the team. Related to this is the suggestion that research explore how team grit can be developed and sustained over time, and also what may cause team grit to be diminished. Extant conceptual studies have proposed that strong emotions have a greater likelihood of being 'caught' through emotional contagion in teams (Bernardy & Antoni, 2021). This could see emotions like anger and irritation expanding within a team and reducing its grit levels. As already mentioned, research should consider what role humour and venting play in the team, and how these relate to the emotional dimensions of the team and the team connectedness.

There may be a dark side to team grit, in the same way that there is a dark side to individual grit (Arli et al., 2020; Lucas et al., 2015). This may be driven by the type of goal that the team chooses to pursue, i.e., if it is a nefarious goal. It could also be related to what Lucas and colleagues term 'costly perseverance' (Lucas et al., 2015, p.15), which sees an individual persevering even though there is a negative impact on them personally. In the team context this could see the team burning out due to their insistence in pushing forward towards the goal and encouraging one another to do so. This too is a recommended area of future research.

Lastly, further areas of research could include the dynamic between grit at multi-levels, individual, team and organisational; team grit in teams outside of organisational contexts, such

as sporting teams or crisis rescue teams; the temporal aspect of team grit, and the assessment of team grit for diverse cultures (Datu et al., 2017).

6.5 Conclusion

This study asks a number of questions: 'What is team grit?'; 'How is team grit different from individual grit?', 'How best can team grit be measured and psychometrically operationalised?' and "How does team grit fit into a net of team constructs?". The starting point was recognising that the very construct under examination in this study was itself barely developed. It required that the researcher undertake a crucial evaluation of the grit literature at the individual level in order to begin the journey towards the ultimate measure. Literature provided insight into the functioning of teams and how team constructs emerge, through the actions and interactions between team members. A conceptual model of team grit was proposed, which showed the links between individual grit and team grit, as seen in the limited literature on the collective construct to date. Furthermore, antecedent and outcomes were proposed for team grit and the construct tentatively defined.

Following the literature review the scale development process commenced. As this was a mixed methods study, and in order to confirm and expand the understanding of team grit as developed through literature, focus groups were held with teams. Ten teams provided rich insight into team grit and related constructs, which enabled the researcher to compile a draft pool of 56 items. Six domain experts were consulted who provided valuable critique of the item pool, leading the researcher to refine the pool to 48 items. After a brief pilot survey, the researcher embarked on waves of quantitative data generation and analysis. In total, four waves of data were gathered, and the number of items was reduced, and the factor structure refined. Exploratory and confirmatory factoring processes resulted in a final valid and parsimonious measure. Team grit was found to be a one-dimensional construct, measured by the team grit scale. The validation process served to confirm that team grit is clearly distinct from individual grit, and measurement invariance and nomological validity were upheld. Team goal commitment and team psychological safety were shown to be antecedents to team grit, and team grit was shown to predict two outcomes, team work engagement and team innovation.

The development and validation of the team grit scale has opened the team grit domain for further study and practical application. It is hoped that through ongoing conceptual and empirical studies this area will rapidly grow and contribute valuable insights to the team domain.

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Appendices

Appendix one: Focus group questionnaire

Introduction: [Voiced over at the start of the focus group]

Thank you for your wiliness to participate in this study. I am a PhD student at GIBS, and I am conducting several focus groups with teams as part of my research. I have a few categories of questions, each with some probing sub-questions, to explore the topic of team functioning and team dynamics. When you answer would you think about how your team functions.

I want to stress that your participation is entirely voluntary. Please don't feel that you have to answer any particular question. And if at any stage you would like to leave you are welcome to. You should not feel compelled to participate in any way. I also want to confirm that your participation is anonymous. All individual names and team identities will be coded in my analysis so that it will not be possible to identify an individual participant or the team. Please note that the interview will be recorded in order for it to be transcribed afterwards and for me to be able to analyse the content. Please feel free to ask any clarifying questions at any time.

Focus group guide: [Questions asked of the whole group, not directed at any one person. Gently prompt responses to get answers from several team members]

1. Thinking about the team's goal:
    - What would you say is the goal of this team?
    - How important is this goal to this team?
    - How effective is this team at working towards the goal?
    - What words could you use to describe how you feel about your team's goal?

2. Emotions within the team:
    - What emotions are felt and shared within this team?
    - Can you name the emotions that this team shares most often?
    - What effect does negative emotion have within this team?
    - What role does the goal play in managing negative emotion?
    - What effect does positive emotion have within this team?

3. Team communication and connection:
    - What team connection and communication mechanisms are used?
    - What effect do they have on the team?

4. Team perseverance:
    - How effective is this team at persevering towards your goal?
    - What words could you use to describe your perseverance of your goal?
    - How important is perseverance in the team?

5. Humour in the team:
    - Does your team use humour?
    - If so, how?
    - What effect does humour have within the team?

6. Team adaptability:
    - How important is it for this team to be adaptable?
    - In what ways does the team adapt?

7. Team success:
    - What drives the success of this team?

Appendix two: Qualitative codes

Code	Theme	Source
We are constantly having to adapt our roles in the team	Adaptability	Literature/Interviews
We are constantly having to adapt to external changes	Adaptability	Literature/Interviews
The team members adapt to changing circumstances in the team	Adaptability	Literature/Interviews
We need to constantly adapt to changing goals	Adaptability	Literature/Interviews
We have to be highly adaptive in order to achieve our goal	Adaptability	Literature/Interviews
Changing plans or strategies is important to achieve our long-term team goals	Adaptability	TMGS scale (Datu et al., 2017)
Changes at work motivate our team to work harder	Adaptability	TMGS scale (Datu et al., 2017)
Our team is able to cope with the changing circumstances at work	Adaptability	TMGS scale (Datu et al., 2017)
Our team appreciates new opportunities that come about for us	Adaptability	TMGS scale (Datu et al., 2017)
We use certain expressions and terminology that are unique to our team	Connectedness	Literature/Interviews
We feel supported by one another	Connectedness	Literature/Interviews
The bond between us has grown stronger over the time we worked as a team	Connectedness	Literature/Interviews
The members of our team collaborate in setting our goal	Connectedness	Literature/Interviews
We enjoy social time together	Connectedness	Literature/Interviews
Our team members grow closer when we spend social time together	Connectedness	Literature/Interviews
The team members' individual strengths are valued in the team	Connectedness	Literature/Interviews
We feel a sense of belonging in our team	Connectedness	Literature/Interviews
The sense of belonging is important in helping us to persevere	Connectedness	Literature/Interviews
We trust one another in our team	Connectedness	Literature/Interviews
The trust between us helps to avoid conflict in the team	Connectedness	Literature/Interviews
Trust grows over time in our team	Connectedness	Literature/Interviews

