Gordon Institute of Business Science
University of Pretoria

The implications of high virtuality on the collaboration, creativity and innovation of virtual teams.

13094590

A research project submitted to the Gordon Institute of Business Science, University of Pretoria, in partial fulfilment of the requirements for the degree of Master of Philosophy in Corporate Strategy.

28 November 2022

Abstract

The proliferation of telecommunication technology, globalisation and the recent COVID-19 pandemic has resulted in the widespread adoption of virtual work within organisations and teams. While the benefits of increased virtuality have been well-researched at an individual level, research on team implications – especially for team collaboration, creativity and innovation - has been limited. This study explores the implications of high virtuality of work on team collaboration, creativity and innovation by adopting an exploratory, qualitative research design. Fifteen semi-structured interviews with participants and managers of virtual teams across eight industries provide insights that are utilised to generate the findings of the study. Two of the key findings of the study that contribute to the literature on virtual teams is the insight that increased demand on virtual collaborators due to high virtuality of work has resulted in negative implications for knowledge sharing and decision-making of virtual teams impacting creativity. The second key finding relates to the changing nature of virtual relations to become more transactional and has implications for the motivation and leadership of virtual teams. Lastly, the concludes by providing recommendations for managers and organisations on how to promote the positive benefits of collaboration and creativity within virtual teams, which was previously experienced in face-to-face teams.

Key words

Virtualisation, virtuality, collaboration, creativity, innovation, telework, remote work

Declaration

I declare that this research project is my own work. It is submitted in partial fulfilment of the requirements for the degree of Master of Philosophy in Corporate Strategy at the Gordon Institute of Business Science, University of Pretoria. It has not been submitted before for any degree or examination in any other University. I further declare that I have obtained the necessary authorisation and consent to carry out this research.

Senzosenkosi Nsibande

28 November 2022

List of tables

List of Figures

Contents

Chapter 1: Introduction

1.1. Introduction

The proliferation of telecommunication technology, globalisation and the recent COVID-19 pandemic has resulted in the rapid scaling and adoption of virtual work within organisations and teams (Das et al., 2021). This rapid scaling has resulted in teams increasing the frequency and length of time working in remote settings, including the introduction of virtual-only teams. Further to its implications for productivity, employee wellbeing and others, this heightened virtuality of work has also fuelled the academic and management debate on its potential implications for collaboration, group-level creativity and innovation behaviours for teams (George et al., 2020).

Can the benefits (collaboration, creativity, innovation and similar) which were previously established through regular face-to-face (F2F) interactions, be sustained, or enhanced by virtual teams? For example, informal conversations held with lesser-known colleagues around the water cooler to share ideas and information provided great opportunities for knowledge sharing which is vital for innovation (Spicer, 2020). Can these be replicated through high engagements on zoom calls?

1.2. Background to Research

Virtualisation is considered as the use of technology by “geographically dispersed teams working interdependently to communicate and collaborate across time and space”(Choi & Cho, 2019, p. 1). Choi and Cho (2019) argue that using technology to enable virtual interactions provides positive benefits to the organisation by providing a platform in which geographically dispersed teams can communicate, coordinate tasks, share knowledge, process large amounts of information, and improve productivity and speed of decision-making.

Examples of the virtualisation of work are evidenced in literature within the themes of remote working, which encompasses all work done outside of the traditional workplace (i.e. previously used to describe geographically dispersed employees in multi-national organisations) (Felstead & Henseke, 2017). Also inclusive of telework, it extends to constructs like Work from Home (WFH) and Work from Anywhere (WFA) which represent branches of virtual work and include employees that are geographically dispersed and those who interchange between remote and traditional workspaces – blended or hybrid work (Kniffin et al., 2021). Importantly, virtualisation within teams is not uniform and varies between high degrees of virtuality (virtual-only teams) and lower degrees of virtuality (largely F2F teams with low technology usage) (Asatiani et al., 2021).

Despite their recent prevalence, Asatiani et al. (2021) state that virtual work environments have existed before the COVID-19 pandemic and have been especially prevalent in knowledge-intensive occupations like Information Technology (IT) and data sciences. They state that more than 40 per cent of United States (US) employees reported that they had been working virtually for portions of their time since 2016 (Asatiani et al., 2021). However, strict regulations imposed by governments during the COVID-19 pandemic, limiting the movement of people has resulted in the implementation of 1) sustained virtual teams, 2) across wider functions of the organisation – including roles that had previously experienced less prevalence of virtual work (Bernstein et al., 2020). That is, virtual work shifted from being an infrequent occurrence for some teams within the organisation to a more permanent feature across the organisation.

Asatiani and Penttinen (2019), suggest that the modern advancement of Information Communication Technologies (ICT) and the reduced cost of virtual computing, supported by the proliferation of internet access has supported the scaling of geographically dispersed individuals and teams. They posit that knowledge workers and organisations alike, have embraced virtual work due to its potential positive outcomes for productivity and cost. At its extreme, these factors contribute to the recent emergence of virtual organisations, which have no physical location (Asatiani & Penttinen, 2019). However, virtual work presents potential challenges including the supervision of virtual workers, sustaining organisational culture, and isolation of individuals. Furthermore, virtual work is not uniform and varies between purely virtual (high degree of virtuality) to purely physical (low degree of virtuality), and is also impacted by how it is adopted, potentially impeding some of its potential benefits for firm outcomes (Asatiani & Penttinen, 2019).

A recent article from Harvard Business Review on the implications of working without an office due to rapid WFH adoption also highlights the potential impacts of scaled virtual work on collaboration, productivity, creativity and innovation (Bernstein et al., 2020). It is suggested that some potential negative outcomes of virtual-only teams may be caused by weakened ties between virtual team members - derived from shallow relationships in the organisation, which have not sufficiently developed due to the virtualisation of work (Bernstein et al., 2020). In addition, the opportunity to interact with lesser-known colleagues and collaborators to share ideas has been reduced by more than 10%, further contributing to the reduced collaboration and creativity (Bernstein et al., 2020). This avers that there is ongoing business debate on the implications of virtual work.

While recent research has determined that there are some positive gains in the productivity of employees associated with the virtualisation of work (Choudhury et al., 2021), for

organisations, the ability to maintain and grow their competitive advantage despite the increased degree of virtuality of virtual teams (less F2F interactions), necessitates the further understanding of the impact of virtual work on team and firm outcomes (Asatiani et al., 2021; George et al., 2020; Nyberg et al., 2021; Spicer, 2020). Furthermore, surveys have found that some employees selected to continue virtualisation post the relaxation of COVID-19 restrictive government measures, citing positive benefits of virtual work including flexible work schedules, the ability to work from anywhere (relocation to preferred geographic location) and benefits to employee wellbeing (PWC, 2021). Thus, for organisations, the ability to provide sustained virtual work arrangements beyond COVID-19 is expected to be a differentiator to attract skilled employees (PWC, 2021). This then suggests that virtual work is likely to be more prevalent in the future and understanding its implications for team outcomes, especially those implications influencing organisational outcomes such as collaboration, creativity and innovation requires further understanding.

For managers, the implications of heightened virtuality of work may be vast, especially in driving positive organisational outcomes through virtual teams (presenting both opportunities and challenges). Asatiani and Penttinen (2019) suggest that the rapid switching towards virtual communication using both synchronous and asynchronous communication channels may result in ineffective communication in virtual teams. Furthermore, the ability of leaders to communicate their vision, share knowledge, transport organisational culture (norms and rituals) and solicit contributions during idea generation and debate, may be challenged in a virtual setting (Asatiani & Penttinen, 2019; Kozlowski & Chao, 2018; Thayer et al., 2018). In their study titled, *introducing changes at work: How voice behaviour relates to management innovation*, Guzman and Espejo (2019) found that managers' ability to promote willingness to share ideas from participants was impacted by situational characteristics (context, environment, and availability of resources). It can be argued that the changes brought on by COVID-19 also present large changes in the situational characteristics of team and virtual participants, and thus we theorise in the study that this may influence virtual team participants' willingness to engage and share ideas. Other consequences for managers include their ability to influence the cognition processes within virtual teams that support creativity and innovation within teams (Ratzmann et al., 2018). These include the ability to influence how teams acquire internal and external knowledge, conduct information exchange, and have relevant debates to decide on the appropriate ideas. These are some of the challenges managers are postulated to face due to the high virtuality of work (Ratzmann et al., 2018).

Furthermore, there is literature that highlights the potential implications for leaders of virtual teams, requiring them to incorporate context into their leadership style to adapt to heightened changes in the environment and effectively support teams to deliver positive team and

organisational outcomes like creativity and innovation (Burak, 2018). In addition, Lin et al. (2019) argue that virtual teams respond to extrinsic motivation like rewards when tasks are fulfilled, due to reduced connection with team participants. This transactive nature of the relationship may result in increased pressure for managers to motivate virtual participants and teams for complex or extended tasks like innovation. And so, with rapid changes brought on by virtual work, changes in the team environment (Ratzmann et al., 2018; Thayer et al., 2018), potential changes in participant motivation behaviours (Lin et al., 2019), and potential requirements for the changes of leadership styles for managers (Burak, 2018), it suggest that further research is required to understand the implications of increased virtuality of work for managers.

Furthermore, the prolonged nature of the COVID-19 lockdown has resulted in more sustained virtual work adoption and the prevalence of fully virtual teams, as opposed to previous blended working arrangements, resulting in prolonged periods away from physical organisation workspaces, geographic relocation (work from anywhere), and the need for digital onboarding of some new employees without any interaction with traditional workspaces (George et al., 2020). George et al. (2020), posit that research has shown that F2F interactions positively impact group creativity, collaboration and knowledge sharing. However, there is limited understanding of how the increased virtualisation of work will influence these outcomes for teams and organisations alike. They suggest that further research be conducted into the impacts of virtualisation, largely due to COVID-19, on collaboration and creativity in driving innovation (George et al., 2020). In addition, with more recent relaxation of COVID-19 regulations, and the option of teams to return to in-person engagements, there remains the ongoing debate on how any benefits derived from virtual engagements, complemented with face-to-face engagements (hybrid/ blended work) can be structured for optimal team and organisational outcome, while managing the drawbacks (Yang et al., 2022).

By expanding on the invitation for further research by George et al. (2020) in their paper, *what has changed? The impact of the COVID pandemic on technology and innovation management research agenda,* the study seeks to explore the consequences of the increased adoption of virtual work on the collaboration patterns, group-level creativity and the innovation behaviours of virtual teams.

1.3. The research problem

This research seeks to understand how the recent adoption of high degrees of virtuality within virtual work will influence the collaboration, creativity, and innovation of virtual teams. The subject of the analysis will be virtual teams including the individuals that participate and

manage them. Driskell, Salas and Driskell (2018), suggest that teamwork and team dynamics, present high interest for academia due to the key points of (i) outcomes from teams result in big effects for organisations, and society alike (ii) understanding team effects present opportunities to promote positive outcomes and reduce negative outcomes (deliberately), (iii) teams are prevalent across many structures and organisations. That is, the focus on specifically teams for the study presents an opportunity to further contribute to matters that are prevalent and relevant across multiple contexts and have meaningful consequences for organisations.

Further expansion on the research problem is discussed below.

1.3.1. Consequences of heightened virtualisation for collaboration

Choi and Choi (2019) defined collaboration as the coming together of multiple participants to achieve mutually beneficial results. Furthermore, they state that it is vital for organisational performance outcomes (Choi & Cho, 2019). Collaboration can be further classified into the dimensions of co-operation, coordination and knowledge sharing (Choi & Cho, 2019). Earlier literature determined that virtual team collaboration was impacted due to the lack of social cues including non-verbal communication (Schmidt, 2014). They present literature that provides evidence that trust, within virtual team members, affects these collaborative behaviours, and most importantly they find that goal congruence (shared goals) is more important for building trust and positively influencing collaboration compared to the other interpersonal trust drivers including integrity, ability and benevolence (Choi & Cho, 2019). That is, virtual teams collaborate better, by building trust through clarity of shared goals.

It is suggested that common working spaces are a source of information sharing and knowledge transfer which improves collaboration and innovation (Choudhury et al., 2021). This is supported by George, Lakhani and Puranam (2020) who posit that there are positive results to F2F interactions on group-creativity, collaboration, knowledge sharing and innovation for organisations. For example, informal conversations held around the water cooler by employees to share ideas and information provide great opportunities for knowledge and information sharing which is vital for innovation. This reinforces the importance for managers, and organisations alike, to understand the potential impacts of remote working on innovation.

Furthermore, these studies highlight that a change in the context, coordination patterns or environment of collaborators i.e., high degrees of virtuality, may result in changes in the

collaboration patterns of teams which influence innovative behaviours (negatively or positively). This begins to highlight a gap in the understanding of managers of the effects of virtualisation on collaboration for virtual teams, and how to promote those impacts that will positively promote collaboration within virtual teams.

1.3.2. Consequences of heightened virtualisation for creativity and innovation

Acar et al. (2019) confirm the importance of creativity and innovation in generating a sustained competitive advantage for organisations. That is, the ability of an organisation to extract ideas and implement them is a competitive advantage (Anderson et al., 2014). They define creativity in the context of a team as " the generation of novel and useful outcomes" (Acar et al., 2019, p. 97) - ideas. These ideas are then intentionally adopted and implemented as new products, processes, and services (innovation). This definition provides insight into the interdependency between creativity within teams (generation of new ideas) and innovation (implementation of ideas), a lens which also differentiates between the two constructs.

For academia, the relationships between creativity and innovation have been well-researched with theories including the *Componential Theory of Organizational Creativity* and Innovation, and the *Interactionist Perspective of Organizational Creativity* which is used to explain the relationships between creativity and innovation within individuals and teams in the organisation (Anderson et al., 2014). It is argued that the key take-out of these theories is that work environments affect collaboration, creativity and innovation across factors like motivation, expertise, resources, managerial practice, social influence, physical environment and others. This suggests that a rapid change in the work environment brought about by the quick adoption and higher virtuality of virtual work may influence creativity and innovation in virtual teams. In addition, George et al. (2020) argue that the creativity and innovation of virtual teams is scantily researched, suggesting that further enquiry into its consequences is required. This presents a gap in the literature on collaboration, creativity and innovation amongst virtual teams.