Code	Theme	Source
I feel that my team members have 'got my back'	Connectedness	Literature/Interviews
Team members look out for each other when they need assistance	Connectedness	Literature/Interviews
It is important to us that we are a cohesive team	Connectedness	Literature/Interviews
We value each other's individual skills	Connectedness	Literature/Interviews
We trust each other	Connectedness	Literature/Interviews
We hold one another accountable	Connectedness	Literature/Interviews
Our team has our own special terms and expressions that we use	Connectedness	Literature/Interviews
In our team each individual's personal development is encouraged	Connectedness	Literature/Interviews
The mix of different personalities in our team contributes to its success	Connectedness	Literature/Interviews
We feel supported by our team leader	Connectedness	Literature/Interviews
We feel supported by each other	Connectedness	Literature/Interviews
Our leader stands up for our team	Connectedness	Literature/Interviews
We have fun as a team	Connectedness	Literature/Interviews
In our team we encourage on another's individual successes	Connectedness	Literature/Interviews
We have empathy with each other in this team	Connectedness	Literature/Interviews
We value each other's different opinions	Connectedness	Literature/Interviews
It is important to us to belong to this team	Connectedness	Literature/Interviews
We read one another's emotions well	Connectedness	Literature/Interviews
As a team we mentor each other	Connectedness	Literature/Interviews
Everyone's viewpoint is welcomed in this team	Connectedness	Literature/Interviews
There isn’t a seniority divide in our team	Connectedness	Literature/Interviews
The support we get from team members helps us to laugh at our challenges	Humour	Literature/Interviews
Laughing at our challenges together helps us to persevere through tough times	Humour	Literature/Interviews
We laugh a lot in our team	Humour	Literature/Interviews
Humour in the team strengthens the bond between us	Humour	Literature/Interviews
We enjoy sharing team 'inside jokes'	Humour	Literature/Interviews
The times we have laughed together has created unity in our team	Humour	Literature/Interviews

Code	Theme	Source
Humour relieves stress for our team	Humour	Literature/Interviews
When we joke with each other it is not at someone's expense	Humour	Literature/Interviews
We believe that achieving our goal makes a positive impact	Meaningful goal	Literature/Interviews
Our team purpose is meaningful to us	Meaningful goal	Literature/Interviews
Our team purpose will make a meaningful difference to the world	Meaningful goal	Literature/Interviews
Our personal goals are aligned to our team goals	Meaningful goal	Literature/Interviews
We feel that our team goal is an important purpose	Meaningful goal	Literature/Interviews
I feel that my personal goals are supported by my team	Meaningful goal	Literature/Interviews
My personal goals are aligned to the team's goal	Meaningful goal	Literature/Interviews
We consider our team goal to be important	Meaningful goal	Literature/Interviews
We consider our team goal to be meaningful	Meaningful goal	Literature/Interviews
We consider our team goal to have a high order purpose	Meaningful goal	Literature/Interviews
The significance of our goal feels like a responsibility on us	Meaningful goal	Literature/Interviews
All the members of the team buy into the team's goal (or purpose?)	Meaningful goal	Literature/Interviews
We are all involved in setting the team goals	Meaningful goal	Literature/Interviews
We feel that our goal makes a meaningful difference	Meaningful goal	Literature/Interviews
Our overarching team goal stays constant	Meaningful goal	Literature/Interviews
We have sub-goals which shift from time to time	Meaningful goal	Literature/Interviews
Our sub-goals often change	Meaningful goal	Literature/Interviews
Our team has an overarching goal/purpose plus several sub goals	Meaningful goal	Literature/Interviews
Our shared vision has developed over time	Meaningful goal	Literature/Interviews
The importance of our goal weighs us down with anxiety	Meaningful goal	Literature/Interviews
The importance of our goal feels like a big responsibility	Meaningful goal	Literature/Interviews
We like to talk among ourselves about our team vision	Meaningful goal	Literature/Interviews

Code	Theme	Source
The team purpose aligns with my values	Meaningful goal	Literature/Interviews
The team purpose is aligned to my own purpose	Meaningful goal	Literature/Interviews
As a team we feel positive about our goal	Passion	Literature/Interviews
Our team members are emotionally invested in achieving our purpose	Passion	Literature/Interviews
The team goal is clear to all of us	Passion	Literature/Interviews
The team goal may change from time to time	Passion	Literature/Interviews
We feel excited about our team purpose	Passion	Literature/Interviews
We feel proud of our goal	Passion	Literature/Interviews
Our team has positivity	Passion	Literature/Interviews
We are positive about our goal/purpose	Passion	Literature/Interviews
Our team's positive emotion is noticed by those outside the team	Passion	Literature/Interviews
We are proud to be in our team	Passion	Literature/Interviews
We are proud of our goal/purpose	Passion	Literature/Interviews
The happy team climate encourages us to persevere	Passion	Literature/Interviews
Time spent reflecting on our purpose re-energises our team	Passion	Literature/Interviews
All team members feel a sense of connection to the team goal	Passion	Literature/Interviews
We are excited about our purpose	Passion	Literature/Interviews
Our team is really passionate about goals	Passion	Passion scale (Sigmundsson et al., 2020)
As a team we would like to use a lot of time to become good in achieving our goal	Passion	Passion scale (Sigmundsson et al., 2020)
We think we could be expert in the area of our team goal	Passion	Passion scale (Sigmundsson et al., 2020)
Our team has enough passion to become very good in the area we focus on	Passion	Passion scale (Sigmundsson et al., 2020)
We work hard enough to fulfil our team goals	Passion	Passion scale (Sigmundsson et al., 2020)
We have a burning passion for the work our team does	Passion	Passion scale (Sigmundsson et al., 2020)