1.3.3. Consequences for organisations

While the primary focus of the study is the implications of high virtuality for individuals and teams, these are expected to influence organisational outcomes. Furthermore, it is argued that most of the work in organisations is executed through teams, which are ubiquitous across organisations, as the smallest constituents of organisations (Driskell et al., 2018). So, understanding the impact and outcomes of teams and team work will have consequences for organisations (Driskell et al., 2018). For Academia, understanding the organisation's methods

of sharing knowledge at a team level and how this translates into organisational learning used in decision-making remains topical due to its influence on firm outcomes including developing and sustaining a competitive advantage (Oyemomi et al., 2019). This is supported by Lin, Chiu and Liu (2019) who argue that due to the rise in geographically dispersed teams who coordinate using technology to complete organisational tasks - highly virtual teams have notably become critical for generating organisational value and delivering a sustained competitive advantage.

In addition, Oyemomi et al. (2019) state that knowledge sharing and organisational learning encourages innovation within organisations, enabling them to sustain a competitive advantage over competitors. Furthermore, they find that an enabling organisational culture can encourage further organisational learning, and improve firm performance (Oyemomi et al., 2019). Thus, understanding the implications of high virtuality of teams for collaboration may have some academic implications for, (i) organisations utilising the benefits of team virtual work to promote sustained competitive advantage as well as (ii) contributions to theories of organisational learning.

1.3.4. Specific focus on Knowledge Workers

To further explore this impact, the study will have a keen focus on knowledge workers and how the identified constructs of virtuality, collaboration, creativity, and innovation in virtual teams look like for this population. This is firstly due to the higher prevalence of virtual work among knowledge workers, compared to other organisational employees – where knowledge workers are classified as those in information technology, data, professionals, creatives and consultants - have also increased in geographic relocation, necessitating the adoption of high degrees of virtuality (Issahaka & Lines, 2021; Jain & Huang, 2020). Secondly, knowledge work relies on a higher need for collaboration, creativity, and innovation as it focuses on information processing, problem-solving, research and development and implementation. This involves executing varied tasks compared to operationally routine work (Issahaka & Lines, 2021). It is also argued that knowledge work is vital for innovation (Tsai, 2018). In addition, Issahaka and Lines (2021) have suggested that knowledge workers have received additional focus from management scholars due to the global shifts in work towards utilising intellectual capability – largely derived from knowledge workers - to sustain competitive advantage for organisations. And so, understanding how to promote the enhanced generation of novel ideas has become vital for organisations and managers alike to understand.

1.4. Research questions

The constructs of collaboration, creativity and innovation in teams, are well-researched in literature due to their importance for firm outcomes (Acar et al., 2019; Anderson et al., 2014; Jain & Huang, 2020). However, the influence of virtualisation on this relationship is scantily understood across management, innovation and technology research, with George et al (2020) requesting further research. Furthermore, the implications for knowledge workers which are critical for innovation within organisations present a gap in the literature for academia and managers alike (Jain & Huang, 2020). This study seeks to accept this invitation for further study by George et al (2020) and explores the below main research question:

How will high degrees of virtuality impact the collaboration patterns, group creativity and innovation of virtual teams – specifically comprised of knowledge workers?

Based on the existing literature focused on the main research question of the study, five sub-level questions are also positioned to refine the main question:

i. How will high degrees of virtuality impact the collaboration patterns (across coordination, cooperation and knowledge sharing) of virtual teams?
ii. How can managers sustain the positive benefits of collaboration previously evidenced in F2F teams, within highly virtual teams?
iii. How will high levels of virtuality impact the generation of novel ideas (creativity) in virtual teams?
iv. How will high virtuality impact the implementation of ideas (innovation) in virtual teams?
v. How can organisations maintain or improve the positive benefits of collaboration and creativity within teams that were predominately F2F before adopting higher levels of virtuality?

1.5. The purpose of the research

This section concludes this chapter by defining the purpose of the study. The purpose of this study is to understand the consequences of the increased adoption of virtual work on the collaboration patterns, group-level creativity and innovation behaviours of virtual teams. This is expected to contribute to the academic literature on virtual teams and provide insights for management practitioners on how to maintain and promote these constructs which are vital for maintaining a competitive advantage (George et al., 2020).

Chapter 2: Theory and literature review

2.1. Introduction

The chapter considers the relevant academic literature related to remote work, virtuality, collaboration, creativity, innovation, team creativity, team innovation and other literature relevant to the study. This chapter follows Chapter one by supporting the need for the study.

The chapter will begin with a short background on Virtual work discussing its history, and how recent context like relevance to the study. We will then proceed to first discuss the shift to heightened virtuality of work before we explore the literature on its impacts on collaboration, creativity and innovation of virtual teams separately. The study will then consider the literature on the implications for organisations. Research sub-questions that the study seeks to explore will be introduced after each relevant discussion of literature. Finally, the chapter will conclude with a proposed research model, followed by a brief conclusion of the chapter.

2.2. Virtual Work

In this section, the study considers the background of virtual work, defining it and investigating its origins and how it has evolved overtime. The study then considers the literature on how virtually has increased to have various degrees, depending on factors including geographic dispersion and the proportion of virtual engagements. The section concludes by discussing its relevance for virtual teams.

2.2.1. Virtualisation

Literature defines virtualisation as the use of technology by “geographically dispersed teams working interdependently to communicate and collaborate across time and space”(Choi & Cho, 2019, p. 1). As defined in the previous chapter, it includes telework (also discussed as remote work) and extends to the constructs of Work From Home (WFH) and Work From Anywhere (WFA) which represent sub-themes of virtual work. It incorporates employees that are geographically dispersed and those who interchange between remote and traditional workspaces - blended work (Kniffin et al., 2021). Due to its relevance for employees, teams, workplace dynamics and implications for mangers and organisations, it has found prominence in Psychology and Management studies.

According to Das et al. (2021), virtualisation of work is not a new concept and has scaled with the proliferation of telecommunication technologies – especially for knowledge and information workers, whose roles don’t require physical engagement.

Early literature on virtualisation and virtual teams has mainly focussed on describing virtual adoption through a binary lens of only virtual or only F2F teams (Mak & Kozlowski, 2019). However, recent scholars have begun to introduce the concept of virtuality, representing the level to which teams are virtual as a continuum between only virtual to predominately F2F teams (Hoch & Kozlowski, 2014; Mak & Kozlowski, 2019). This is in line with acknowledging the proliferation in the use of technology (email, communication and the like), even by those teams that interact largely F2F, thus recognising that most teams have elements of virtual interactions but are differentiated by the level of use and engagement. Kniffin et al. (2020), state that measures for virtuality have evolved to include multiple dimensions including the level of geographic dispersion (distance, proportion of team, and others), the proportion of virtual engagement and electronic communication (including nuances between synchronous and asynchronous), and cultural differences. In this study, it is argued that the recent implementation of WFH and WFA triggered by the COVID-19 pandemic, where teams are highly dispersed (limited F2F interactions) and only use digital means of communication (software applications like Microsoft Teams, Zoom and similar) represents a high degree of team virtuality and its potential consequences for teams should be investigated further (George et al., 2020; Kniffin et al., 2021). In further understanding the impacts of high levels of virtuality, we consider previous literature including that of telework and its impact on virtual teams– a version of virtual work with lesser degrees of virtuality (employees who work virtually and F2F)

Earlier research exists that investigates the positive benefits of telework for society (reduced traffic, traffic congestion and pollution), organisations (access to a wider pool of recruits, retention, employee productivity and performance and lower office space costs)(Bloom, Liang, Roberts, & Ying, 2015), and employees (reduced commute time and costs, improved wellness, satisfaction, work-life balance)(Greer & Payne, 2014). Furthermore, there is literature that supports the view that some employees prefer remote work showing improved levels of productivity when compared to traditional office-based employees (Bloom et al., 2015). A recent study, investigating the impact of geographic flexibility brought about through WFA, on employee productivity, found that some workers found greater utility by being able to relocate to other geographic locations, which translated to further productivity increases, above those simply provided by WFH (Choudhury et al., 2021). This suggests that there is some positive influence of higher degrees virtuality of virtual work on firm and employee outcomes.