Code	Theme	Source
As a team we spend a lot of time on the work we like	Passion	Passion scale (Sigmundsson et al., 2020)
Our shared passion is important for the team	Passion	Passion scale (Sigmundsson et al., 2020)
We don't get distracted from ideas and projects by new ones	Passion - Consistency of Interests	Grit-S scale (Duckworth & Quinn, 2009)
Our team has been obsessed with a certain idea or project for a short time and later did not interest	Passion - Consistency of Interests	Grit-S scale (Duckworth & Quinn, 2009)
When we set a goal, we follow through with it	Passion - Consistency of Interests	Grit-S scale (Duckworth & Quinn, 2009)
We have very little difficulty maintaining focus on projects that take more than a few months to complete	Passion - Consistency of Interests	Grit-S scale (Duckworth & Quinn, 2009)
Our team leader helps us to persevere to reach our goal	Perseverance	Literature/Interviews
Collaborating enables us to persevere as a team	Perseverance	Literature/Interviews
My team perseveres through tough times to work towards our goal	Perseverance	Literature/Interviews
We see our goal as just being surviving through tough times	Perseverance	Literature/Interviews
We keep persevering towards our goal despite experiencing many frustrations as a team	Perseverance	Literature/Interviews
Giving up is not an option for this team	Perseverance	Literature/Interviews
Our goal is much too important to give up on	Perseverance	Literature/Interviews
We persevere because we do not want to let down the team	Perseverance	Literature/Interviews
We are inspired to persevere individually because of the perseverance of the team	Perseverance	Literature/Interviews
We keep persevering towards our goal over many months	Perseverance	Literature/Interviews
We encourage each other to persevere	Perseverance	Literature/Interviews
The importance of our goal motivates us to persevere	Perseverance	Literature/Interviews
The sense that 'we're in this together' makes it easy to persevere	Perseverance	Literature/Interviews
We are hard workers	Perseverance - of Effort	Grit-S scale (Duckworth & Quinn, 2009)
Our team finishes whatever we begin	Perseverance - of Effort	Grit-S scale (Duckworth & Quinn, 2009)

Code	Theme	Source
We are diligent	Perseverance - of Effort	Grit-S scale (Duckworth & Quinn, 2009)
Setbacks don't discourage our team	Perseverance - of Effort	Grit-S scale (Duckworth & Quinn, 2009)
Our team vents frustrations to one another from time to time	Venting/Connectedness	Literature/Interviews
Our team vents our frustrations to get rid of negative emotions	Venting/Connectedness	Literature/Interviews
We can be more effective after we've had a good vent of our feelings	Venting/Connectedness	Literature/Interviews

Appendix three: Draft set of items for expert review

The below set of items was proposed by the researcher at the end of the qualitative interview phase. A total of 56 items made up the pool. The item pool is made up of items written based on the qualitative focus groups, as well as items drawn from extant scales where the referent was changed from “I” to “We” (Chan, 1998). The latter scales from which items were drawn are: Consistency of Interest (CI) and Perseverance of Effort (PE) items from the Grit-S scale (Duckworth and Quinn, 2009); Passion scale (Sigmundsson et al., 2020), and the Triarchic Model of Grit Scale, TMGS (Datu et al., 2017). The original wording of these extant scales is also noted below. This draft item list was provided to the expert reviewers for their review.

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Total #		Draft item	Item Source	Source scale original wording
		Passion (16)		
1	1	Once we have set our goal, we keep focused on it	GRIT-S CI	I often set a goal but later choose to pursue a different one
2	2	Our team has been obsessed with a certain idea or project and not lost interest in it	GRIT-S CI	I have been obsessed with a certain idea or project for a short time but later lost interest in it
3	3	Even if a project takes more than a few months to complete, we remain focused on it	GRIT-S CI	I have difficulty maintaining focus on projects that take more than a few months to complete
4	4	New ideas and projects seldom distract us from previous ones	GRIT-S CI	New ideas and projects sometimes distract me from previous ones
5	5	Our team is really passionate about our purpose	Passion scale	I have an area/theme/skill I am really passionate about
6	6	As a team we would like to commit a lot of time to become good in achieving our goal	Passion scale	I would like to use a lot of time to become good in that area/theme/skill
7	7	We think we could be expert in the area of our team goal	Passion scale	I think I could be an expert in one area/theme/skill
8	8	Our team has enough passion to become very good in the area we focus on	Passion scale	I have passion enough to become very good in the area/theme/skill I like
9	9	We work hard enough to fulfil our team goals	Passion scale	I work hard enough to fulfil my goals
10	10	We have a burning passion for the work our team does	Passion scale	I have a burning passion for some areas/theme/skills
11	11	As a team we spend a lot of time on the work we like	Passion scale	I use lot of time on the projects I like
12	12	Our shared passion is important for the team	Passion scale	My passion is important for me
13	13	We are passionate about our team goal	Focus groups	
14	14	Our team members feel a sense of connection to the team goal	Focus groups	
15	15	We feel that our goal makes a meaningful difference	Focus groups	

Total #		Draft item	Item Source	Source scale original wording
16	16	Our team members are emotionally invested in achieving our purpose	Focus groups	
		Perseverance of Effort (15)		
17	1	Our team is a hard-working team	GRIT-S PE	I am a hard worker.
18	2	Our team finishes whatever we begin	GRIT-S PE	I finish whatever I begin.
19	3	We are a diligent team	GRIT-S PE	I am diligent. I never give up.
20	4	Setbacks don't discourage our team.	GRIT-S PE	Setbacks don’t discourage me. I don’t give up easily
21	5	Our team perseveres through tough times to work towards our goal	Focus groups	
22	6	Giving up is not an option for this team	Focus groups	
23	7	Our goal is much too important to give up on	Focus groups	
24	8	We keep persevering towards our goal over many months	Focus groups	
25	9	The importance of our goal motivates us to persevere	Focus groups	
26	10	We are inspired to persevere individually because of the perseverance of the team	Focus groups	
27	11	We encourage each other to persevere	Focus groups	
28	12	We keep persevering towards our goal despite experiencing many frustrations as a team	Focus groups	
29	13	The sense that we're in this together makes it easier to persevere	Focus groups	
30	14	We persevere because we do not want to let down the team	Focus groups	
31	15	We deal with challenges by looking for solutions as a team	Focus groups	
		Adaptability (12)		
32	1	Our team appreciates new opportunities that come about for us	TMGS	I appreciate new opportunities that come into my life

Total #		Draft item	Item Source	Source scale original wording
33	2	Changing our plans or strategies is important to achieve our long-term team goals	TMGS	Changing plans or strategies is important to achieve my long-term goals in life
34	3	Changes at work motivate our team to work harder	TMGS	Changes in life motivate me to work harder
35	4	Our team is able to cope with the changing circumstances at work	TMGS	I am able to cope with the changing circumstances in life
36	5	We are constantly adapting our roles in the team	Focus groups	
37	6	We are constantly adapting to external changes	Focus groups	
38	7	Our team members adapt to changing circumstances in the team	Focus groups	
39	8	As a team we have to be highly adaptive in order to achieve our goal	Focus groups	
40	9	We believe in our team's ability to grow through hard work	Focus groups	
41	10	Our team is willing to learn when things change	Focus groups	
42	11	As a team, we have a desire to learn	Focus groups	
43	12	We constantly look for ways to improve as a team	Focus groups	
		Connectedness (13)		
44	1	We trust one another in our team	Focus groups	
45	2	The bond between us has grown stronger over the time we worked as a team	Focus groups	
46	3	Our team members grow closer when we spend social time together	Focus groups	
47	4	Team members look out for each other when they need assistance	Focus groups	
48	5	In our team we encourage one another's individual successes	Focus groups	
49	6	We feel supported by each other	Focus groups	
50	7	It is important to us that we are a cohesive team	Focus groups	

Total #		Draft item	Item Source	Source scale original wording
51	8	We use certain expressions and terminology that are unique to our team	Focus groups	
52	9	The team members' individual strengths are valued in the team	Focus groups	
53	10	Humour in the team strengthens the bond between us	Focus groups	
54	11	Laughing at our challenges together helps us to persevere through tough times	Focus groups	
55	12	Our team vents our frustrations to get rid of negative emotions	Focus groups	
56	13	We can be more effective after we have had a good vent of our feelings	Focus groups	

Appendix four: Wave one survey - descriptive analysis and pattern matrices

Wave one descriptive analysis

#	Item	N	Min	Max	Mean	Std. Deviation	Skewness		Kurtosis	
		Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
1	Once we have set our goal, we keep our focus on it	205	1	5	4.08	0.854	-0.818	0.170	0.456	0.338
2	Our team has been obsessed with a certain project and remained interested in it	205	1	5	3.78	0.993	-0.548	0.170	-0.192	0.338
3	Even if a project takes more than a few months to complete, we remain focused on it	205	1	5	4.05	0.870	-0.736	0.170	0.175	0.338
4	New ideas don’t distract us from previous ones	205	1	5	3.28	1.023	-0.120	0.170	-0.726	0.338
5	As a team we commit a lot of time to become good in the area of our goal	205	2	5	3.98	0.887	-0.652	0.170	-0.223	0.338
6	We strive to be experts in the area of our team goal	205	2	5	4.18	0.861	-0.780	0.170	-0.206	0.338
7	Our team has enough passion to become very good in the area that we focus on	205	2	5	4.30	0.796	-0.956	0.170	0.292	0.338
8	We work hard to fulfil our team goals	205	2	5	4.36	0.731	-0.908	0.170	0.246	0.338
9	We have a burning passion for the work our team does	205	1	5	4.02	0.918	-0.769	0.170	0.205	0.338
10	As a team we spend a lot of time on the work we see as important	205	1	5	4.13	0.815	-1.070	0.170	1.977	0.338
11	A shared desire to achieve our goals is important for our team's success	205	1	5	4.26	0.828	-1.107	0.170	1.093	0.338
12	Our team members feel connected to the team goal	205	1	5	4.05	0.867	-0.868	0.170	0.754	0.338
13	We believe that achieving our goal will make a meaningful impact	205	2	5	4.29	0.836	-1.156	0.170	0.857	0.338
14	We feel proud of the work our team does	205	2	5	4.47	0.689	-1.286	0.170	1.702	0.338
15	Our team keeps working hard	205	1	5	4.31	0.804	-1.140	0.170	1.229	0.338
16	Our team finishes whatever we begin	205	1	5	4.00	0.900	-0.650	0.170	0.064	0.338
17	We are a diligent team	205	2	5	4.19	0.827	-0.840	0.170	0.164	0.338

#	Item	N	Min	Max	Mean	Std. Deviation	Skewness		Kurtosis	
		Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
18	Setbacks don’t discourage our team	205	1	5	3.85	0.879	-0.716	0.170	0.408	0.338
19	Our team perseveres through tough times to work towards our goal	205	1	5	4.26	0.816	-1.122	0.170	1.265	0.338
20	Our goal is much too important to give up on	205	1	5	4.23	0.886	-1.107	0.170	0.971	0.338
21	We keep persevering towards our goal over many months	205	1	5	4.33	0.765	-1.042	0.170	1.106	0.338
22	The importance of our goal motivates us to persevere	205	1	5	4.19	0.831	-0.876	0.170	0.530	0.338
23	We are inspired to persevere individually because of the perseverance of our team	205	1	5	4.03	1.007	-0.913	0.170	0.274	0.338
24	We encourage each other to persevere	205	1	5	4.04	0.992	-0.972	0.170	0.486	0.338
25	We keep persevering towards our goal despite experiencing many frustrations as a team	205	1	5	4.07	0.865	-0.913	0.170	0.863	0.338
26	The sense that we're in this together makes it easier to persevere	205	1	5	4.08	0.999	-1.151	0.170	0.957	0.338
27	We don’t want to let down our team in achieving our goal	205	1	5	4.16	0.905	-1.076	0.170	1.083	0.338
28	We deal with obstacles to achieving our goals by looking for solutions as a team	205	1	5	3.99	0.970	-0.794	0.170	0.000	0.338
29	Our team appreciates opportunities for us to improve our skills	205	1	5	3.97	0.939	-0.839	0.170	0.585	0.338
30	Being willing to adapt our plans and strategies is important to achieve our long-term goals	205	1	5	4.21	0.822	-1.208	0.170	2.209	0.338
31	Changes at work motivate our team to work harder	205	1	5	3.27	1.021	-0.291	0.170	-0.333	0.338
32	Our team is able to cope with the changing circumstances at work	205	1	5	3.83	0.905	-0.738	0.170	0.813	0.338
33	We are willing to adapt our roles in the team to achieve our goals	205	1	5	3.82	0.951	-0.634	0.170	0.018	0.338
34	We are successful in adapting to external changes	205	2	5	3.98	0.863	-0.517	0.170	-0.401	0.338