However, despite a large initial body of knowledge on the positive outcomes of virtual work, Greer and Pyne (2014), in their study *Overcoming Telework Challenges,* found that there were challenges related to telework including lack of F2F interaction and communication, impacts

on team and collaboration activities, managing performance, and suitability of the home environment for work tasks and employee wellbeing. These challenges are also reaffirmed by Kniffin et al (2021), citing a lack of communication and disproportionate escalation of team problems compared to traditional F2F teams. They proposed that organisations implementing virtual work required a shift in individual and organisational culture, training for managers and changes in processes and procedures to overcome challenges brought on by virtual work adoption(Greer & Payne, 2014; Larson et al., 2017). This research begins to shed light on the view of the study that the rapid adoption of higher degrees of virtual work may have consequences for virtual teams for coordination, collaboration, creativity and innovation.

In addition, research has previously established that collaboration and information exchange are key enablers of creativity and innovation (Choudhury et al., 2021). Furthermore, Jain and Haung (2020) state that empirical studies support the view that the performance of knowledge workers for group-related activities, like complex problem-solving, idea generation or developing valuable innovations requires collaboration (Jain & Huang, 2020). A view that is supported by George et al. (2020), that F2F interactions have a positive influence on groupthink and creativity. This chapter now discussed the potential consequences of heightened levels of virtual work on the collaboration behaviours, group creativity and innovation behaviours of virtual teams.

Management Studies have shown that collaboration – especially between knowledge workers (like scientists) – has positive benefits for innovation(Jain & Huang, 2020). These benefits are derived from the ability of workers to effectively coordinate activities, share knowledge, rapidly prototype and build on ideas (creativity) and develop new links between old and new collaborators to deliver innovations(Jain & Huang, 2020). Yet, Jain and Huang (2020) find that the effectiveness of collaboration to promote innovation can be impacted by the physical relocation of collaborators, where changes in context and how team members relate, may adversely influence the value of innovations generated. While their study focused mainly on the physical relocation of collaborators, another study focussing on understanding the conditions that affect collaboration specifically within virtual teams - looking at trust - found that promoting collaborative behaviours in virtual teams presents a challenge due to the way virtual teams develop trust as compared to F2F interacting teams(Choi & Cho, 2019). There is also research contradicting this, which highlights the disadvantages of virtual teams which include reduced levels of commitment toward achieving outcomes, team harmony, poor cooperation levels and reduced work satisfaction (Hoch & Kozlowski, 2014). This provides insight that, while there exist positive benefits for virtualisation, there are potentially negative

outcomes – and any positive benefits to collaboration may require different individual and team influences to derive similar benefits as those that interact F2F.

2.3. Consequences for collaboration

Choi and Cho (2019), define collaboration as “a process in which two or more parties work closely with each other to achieve mutually beneficial outcomes” (p. 306). They posit that collaboration is a multi-dimensional concept related to team behaviours and should be evaluated in three related aspects, namely: i) coordination; ii) cooperation; iii) and information exchange (Choi & Cho, 2019). The importance of collaboration and knowledge exchange is supported by the Knowledge-based-view of teams – a theory derived from the Resource-Based View (RBV) – which argues that the main function of a team is to coordinate, create and apply knowledge (Lin et al., 2019). Furthermore, it argues that knowledge can be considered a key resource that can be used to derive a competitive advantage for the organisation(Lin et al., 2019), thus making its exchange within teams critical for managers and academia alike. The three core dimensions of collaboration are now discussed further.

2.3.1. Coordination

Driskell et al. (2018) define coordination in teams as the arrangement of independent actions within teams to achieve team goals(Driskell et al., 2018). These include both sequencing and timing of actions/activities, sequencing delivery of tasks, and linking team member resources to tasks to deliver shared goals (Driskell et al., 2018). Virtual work has provided teams with an improved ability to coordinate engagements enabling more deliberate and planned engagements (Yang et al., 2022). They also posit that at the height of virtual work brought on by COVID-19, employees were spending more time communicating through email, instead of formalised meetings (Yang et al., 2022). In addition, Jarvenpaa and Valikanga (2020), furthers this view, having found that employees that had worked virtually, using mainly asynchronous communication means had improved their social time and also spent more time reflecting on their contributions during communication responses, which presented more distinct contributions. However, other studies have shown that there are limited informal and spontaneous interactions with indirect team members (other colleagues within the organisation), which is necessary to acquire new information for outcomes like creativity and innovation (Yang et al., 2022). Furthermore, In a study focusing on virtual team performance, utilising social exchange theory, it was determined that virtual teams require incentivisation as a motivation to coordinate and collaborate (Lin et al., 2019). Highlighting how managers may require different actions to maintain or promote the benefits of coordination and collaboration.

This also suggests a potential shift in the social contracting of virtual teams to more of a transactional relationship exchange (Lin et al., 2019).

2.3.2. Cooperation

Cooperation refers to the willingness of team members to participate in the completion of interdependent tasks (Choi & Cho, 2019). Choi and Cho (2019) also found that cooperation had a significant influence on the relationship between trust in virtual teams and knowledge sharing. That is, a focus on promoting cooperation in virtual teams would improve trust, and knowledge sharing within virtual teams. Jiang and Chen (2018), also support this argument that cooperation is vital for the third dimension of collaboration, arguing that group cooperation is vital for knowledge sharing to be continuous and reliable. They further stated that it is important that leaders embed this as an integrated norm of the team to continue to reap the benefits of collaboration in virtual teams (Jiang & Chen, 2018).

2.3.3. Information sharing

Information sharing (knowledge sharing) was proposed as the third dimension of collaboration and refers to the level to which knowledge is combined and distributed to team members to complete tasks (Choi & Cho, 2019). This includes the ability to communicate formally and informally, and the richness of the communication, including the use of non-verbal cues, which are important for the communication of F2F teams (Greer & Payne, 2014). In addition, Asatiani and Penttinen (2019), argue that organisations with highly virtual teams have formalised communication management, which is less natural and presents inefficiencies for information sharing. Recent literature found that the shift to organisation-wide remote work driven by COVID-19, resulted in employees spending more time engaging with collaborators which whom they had strong previous ties (driven by trust) – these types of collaborators were found to be beneficial for information transfer (Yang et al., 2022). However, this also meant employees spent less time collaborating with new collaborators with reduced ties, which is suggested to provide facilitate the information sharing of new information (Yang et al., 2022). It has been previously established that new information is vital for the generation of novel ideas (creativity) (Choudhury et al., 2021). The literature suggests that knowledge sharing and collaboration within virtual teams remain critical for an organisation's competitive advantage. In addition, the way collaboration occurs in highly virtual teams may be impacted by higher virtuality brought on by COVID-19 and managers may require different strategies to promote or maintain collaboration behaviours. This then presents the first two sub-questions of the study, namely:

(i) How will high degrees of virtuality impact the collaboration patterns (across coordination, cooperation and knowledge sharing) of virtual teams?

(ii) How can managers sustain the positive benefits of collaboration previously evidenced in F2F teams, within highly virtual teams?