#	Item	N	Min	Max	Mean	Std. Deviation	Skewness		Kurtosis	
		Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
35	As a team we are able to be highly adaptive in order to achieve our goal	205	1	5	3.90	0.926	-0.580	0.170	-0.110	0.338
36	We believe in our team's ability to grow through hard work	205	1	5	4.00	0.937	-0.858	0.170	0.629	0.338
37	Our team is willing to learn when things change	205	1	5	4.13	0.888	-0.889	0.170	0.536	0.338
38	We constantly look for ways to improve as a team	205	1	5	3.82	1.014	-0.724	0.170	0.157	0.338
39	We trust one another in our team	205	1	5	4.00	1.105	-1.003	0.170	0.302	0.338
40	The bond between us has grown stronger over the time we have worked together as a team	205	1	5	4.18	1.038	-1.342	0.170	1.352	0.338
41	Our team members grow closer when we spend time together	205	1	5	4.11	0.966	-1.051	0.170	0.782	0.338
42	In our team we celebrate one another's individual successes	205	1	5	4.12	1.110	-1.256	0.170	0.870	0.338
43	We encourage one another	205	1	5	4.15	1.028	-1.227	0.170	1.031	0.338
44	We use certain expressions that are unique to our team	205	1	5	3.53	1.301	-0.471	0.170	-0.969	0.338
45	The team members' individual strengths are valued in our team	205	1	5	4.24	0.911	-1.514	0.170	2.639	0.338
46	Humour in the team strengthens the bond between us	205	1	5	4.26	0.975	-1.320	0.170	1.266	0.338
47	We enjoy working together in our team	205	1	5	4.24	0.911	-1.278	0.170	1.683	0.338
48	We support each other in tough times	205	1	5	4.26	0.943	-1.354	0.170	1.624	0.338

Item-total correlation statistics after wave one purification

#	Item	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
1	Once we have set our goal, we keep our focus on it	97,76	256,81	0,565	0,489	0,954
2	As a team we commit a lot of time to become good in the area of our goal	97,86	257,217	0,527	0,465	0,954
3	We believe that achieving our goal will make a meaningful impact	97,55	257,306	0,559	0,482	0,954
4	Our team finishes whatever we begin	97,84	257,61	0,504	0,487	0,954
5	We are a diligent team	97,65	255,466	0,637	0,644	0,953
6	Our goal is much too important to give up on	97,61	255,2	0,601	0,639	0,953
7	We keep persevering towards our goal over many months	97,51	258,506	0,565	0,569	0,954
8	The importance of our goal motivates us to persevere	97,65	252,814	0,737	0,711	0,952
9	The sense that we're in this together makes it easier to persevere	97,76	248,054	0,761	0,654	0,952
10	Our team is able to cope with the changing circumstances at work	98,01	255,922	0,561	0,513	0,954
11	We are willing to adapt our roles in the team to achieve our goals	98,02	255,032	0,562	0,523	0,954
12	We are successful in adapting to external changes	97,86	254,69	0,637	0,74	0,953
13	As a team we are able to be highly adaptive in order to achieve our goal	97,94	252,381	0,671	0,748	0,953
14	We constantly look for ways to improve as a team	98,02	249,177	0,712	0,591	0,952
15	We trust one another in our team	97,85	245,875	0,747	0,737	0,952
16	The bond between us has grown stronger over the time we have worked together as a team	97,66	247,77	0,739	0,774	0,952

#	Item	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
17	Our team members grow closer when we spend time together	97,73	251,854	0,659	0,612	0,953
18	In our team we celebrate one another's individual successes	97,72	244,883	0,774	0,755	0,952
19	We encourage one another	97,69	245,514	0,82	0,814	0,951
20	*We use certain expressions that are unique to our team*	*98,31*	*252,459*	*0,456*	*0,419*	*0,956*
21	The team members' individual strengths are valued in our team	97,6	250,13	0,765	0,691	0,952
22	Humour in the team strengthens the bond between us	97,58	251,729	0,657	0,609	0,953
23	We enjoy working together in our team	97,6	248,426	0,827	0,801	0,951
24	We support each other in tough times	97,58	248,292	0,802	0,758	0,951
25	We encourage each other to persevere	97,8	248,542	0,751	0,675	0,952

Appendix five: Wave two survey descriptive analysis and pattern matrices

Wave two descriptive analysis

#	Item	N	Range	Minimum	Maximum	Mean	Std. Deviation	Skewness		Kurtosis	
		Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
1	Once we have set our goal, we keep our focus on it	236	3	2	5	4.21	.687	-.532	.158	.126	.316
2	As a team we commit a lot of time to become good in the area of our goal	236	3	2	5	4.05	.811	-.472	.158	-.413	.316
3	We believe that achieving our goal will make a meaningful impact	236	3	2	5	4.28	.755	-.823	.158	.190	.316
4	We are a diligent team	236	3	2	5	4.25	.734	-.569	.158	-.498	.316
5	Our team finishes whatever we begin	236	3	2	5	4.29	.746	-.720	.158	-.227	.316
6	Our goal is much too important to give up on	236	3	2	5	4.16	.764	-.389	.158	-.836	.316
7	We keep persevering towards our goal over many months	236	3	2	5	4.23	.748	-.647	.158	-.147	.316
8	The importance of our goal motivates us to persevere	236	3	2	5	4.00	.853	-.506	.158	-.431	.316
9	We encourage each other to persevere	236	3	2	5	4.08	.886	-.631	.158	-.445	.316
10	The sense that we're in this together makes it easier to persevere	236	3	2	5	4.13	.848	-.634	.158	-.413	.316
11	Our team is able to cope with the changing circumstances at work	236	3	2	5	4.07	.758	-.291	.158	-.704	.316