Due to the importance of collaboration for creativity, we now explore the impact of high virtuality on the creativity of virtual teams.

2.4. Consequences of high virtuality on creativity and innovation

The generation of novel ideas and the implementation thereof (products, processes), supported by knowledge sharing and collaboration remains a critical function for employees of organisations in sustaining a competitive advantage (Acar et al., 2019). In this section, we discuss the constructs of idea generation(creativity) and implementation(innovation) within groups (or teams) to derive business benefit (innovation as the outcome) within the same sub-headings due to their close relation. This interdependency is also highlighted in the literature (Acar et al., 2019; Anderson et al., 2014; Hughes et al., 2018). However, as discussed in chapter one, based on recent literature, creativity can be considered as the generation of novel and useful ideas, while innovation is largely discussed as the process and implementation thereof (Hughes et al., 2018). This definition will be used for the study as it seeks to focus on creativity and innovation specifically within groups and teams and their ability to ability to generate novel ideas and implement them.

Lee et al. (2019) define group creative processes as “members working together in such a manner that they link ideas from multiple sources, delve into unknown areas to find better or unique approaches to a problem, or seek out novel ways of performing a task” (p. 826). In addition, this creative process is said to be a prerequisite for group innovation (Lee et al., 2019). Lee et al. (2019), investigating the role of HR systems in the creative process and group creativity, posit that the attitude of individual contributors within groups during the creative process played a prominent role in information sharing, willingness to problem-solve and implement initiatives for group creativity. This raises further questions about the extent to which individual attitudes within groups towards virtual work, influence the group's creative process and group innovation.

In addition, the study considers a supplementary definition of creativity and innovation as defined by Jiang and Chen (2018). They define team innovation as “the intentional introduction and application of ideas, processes, products, or procedures that are new to the team and designed to be beneficial” (Jiang & Chen, 2018, p.4). They argue this definition articulates two important themes; first that the innovation process spans both the generation of ideas

(creativity) and the implementation thereof (Jiang & Chen, 2018), which recognises the interconnected relationship between creativity and innovation for the study. Furthermore, it recognises the role of the collective team, beyond the individual in innovation (Jiang & Chen, 2018). This context, then suggests that the impacts of heightened virtuality may differ, between the impacts of individuals when compared to the overall team impact.

In another study that evaluated the creativity and innovation of teams, by considering the constraints that promote or inhibit these constructs(Acar et al., 2019). These constraints are evaluated considering their impact on motivation (desire to engage with creative and innovative activities – attitudes), cognition (the process of creativity and innovation) and social (interactions between teams on creative and innovation activities) dimensions(Acar et al., 2019). Using constraints theory, they find that while process (procedural) constraints enable some focused interactions for teams to be creative and innovate by fostering processes for knowledge exchange, excessive rules diminish creativity and innovation (Acar et al., 2019). That is, the reduction or complete removal of informal processes to interact, brought on by moving large parts of the organisation to highly virtual work i.e. complete reduction in spontaneous conversations due to virtual work, may negatively influence creativity and innovation outcomes for organisations.

While there has been much research on team creativity and innovation, Thayer, Petruzzelli and McClurg (2018), synthesised six key dimensions that were critical for considering team innovation. These were namely: (1)composition and characteristics, (2) communication and knowledge integration, (3) cognition, (4)conflict, (5) creative leadership, and (6) context (climate and culture) (Thayer et al., 2018). We now consider some of these individually to understand the potential impact of heightened virtual work on these dimensions for team innovation.

2.4.1. Composition

Composition considers induvial level attributes (Thayer et al., 2018), qualities and behaviours that influence team innovation processes. These extend to knowledge, skill, ability and diversity within teams. They suggest that characteristics like openness, personality (extroversion), need for affiliation, self-acceptance, and creative self-efficacy are vital for idea generation and the creativity component of innovation (Thayer et al., 2018). In addition, the composition characteristic of diversity is argued as influential for the idea generation and implementation process within teams (Driskell et al., 2018; Larson et al., 2017). That is differences in individual attributes within the team. This is due to the importance of varying knowledge within teams to improve solutioning and themes like includes tenure, functional training and time within a team (Thayer et al., 2018). This is supported by Larson et al. (2017),

in their study of virtual work, who argue that there are specific individual characteristics and differences, that make some virtual workers more successful than others. For example, high levels of openness influenced virtual decision-making and encouraged virtual (highly virtuality) over in-person teams (low virtuality), which are critical for successful innovation (Larson et al., 2017). However, there exists some research that suggests that demographic diversity in work teams can be detrimental for group performance is some context (Burak, 2018). However, this is also contradicted by Ratzmann et al. (2018), who support the more conventional view that teams that have different backgrounds (function, culture and others) obtain inherent diversity which enables the finding of novel ideas more possible. Other characteristics included motivation disposition and cultural background (Larson et al., 2017). This suggests that composition and individual level characteristics were important the team creativity and innovation of highly virtual teams, with individuals with specific attributes influencing team innovation differently than others.

2.4.2. Cognition

Cognition discussed the process of acquiring knowledge by various means to facilitate creativity and innovation processes whereas team cognition refers to cognition that facilitates team innovation (Thayer et al., 2018). Furthermore, Larson, Makarius and Gibbs (2017), argued the urgent need for scholars to understand the cognitive processes of virtual workers, due to the recent scaling of virtual work. This includes how virtual intelligence is developed, cognitive processes associated with initiating work, and more importantly for this study, how does virtual work influence creative processes (Larson et al., 2017). This suggests that there may be limited understanding of the impact of virtual work on cognition processes for creativity and innovation.

Key cognition processes for innovation within teams include motivating processes (committing to innovative goals), reflexivity (systematic information processing activity reflecting on previous goals) and social cognition (learning through sense-making)(Ratzmann et al., 2018). While there exist multiple forms of team cognition, the cognition elements that allow teams to be more aligned, are grouped as shared mental models (SMMS) and Thayer et al. (2018), posit that these have positive benefits for creativity. However, there exists literature that suggests some of the shared mental models inhibit differing thoughts within teams resulting in reduced innovation.

2.4.3. Communication and knowledge integration

Similar to collaboration, the importance of communication for innovation is argued to be important and enables teams to exchange knowledge and ideas with each other(creative

process), which is covered by this dimension (Thayer et al., 2018). Furthermore, communication is argued to assist teams to expand existing knowledge by acquiring external and internal insight vital for team innovation, especially for knowledge activities (Jiang & Chen, 2018). Kozlowski and Chao (2018), posit that the rapid changes in the last twenty-five years in technology have significantly influenced the way people and teams communicate. Internet communication like chat and email has also introduced new methods in which teams interact socially to introduce (asynchronous and synchronous). They further argue that in response, organisations have executed large change in team based ways of work in order to support collaboration, problem solving and innovation(Kozlowski & Chao, 2018). The impacts of these rapid changes on teams (like increased virtuality) are less known, with research availability scant.(Kozlowski & Chao, 2018). However, there has been some research on some factors that influences communication in virtual team, for example, in their study of virtual work environments and organisation culture, Asatiani, Rossi and Penttinen (2021) found that differences in organisational culture across organisation, introduce issues for co-ordination resulting in ineffective communication. This was especially prevalent in highly virtual teams and organisations (Asatiani et al., 2021). This sheds light, that changes brought on by high virtuality within teams, may impact the communication and knowledge sharing within teams, which in turn would impact the creativity and innovation of teams.

In addition, Jarvenpaa and Valikangas (2020), using the notion of inner time defined as the “temporal capacity to reflect on actions, meanings and consequences over time” (p.566), and outer social time defined as “time spent with others” (p.566), to investigate the impact of rapid advancements in technology on collaborative creativity, also found that both time to think(inner time) and time to socialise (social time) may be significantly reduced with the increased advancement of digital technology. This provides insight that highly virtual teams may be negatively impacted by heightened virtuality as it related to collaboration and creativity.

2.4.4. Conflict

The fourth consideration raised for consideration is conflict, which discusses the disagreements within teams from matters related to the task (task conflict) or those that relate to the relationship with team members (relationship conflict) (Thayer et al., 2018). Thayer et al. (2018) posit that task-related conflict can result in positive outcomes for creativity and innovation. There exists research using theory related to Sense Making and Task Discourse in innovations, to explain how teams that engage in innovation tend to have conflict and challenge each other as part of the cognitive process of information sharing and motivational processes (Ratzmann et al., 2018). This enables them to make sense of ambiguous and often

complex problems associated with innovation tasks. Ratzmann et al. (2018), argue that this sense-making through discourse (challenging, questioning, and others) promotes a better understanding of the problem, increased creativity and facilitates innovation (Ratzmann et al., 2018). However, while there exist positive benefits for innovation from discourse and conflict, Thayer et al. (2018) argue that it is only effective if teams can manage it. Kniffin et al. (2020), posit that one of the implications of Covid-19 and heightened virtuality, is the lack of clarity on how to build and maintain trust remotely, especially for new team members, this provides further insight that research is required to understand how virtual teams can appropriately introduce and manage conflict and discourse as part of the creativity and innovation process.

2.4.5. Creative leadership

Creative leadership acknowledges the role of leadership in supporting team innovation, including how to support an environment for subordinates to participate in idea generation and implementation (Thayer et al., 2018). In a study investigating team innovation, by considering the effects of transformational leadership, they found that team innovation performance was improved by leaders delegating tasks and decision-making and forming clear expectations of co-operation by team members (Jiang & Chen, 2018). That is, the way leaders were able to adopt, promote and drive clear norms for cooperation including processes like knowledge sharing (internal sharing of knowledge amongst teams), would influence creativity and innovation(Jiang & Chen, 2018). Hoch and Kozlowski (2014) posited that there was academic consensus that virtual teams were more difficult to manage than face-to-face due to, (i) geographic dispersion resulting from lack of face-to-face engagement, (ii)asynchronous communication, (iii) difficulty in leaders performing traditional hierarchical tasks like motivating and effecting team dynamics. They argue that traditional hierarchical leadership (transformational leadership, Leader-Member exchange), needs to be complimented with structural support (reward systems, communication) and shared team leadership (cognitive team learning, affective team support) to maintain and drive team performance of virtual teams (Hoch & Kozlowski, 2014).

In addition, Lin, Chiu and Liu (2019) provide literature that argues that phycological fulfilment – which is the team belief of how organisations are keeping their commitments in exchange for team effort - and knowledge-orientated leadership – leadership that encourages knowledge management practice - are vital for virtual teaming to achieve success. In addition, the incentives that drive virtual team members are largely extrinsic and transaction, resulting in increased difficulty in driving and motivating team performance towards tasks like creativity

and innovation (Lin et al., 2019). This highlights the potential changes in leadership requirements in highly virtual teams, for supporting creativity and innovation.

Furthermore, the importance for leaders and organisations to support teams to solve ever more complex problems and innovate, by facilitating information-sharing, knowledge transfer and creativity, remains a key area of study due to its links to firm performance (Jiang & Chen, 2018). Traditional methods of encouraging innovation through elevating groupthink, design thinking, prototyping and the likes, have been highly premised on F2F interaction in traditional workspaces (Elsbach & Stigliani, 2018; George et al., 2020). Despite the importance of this knowledge and the large-scale shift to virtual work, there is limited understanding of the potential impacts of virtual work on innovation within teams(George et al., 2020)

Lastly, considerations around contextual leadership and its role in promoting creativity and innovation outcomes. Burak (2018), suggest that research on leadership that is influenced by situational(contextual) factors have been vast, for example, there exists research and theoretical models that shows how leadership behaviour can change in extreme environments (brought on by jolts, like COVID-19) and how that can influence organisation and team outcomes. With the high virtuality of teams presenting an increased change in the leadership context, this suggests that leadership may contribute positively or negatively to supporting innovation outcomes.

2.4.6. Context (climate and culture)

Context is discussed by considering climate and culture. Climate is defined as “the set of norms, attitudes, and expectations that individuals perceive to operate in a specific social context” (Thayer et al., 2018, p. 371). For innovation in teams, that includes vision, participant safety, goals and backing for innovation (Thayer et al., 2018). Tu et al. (2019), posit that the psychological safety climate, which is defined as “the characteristics of an environment where individuals are free of the risk associated with proposing new solutions, challenging the status quo and behaving innovatively” (p. 552), influences both individual and team creativity. In addition, the psychological safety climate provides a mediating role between ethical leadership and team-level creativity, by providing role clarity, interpersonal trust, and heightened freedom to express individuality and risk-taking (Tu et al., 2019). Furthermore, uncertainty reduction theory was used as a foundation to explain that team member who encounters uncertainty in their work lives, tend to search for external guides to model their behaviour, and thus a lack of psychological safety climate may result in members adopting behaviours that impede team objectives like creativity and innovation (Tu et al., 2019). Earlier literature has established the challenges in communication and building team interpersonal relationships in highly virtual

teams (Choudhury et al., 2021; Felstead & Henseke, 2017; Hoch & Kozlowski, 2014), which suggests that there may be implications for creativity and innovation which are depended on psychological safety for the sharing and integrating of knowledge. In addition, Kniffin et al (2020), argue that high virtuality of work encourages more participation and engagement as physical signs of dominance (seniority, age, gender) are less evident in highly virtual engagements.

In addition, Driskell, Salas and Driskell (2019), posit that like all teams, virtual teams need to develop positive relations, which can be achieved through interpersonal interactions within the group. They suggest that interpersonal relations need to be developed by encouraging cooperative behaviour, building team morale and pre-emptive conflict management(Driskell et al., 2018). Furthermore, they develop a model, that focuses on Affect management (management of emotions of togetherness within teams) to promote coordination, motivation and creativity within teams(Driskell et al., 2018). That is, to promote the willingness for collaborations to share information like new ideas It is suggested that teams should promote affect management through structured activities like team building, review sessions, informal engagement and open conflict resolution (Driskell et al., 2018). For highly virtual teams, establishing these interpersonal relations may be a challenge.

The other consideration within context and climate discusses the availability of resources provided by organisations to teams to fulfil creativity and innovation tasks. Guzman and Espejo (2019), state that resources are vital for employees' willingness to expend the required effort towards idea generation and implementation. Their study, investigating how voice behaviour relates to management innovation - which is the study of how employees "proactively share ideas that have the intent to improve the existing state of affairs" (Guzman and Espejo, 2018, p. 1) - Guzman and Espejo (2018), found that the concept of willingness to share ideas connected the of idea generation (voice) and idea implementation (innovation) by connecting the discussions between idea generation and idea selection. That is members' willingness to discuss and share ideas positively influenced the innovation process and promoted voice to improve innovation (Guzman & Espejo, 2019). For virtual teams, the ability to promote willingness to share ideas within teams to support innovation remains under-investigated, but vital for innovation processes. The study now considers the role of organisational culture within the context of the creativity and innovation of virtual teams.