#	Item	N	Range	Minimum	Maximum	Mean	Std. Deviation	Skewness		Kurtosis	
		Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
12	We are willing to adapt our roles in the team to achieve our goals	236	4	1	5	4.05	.854	-.676	.158	.091	.316
13	We are successful in adapting to external changes	236	4	1	5	4.05	.808	-.532	.158	.004	.316
14	As a team we are able to be highly adaptive in order to achieve our goal	236	3	2	5	4.00	.817	-.432	.158	-.438	.316
15	We constantly look for ways to improve as a team	236	3	2	5	3.90	.884	-.322	.158	-.738	.316
16	We trust one another in our team	236	4	1	5	4.06	.883	-.827	.158	.637	.316
17	The bond between us has grown stronger over the time we have worked together as a team	236	4	1	5	4.14	.903	-.761	.158	-.167	.316
18	Our team members grow closer when we spend time together	236	4	1	5	4.03	.915	-.664	.158	-.237	.316
19	In our team we celebrate one another's individual successes	236	4	1	5	3.90	1.069	-.773	.158	-.069	.316
20	We encourage one another	236	4	1	5	4.05	.942	-.925	.158	.488	.316
21	We use certain expressions that are unique to our team	236	4	1	5	3.31	1.181	-.127	.158	-.896	.316
22	The team members' individual strengths are valued in our team	236	4	1	5	4.00	.916	-.679	.158	.136	.316
23	Humour in the team strengthens the bond between us	236	4	1	5	4.10	1.016	-1.006	.158	.410	.316
24	We enjoy working together in our team	236	4	1	5	4.17	.806	-.752	.158	.343	.316

#	Item	N	Range	Minimum	Maximum	Mean	Std. Deviation	Skewness		Kurtosis	
		Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
25	We support each other in tough times	236	4	1	5	4.11	.914	-.920	.158	.582	.316
	Valid N (listwise)	236									

Inter-item and average inter-item correlations for 22-item scale

	Inter-item correlation per item																						
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	Average inter-item correlation
1	1,000	0,386	0,570	0,479	0,416	0,413	0,435	0,443	0,324	0,403	0,464	0,484	0,338	0,318	0,349	0,248	0,360	0,268	0,364	0,251	0,415	0,378	**0,414**
2	0,386	1,000	0,437	0,313	0,549	0,546	0,425	0,480	0,405	0,380	0,367	0,398	0,351	0,368	0,394	0,314	0,376	0,284	0,441	0,302	0,419	0,369	**0,423**
3	0,570	0,437	1,000	0,524	0,490	0,413	0,532	0,459	0,443	0,515	0,494	0,516	0,410	0,461	0,476	0,378	0,444	0,219	0,403	0,366	0,511	0,473	**0,479**
4	0,479	0,313	0,524	1,000	0,509	0,319	0,314	0,302	0,356	0,297	0,392	0,410	0,271	0,212	0,293	0,148	0,217	0,178	0,322	0,159	0,280	0,285	**0,344**
5	0,416	0,549	0,490	0,509	1,000	0,547	0,296	0,303	0,378	0,412	0,421	0,455	0,289	0,240	0,304	0,227	0,280	0,277	0,376	0,199	0,331	0,372	**0,394**
6	0,413	0,546	0,413	0,319	0,547	1,000	0,489	0,446	0,342	0,350	0,339	0,433	0,299	0,369	0,311	0,294	0,365	0,282	0,425	0,225	0,358	0,360	**0,406**
7	0,435	0,425	0,532	0,314	0,296	0,489	1,000	0,655	0,372	0,445	0,393	0,475	0,484	0,540	0,506	0,502	0,612	0,376	0,550	0,483	0,548	0,589	**0,501**
8	0,443	0,480	0,459	0,302	0,303	0,446	0,655	1,000	0,476	0,549	0,487	0,490	0,513	0,594	0,549	0,512	0,621	0,380	0,526	0,528	0,554	0,564	**0,520**

	Inter-item correlation per item																						
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**Average inter-item correlation**
9	0,324	0,405	0,443	0,356	0,378	0,342	0,372	0,476	1,000	0,560	0,627	0,625	0,471	0,391	0,365	0,292	0,371	0,205	0,453	0,301	0,372	0,371	**0,432**
10	0,403	0,380	0,515	0,297	0,412	0,350	0,445	0,549	0,560	1,000	0,582	0,676	0,402	0,328	0,347	0,327	0,383	0,233	0,337	0,333	0,452	0,407	**0,442**
11	0,464	0,367	0,494	0,392	0,421	0,339	0,393	0,487	0,627	0,582	1,000	0,709	0,395	0,317	0,291	0,286	0,377	0,327	0,431	0,352	0,366	0,402	**0,446**
12	0,484	0,398	0,516	0,410	0,455	0,433	0,475	0,490	0,625	0,676	0,709	1,000	0,395	0,339	0,341	0,322	0,398	0,272	0,466	0,338	0,387	0,387	**0,469**
13	0,338	0,351	0,410	0,271	0,289	0,299	0,484	0,513	0,471	0,402	0,395	0,395	1,000	0,636	0,530	0,488	0,616	0,289	0,531	0,430	0,584	0,614	**0,470**
14	0,318	0,368	0,461	0,212	0,240	0,369	0,540	0,594	0,391	0,328	0,317	0,339	0,636	1,000	0,747	0,666	0,703	0,460	0,591	0,662	0,700	0,663	**0,514**
15	0,349	0,394	0,476	0,293	0,304	0,311	0,506	0,549	0,365	0,347	0,291	0,341	0,530	0,747	1,000	0,638	0,591	0,436	0,518	0,624	0,634	0,571	**0,492**
16	0,248	0,314	0,378	0,148	0,227	0,294	0,502	0,512	0,292	0,327	0,286	0,322	0,488	0,666	0,638	1,000	0,744	0,502	0,561	0,690	0,626	0,598	**0,471**
17	0,360	0,376	0,444	0,217	0,280	0,365	0,612	0,621	0,371	0,383	0,377	0,398	0,616	0,703	0,591	0,744	1,000	0,450	0,636	0,618	0,663	0,666	**0,522**
18	0,268	0,284	0,219	0,178	0,277	0,282	0,376	0,380	0,205	0,233	0,327	0,272	0,289	0,460	0,436	0,502	0,450	1,000	0,416	0,535	0,434	0,419	**0,375**
19	0,364	0,441	0,403	0,322	0,376	0,425	0,550	0,526	0,453	0,337	0,431	0,466	0,531	0,591	0,518	0,561	0,636	0,416	1,000	0,525	0,622	0,625	**0,506**
20	0,251	0,302	0,366	0,159	0,199	0,225	0,483	0,528	0,301	0,333	0,352	0,338	0,430	0,662	0,624	0,690	0,618	0,535	0,525	1,000	0,645	0,593	**0,462**
21	0,415	0,419	0,511	0,280	0,331	0,358	0,548	0,554	0,372	0,452	0,366	0,387	0,584	0,700	0,634	0,626	0,663	0,434	0,622	0,645	1,000	0,750	**0,530**
22	0,378	0,369	0,473	0,285	0,372	0,360	0,589	0,564	0,371	0,407	0,402	0,387	0,614	0,663	0,571	0,598	0,666	0,419	0,625	0,593	0,750	1,000	**0,521**