Organisational culture is well-researched in strategy and management disciplines due to its influence on firm performance, innovation, employee performance and effectiveness (Meng & Berger, 2019). Thayer et al (2018), support this by acknowledging that organisational culture

is vital for supporting the norms, policies and procedures that are required to promote team innovation. According to Schein (1991), it relates to the basic norms and shared assumptions by an organisation for approaching problem-solving. Historically, norms and assumptions were considered as the two core themes for defining theories for organisational culture (Schein, 1991), but its definition has further expanded to include characteristics of shared learning and knowledge transfer to new members (Meng & Berger, 2019; Schein, 2010) – as presented in this paper's introduction. In addition, Schein (2010), presents the definition of organisational culture using a three-level model for organisational culture with three levels, namely: Artifacts (signs and symbols), Espoused Beliefs and Values (shared values), and Underlying Assumptions. These levels are discussed below.

The first level of his organisational culture model describes Artifacts, which relate to the “visible organisational structures and processes” (Schein, 2010, p. 26) and includes elements like buildings, language, stories and symbolic rituals. Spicer (2020) argues that the well-known symbols of most organisational cultures have changed due to remote work (increased virtuality) brought about through environment jolts like Covid-19. In addition, in-personal cultural rituals in teams for knowledge sharing have been replaced with digital interactions through technologies like Microsoft Teams, Zoom and similar (Spicer, 2020). Schein (2010) himself, states for example that workspace is a key symbol for conveying organisational culture. That is, building size, location, office setup, where management is located, distance between people, and others, contribute highly to the underlying assumptions of organisational culture. Spicer (2020) further proposes that rapid changes due to environmental jolts (Covid-19, financial crisis, or similar) leads to a more conservative organisational culture (reduced risk taking, creativity and innovation), and abrupt management action to adapt to the new environment by changing the visible artefacts of culture without considerations for the other two levels. Spicer (2020) concludes that further research to explore the impact of changes in symbolic work on organisational culture is required to extend the body for managers and academia alike. There is also research from Elsbach and Stigliani (2018), in their study of *Design thinking and organisational culture*, that physical and in-person group interaction for prototyping, collaboration and creativity is vital for building a culture of knowledge sharing and innovation. They further posit that these interactions when implementing design thinking are important for transforming organisational culture to become more innovative and foster a competitive advantage of organisations(Elsbach & Stigliani, 2018). This suggests that a speedy shift to remote work, where some artefacts may become less or non-visible may influence or change organisational culture, with implications for the innovation and creativity of highly virtual teams.

Furthermore, focussing on the third level discusses Underlying Assumptions, which are defined as “unconscious and taken-for-granted conceptions and basic assumptions” (Duerr et al., 2018, p. 5127). Importantly, Schein (2010) suggests that that information on underlying assumption on organisational culture can only be gathered through observation. To this effect, research on virtual workforces suggests that organisations face a challenge in imparting organisational culture to new joiners, with virtual communications serving as insufficient to communicate key values like missions and visions (Nyberg et al., 2021). This is supported by Howard-Grenville (2020), who suggests that deliberate action needs to be taken by organisations to make culture visible for remote employees if it is to be maintained, as beliefs and assumptions become more visible through observed practice. This suggests that remote work may have some influence on an organisations ability to transfer its organisational culture, or parts thereof, for remote workers.

The discussed two of three levels of organisational culture, suggest that elevated virtuality of teams may influence organisational culture which is vital for supporting the norms, policies and procedures that are required to promote team innovation. Thayer et al. (2018), also highlights the the mediating role of organisational culture (collaborative conflict culture) for task conflict and innovation. That is, culture provides norms and beliefs that assist problem solving in virtual teams, by navigating healthly conflict that promotes creativity and innovation – discussed earlier in the chapter.

These dimensions suggest that there may be various implications for the critical dimensions of team innovation and creativity due to heightened virtuality of team, thus presenting two further points of enquiry for the study:

(iii) How will high levels of virtuality impact the generation of novel ideas (creativity) in virtual teams?

(iv) How will high virtuality impact the implementation of ideas (innovation) in virtual teams?

2.5. Implications for organisations

For organisations, innovation and creativity are core to them establishing competitive advantage. Acar, Tarakci and Knippenberg (2019), posit that understanding those elements and components that promote or dimmish this competitive advantage at an individual and team level is critical. Organisations also supply the resources, processes and structures that enable teams to generate novel ideas and implement them that results in competitive advantage (Resource based view) (Barney, 1991). Virtual teams are also reliant on this organisational support. Larson et al. (2017), argues that previous studies have established

that virtual teams are more successful if organisations provide appropriate technologies for virtual work. Addressing information technology challenges, ensuring technology is not outdated, and providing clear technological structures. Furthermore, the formalising of organisational processes is also deemed to be vital for virtual teams to succeed – with policies ensuring that virtual interactions are aligned to organisational culture, are clear and applied consistently and fairly (Larson et al., 2017).

However, in other research, Hitt, Arregle and Homes (2021), discuss the impacts of innovation in the context of environmental jolts like Covid-19. Using the literature also underpinned by the Resource-Based View, they explain how some firms during the pandemic period, have shifted focus from using valuable, rare, inimitable and non-substitutable (VRIO) resources to gain a competitive advantage, towards a focus on survival strategies (Hitt et al., 2021). It is said that this shift is strengthened by the threat-rigidity effect, which occurs when "firms respond to challenges by curtailing innovation and narrowing their focus to what has worked in the past" (Hitt, Arregle, & Holmes, 2021, p. 260). More importantly, they posit that firms need to focus on processes that enable them to reconfigure resources and capabilities as a source of competitive advantage, which largely sits within their employees and teams – concluding that processes to effect innovation in organisations were predominately site-based, and transferring these to predominately virtual environments successfully, requires future research (Hitt et al., 2021). This further reinforces the pressure on innovation in the context of high virtuality and supports the request for future research on how firms promote innovation and creativity in virtual teams. This presents the fifth sub-level question of the study:

(v) How can organisations maintain or improve the positive benefits of collaboration and creativity within teams that were predominately F2F before adopting higher levels of virtuality?

2.6. Conclusion

The chapter sought to discuss the prevailing literature on virtualization, heightened virtuality, the implications for team collaboration, the implications for creativity and the implications innovation. Each construct was considered separately with appropriate literature used to understand what had previously been established by academia and where the were knowledge gaps and opportunities for further research. Implications for organisation were also considered. Five research sub questions emerged from the literature as requiring further understanding for academia and will form the basis for the rest of the study. These supported the invitation from George et al. (2020), to explore the consequences of the increased adoption

of virtual work on the collaboration patterns, group-level creativity and the innovation behaviours of virtual teams.

Chapter 3: Research Questions

3.1. Introduction

This chapter follows on from the one, by concluding the research sub-questions that were investigated in the study. The literature discussed in chapter two focussed virtualisation, group creativity, team collaboration and innovation and supported the requirement for further research to explore the implications of the high virtuality within virtual teams for collaboration, creativity and innovation. This supported the invitation for future research first presented by George et al. (2020). In this chapter, a summary of the main research question and the identified sub-questions is provided:

The main research question of the study is to explore: ***How will high degrees of virtuality impact the collaboration patterns, group creativity and innovation of virtual teams – specifically comprised of knowledge workers.***

3.2. Research sub-questions

Through literature the following sub-questions were derived (see Appendix A – Consistency Matrix):

Sub-question 1: *How will high degrees of virtuality impact the collaboration patterns (across coordination, cooperation and knowledge sharing) of virtual teams?*

This question sought to gain clarity on how the dimensions of collaboration were changed with increased levels of virtual work for teams.