Wave two pattern matrix

#	Item	Factor			
		1	2	3	4
1	Once we have set our goal, we keep our focus on it	0,120	-0,001	**0,541**	0,182
2	As a team we commit a lot of time to become good in the area of our goal	0,126	-0,042	**0,548**	0,178
3	We believe that achieving our goal will make a meaningful impact	0,150	-0,054	0,136	**0,557**
4	Our team finishes whatever we begin	-0,009	0,111	**0,694**	0,003
5	We are a diligent team	0,065	0,239	**0,635**	0,044
6	Our goal is much too important to give up on	-0,013	0,061	0,017	**0,845**
7	We keep persevering towards our goal over many months	0,002	0,153	0,100	**0,601**
8	The importance of our goal motivates us to persevere	0,183	0,217	0,015	**0,611**
9	Our team is able to cope with the changing circumstances at work	0,100	**0,634**	0,055	0,003

#	Item	Factor			
		1	2	3	4
10	We are willing to adapt our roles in the team to achieve our goals	0,120	**0,606**	-0,069	0,120
11	We are successful in adapting to external changes	-0,016	**0,799**	0,063	0,093
12	As a team we are able to be highly adaptive in order to achieve our goal	0,041	**0,810**	0,118	0,022
13	We constantly look for ways to improve as a team	**0,569**	0,219	0,000	0,069
14	We trust one another in our team	**0,718**	0,056	0,236	-0,090
15	The bond between us has grown stronger over the time we have worked together as a team	**0,815**	0,027	0,029	-0,006
16	Our team members grow closer when we spend time together	**0,711**	-0,069	-0,033	0,156
17	In our team we celebrate one another's individual successes	**0,715**	0,025	0,093	0,094
18	We encourage one another	**0,807**	0,075	0,059	0,012
19	We use certain expressions that are unique to our team	**0,521**	0,053	-0,154	0,071
20	The team members' individual strengths are valued in our team	**0,744**	0,032	-0,012	0,141

#	Item	Factor			
		1	2	3	4
21	Humour in the team strengthens the bond between us	**0,704**	0,042	0,041	-0,045
22	We enjoy working together in our team	**0,733**	0,064	0,243	-0,020
24	We support each other in tough times	**0,544**	0,101	0,304	0,076

Appendix six: Wave three survey descriptive analysis, pattern matrices and nomological net scales

The scales below were included in the wave three survey, to assess nomological relationships to team grit. They are included here with the codes that the researcher assigned in the construction of the structural model, and to conduct discriminant validity analysis between grit and team grit. Also included is the Cronbach's alpha reliability score for each of the scales.

Scales included for nomological net

Scale name	**#**	**Items**	**α**
Team goal commitment (Aubé & Rousseau, 2005)	TGC1	We are committed to pursuing the team's goal	0.85
	TGC2	We think it is important to reach the team's goal	
	TGC3	We really care about achieving the team's goal	
Team innovation (Mitchell et al., 2022)	TI1	To what extent is the team's work innovative?	0.93
	TI2	To what extent does the team engender innovation?	
	TI3	To what extent does the team produce new ideas and introduce specific changes?	
	TI4	To what extent do all team members participate in the team's innovative work?	
Team psychological safety (Edmondson, 1999)	TPS1	If you make a mistake on this team, it is often held against you (R)	0.94
	TPS2	Members of this team are able to bring up problems and tough issues;	
	TPS3	People on this team sometimes reject others for being different (R)	
	TPS4	It is safe to take a risk on this team	
	TPS5	It is difficult to ask other members of this team for help (R)	
	TPS6	No one on this team would deliberately act in a way that undermines my efforts	
	TPS7	Working with members of this team, my unique skills and talents are valued and utilized	
Team work engagement	TWE1	During the task my team feels full of energy	0.86
	TWE2	My team feels very persistent during the task	

Scale name	#	Items	α
(TWES-9, Costa et al., 2014)	TWE3	My team feels strong and vigorous during the task	
	TWE4	My team is enthusiastic about the job	
	TWE5	My team enjoys doing the task	
	TWE6	My team feels very motivated to do a good job	
	TWE7	When my team is working, we forget everything else around us	
	TWE8	Time flies when my team is working	
	TWE9	My team feels happy when we are engrossed in the task	

Individual Grit codes for discriminant validity analysis

Code	Item
Consistency of interests	
IG1a	I often set a goal but later choose to pursue a different one
IG1b	I have been obsessed with a certain idea or project for a short time but later lost interest
IG1c	I have difficulty maintaining my focus on projects that take more than a few months to complete
IG1d	New ideas and projects sometimes distract me from previous ones
Perseverance of effort	
IG2a	I finish whatever I begin
IG2b	Setbacks don't discourage me. I don't give up easily.
IG2c	I am diligent
IG2d	I am a hard worker

Correlations and inter-item average correlations after wave three purification

#	Item	We are a diligent team	As a team we are able to be highly adaptive in order to achieve our goal	Our team members grow closer when we spend time together	Once we have set our goal, we keep our focus on it	Our team finishes whatever we begin	Our team is able to cope with the changing circumstances at work	In our team we celebrate one another's individual successes	We use certain expressions that are unique to our team	**Inter-item correlation (average)**
1	We are a diligent team		0,607	0,577	0,468	0,532	0,434	0,453	0,343	**0,488**
2	As a team we are able to be highly adaptive in order to achieve our goal	0,607		0,57	0,487	0,55	0,605	0,501	0,319	**0,520**
3	Our team members grow closer when we spend time together	0,577	0,57		0,415	0,450	0,455	0,573	0,396	**0,491**
4	Once we have set our goal, we keep our focus on it	0,468	0,487	0,415		0,498	0,456	0,409	0,305	**0,434**
5	Our team finishes whatever we begin	0,532	0,55	0,450	0,498		0,514	0,332	0,195	**0,439**
6	Our team is able to cope with the changing circumstances at work	0,434	0,605	0,455	0,456	0,514		0,447	0,328	**0,463**
7	In our team we celebrate one another's individual successes	0,453	0,501	0,573	0,409	0,332	0,447		0,415	**0,447**
8	We use certain expressions that are unique to our team	0,343	0,319	0,396	0,305	0,195	0,328	0,415		**0,328**

Descriptive statistics for 14-item wave three scale

#	Items	N	Minimum	Maximum	Mean	Std. Deviation	Skewness		Kurtosis	
		Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
1	Once we have set our goal, we keep our focus on it	269	2	5	4.17	.827	-.560	.149	-.686	.296
2	We are a diligent team	269	2	5	4.19	.871	-.754	.149	-.374	.296
3	Our team finishes whatever we begin	269	2	5	4.34	.793	-1.098	.149	.684	.296
4	We believe that achieving our goal will make a meaningful impact	269	2	5	4.25	.903	-.973	.149	-.031	.296
5	Our goal is much too important to give up on	269	1	5	4.26	.894	-1.144	.149	.834	.296
6	The importance of our goal motivates us to persevere	269	1	5	4.09	.924	-.913	.149	.595	.296
7	Our team is able to cope with the changing circumstances at work	269	1	5	4.12	.906	-.964	.149	.675	.296
8	We are willing to adapt our roles in the team to achieve our goals	269	1	5	4.15	.908	-.940	.149	.532	.296
9	We are successful in adapting to external changes	269	2	5	4.14	.852	-.566	.149	-.681	.296
10	As a team we are able to be highly adaptive in order to achieve our goal	269	1	5	4.10	.931	-.816	.149	.152	.296
11	Our team members grow closer when we spend time together	269	1	5	4.01	.983	-.759	.149	-.127	.296
12	In our team we celebrate one another's individual successes	269	1	5	4.04	1.046	-.857	.149	-.243	.296
13	We use certain expressions that are unique to our team	269	1	5	3.77	1.158	-.682	.149	-.267	.296
14	Humour in the team strengthens the bond between us	269	1	5	4.28	.909	-1.082	.149	.347	.296

Abbreviations for nomological net

Abbreviation	**Construct name**
TG	Team grit
TGC	Team goal commitment
TI	Team innovation
TPS	Team psychological safety
TWE	Team work engagement
IG	Individual grit

Appendix seven: Wave four survey

Two factor eight item scale estimates

#	Item		Estimate
1	As a team we are able to be highly adaptive in order to achieve our goal	F1	.817
2	Our team is able to cope with the changing circumstances at work	F1	.699
3	Our team finishes whatever we begin	F1	.690
4	We are a diligent team	F1	.740
5	Once we have set our goal, we keep our focus on it	F1	.638
6	We use certain expressions that are unique to our team	F2	.510
7	In our team we celebrate one another's individual successes	F2	.719
8	Our team members grow closer when we spend time together	F2	.806

Appendix eight: Item reduction/retention over four waves

#	Wave 1	Wave 2	Wave 3	Wave 4
1	Once we have set our goal we keep our focus on it	X	X	X F1
2	Our team has been obsessed with a certain project and remained interested in it			
3	Even if a project takes more than a few months to complete, we remain focused on it			
4	New ideas don't distract us from previous ones			
5	As a team we commit a lot of time to become good in the area of our goal	X		
6	We strive to be experts in the area of our team goal			
7	Our team has enough passion to become very good in the area that we focus on			
8	We work hard to fulfil our team goals			
9	We have a burning passion for the work our team does			
10	As a team we spend a lot of time on the work we see as important			
11	A shared desire to achieve our goals is important for our team's success			
12	Our team members feel connected to the team goal			
13	We believe that achieving our goal will make a meaningful impact	X	X	
14	We feel proud of the work our team does			
15	Our team keeps working hard			
16	Our team finishes whatever we begin	X	X	X F1
17	We are a diligent team	X	X	X F1
18	Setbacks don't discourage our team			
19	Our team perseveres through tough times to work towards our goal			
20	Our goal is much too important to give up on	X	X	
21	We keep persevering towards our goal over many months	X		
22	The importance of our goal motivates us to persevere	X	X	
23	We are inspired to persevere individually because of the perseverance of our team			
24	We encourage each other to persevere	X		
25	We keep persevering towards our goal despite experiencing many frustrations as a team			
26	The sense that we're in this together makes it easier to persevere	X		
27	We don't want to let down our team in achieving our goal			
28	We deal with obstacles to achieving our goals by looking for solutions as a team			
29	Our team appreciates opportunites for us to improve our skills			
30	Being willing to adapt our plans and strategies is important to achieve our long-term goals			
31	Changes as work motivate our team to work harder			
32	Our team is able to cope with the changing circumstances at work	X	X	X F1
33	We are willing to adapt our roles in the team to achieve our goals	X	X	
34	We are successful in adapting to external changes	X	X	
35	As a team we are able to be highly adaptive in order to achieve our goal	X	X	X F1
36	We believe in our team's ability to grow through hard work			
37	Our team is willing to learn when things change			
38	We constantly look for ways to improve as a team	X		
39	We trust one another in our team	X		
40	The bond between us has grown stronger over the time we have worked together as a team	X		
41	Our team members grow closer when we spend time together	X	X	X F2
42	In our team we celebrate one another's individual successes	X	X	X F2
43	We encourage one another	X		
44	We use certain expressions that are unique to our team	X	X	X F2
45	The team members' individual strengths are valued in our team	X		
46	Humour in the team strengthens the bond between us	X	X	
47	We enjoy working together in our team	X		
48	We support each other in tough times	X		
		48	25	14	8