Sub-question 2*: How can managers sustain the positive benefits of collaboration previously evidenced in F2F teams, within highly virtual teams?*

This question sought to explore how managers could further improve the collaboration within virtual teams to replicate previous outcomes positive outcomes present in face-to-face engagements.

Sub-question 3: *How will high levels of virtuality impact the generation of novel ideas (creativity) in virtual teams?*

Sub-question three sought to explores the impact on the creativity of virtual teams, by defining creativity as the generation of novel ideas.

Sub-question 4: *How will high virtuality impact the implementation of ideas (innovation) in virtual teams?*

The question follows from the previous one, and sought to explore how the implementation of ideas has been impacted by virtual work.

Sub-question 5: *How can organisations maintain or improve the positive benefits of collaboration and creativity within teams that were predominately F2F before adopting higher levels of virtuality?*

Sub-question five sought to explore the recommendations for transferring outcomes of creativity and collaboration within F2Fteams to virtual teams to sustain innovation within organisations – consequences for organisations.

Chapter 4: Research Methodology

4.1. Introduction

In this chapter, the research design and research methodology for the study are discussed. Each methodology choice was defined, appropriately selected and substantiated, ensuring that it was appropriate for the study which sought to explore the consequences of high virtuality on the collaboration, creativity and innovation of virtual teams.

4.2. Research paradigm

In selecting an appropriate research paradigm (world view) and philosophy for the study, the ontological assumption - understanding the nature of reality - was considered first (Bell et al., 2019). Constructionism (also discussed as constructivism) was adopted as the ontological assumption for the study and is defined as "an ontological position which asserts that social phenomena and their meanings are continually being accomplished by social actors" (Bell, Bryman, & Harley, 2019, p. 18). This choice, aligned with the literature discussed in Chapter Two, suggest that the influences of high virtuality on collaboration, innovation and innovation are largely unexplored, requiring further exploration and observation due to the constantly evolving nature of the phenomenon (George et al., 2020). See Appendix A for the alignment of the study's sub-questions to the chosen literature. The research instrument, in turn, aligns the study's interview questions to sub-questions (see Appendix B).

Secondly, the epistemological and research philosophy was considered. Saunders and Lewis (2018) define a research philosophy as the "overall term that relates to the development of knowledge and the nature of that knowledge in relation to research" (p. 106). Despite several philosophies available for the study, the exploratory nature of the study warrants an epistemological view defined as interpretivism – which focus on "understanding the social world through an examination of the interaction of the world by its participants" (Bell, Bryman, & Harley, 2019, p. 34). This philosophy choice aligned with the constructs the study sought to explore, as it intended to understand the participant's point of view as it relates to virtual work, collaboration, creativity and innovation performance – aligned with Bell, Bryman and Harley's (2019) description of interpretivism research.

Thirdly, the research approach to theory development was inductive, where theory will be developed by analysing data and the discussions that occur (Saunders & Lewis, 2018). This again aligned with the ontological assumptions and epistemological philosophy of the study and was supported by the exploratory nature of the research questions. This alignment of ontology, epistemology and research questions is cited as one of two key considerations to ensure rigour in a study (methodological coherence) (Harley & Cornelissen, 2020).

4.3. Research Methodology and Design

The purpose of this study was to explore, thus adopting an exploratory research design to determine additional insights by exploring heightened virtuality within virtual teams in a context related to collaboration, creativity and innovation. Thus, a qualitative approach was selected. Mohajan (2018), states that "qualitative research is inductive in nature, and the researcher generally explores meanings and insights in a given situation" (p. 23). Creswell (2002) also notes that qualitative research has also been broadly accepted for social and behavioural sciences. In addition, the suggestions for future research on which the study was based, also suggested a qualitative method be considered to explore the research questions (George et al., 2020). This was supported by Yang et al. (2022), who suggest that the effects of virtual work should be further studied using qualitative research in line with the emergent process in which workers experience this phenomenon and to obtain further insights than those considered by quantitative methods. Thus, the combination of 1) alignment to the chosen philosophy; 2) the exploratory nature of the chosen methodology (qualitative research focuses on more depth in understanding); and 3) Its usefulness for behavioural studies which extend to the constructs and concepts of the study, make a qualitative methodology appropriate for the study. Next, considerations were made on the population/ setting, sampling methods, level, and unit of analysis for the study.

4.4. Population/ Setting

Saunders and Lewis (2018) define a population as "the complete set of group members" (p.138). For the study, the setting represents all organisations globally that employ knowledge workers and have implemented virtual work for at least some of their employees (individuals who participate in virtual work practices).

4.5. Unit of analysis

The unit of analysis is defined as "the person from which the researcher collects data" (Kumar, 2018, p. 70). Due to the study's quest to explore matters of collaboration, creativity and innovation specifically within groups (teams), it is appropriate that the study interview the individual participants of virtual teams, and those that are responsible for leading those virtual teams. These two categories of respondents would serve as a proxy for the team, with inputs assessed at a team level during data analysis – that is, a combination of Employees (specifically knowledge workers who are members of teams) and Managers of knowledge workers in virtual teams as defined in the population. This was in line with the current research on virtual work, collaboration, creativity and innovation, which spans employees (Nyberg et al., 2021), Human Resources (Lee et al., 2019) and Management (George et al., 2020). For

the study, knowledge workers are defined as professionals in knowledge-intensive roles (Issahaka & Lines, 2021). These included (but are not limited to) those in information technology, data, science, engineering, medicine, law, academia, creatives, consulting and similar.

4.6. Level of analysis

The level of analysis is defined as “the primary unit of measurement” (Bell et al., 2019, p. 71) Due to the study evaluating constructs that are at a team or group level within an organisation i.e., collaboration behaviours within teams, group creativity and innovation, the level of analysis for the study was the group or team within the organisation.

4.7. Sampling method and criteria

A sample is defined as “ the subgroup of all group members” (Saunders and Lewis, 2018, p. 138). The sampling method selected for the study was purposive sampling, which is defined as “the approach in which a random selection of sampling units within the segment of the population with the most information on the characteristic of interest” (Guarte & Barrios, 2006, p. 277). In line with the study's intent to select those participants who have experienced the phenomenon of high virtuality and were closely involved in virtual work, the study sought out the following participants who will be drawn from the researcher’s professional network:

(i) two participants per organisation employing knowledge workers who participated in virtual work, specifically:
(ii) one manager of a virtual team of knowledge workers within the organisation and one employee within a different virtual team of knowledge workers within the same organisation (the latter selected to avoid the potential for bias caused by manager and direct report respondent selection).
(iii) no specific focus on the organisation's industry will be considered during sampling.

This sampling approach was expected to provide insights into the constructs of the study, triangulating between teams (employee vs manager) and between organisations.

4.8. Sample size

Furthermore, Marshall, Cardon, Poddar and Fontenot (2013) argue the subjective nature of selecting an appropriate sample size influences rigour, however, they recommend between 15 and 30 participants for qualitative studies like this one or until saturation is reached – “when the researcher gathers data to the point of diminishing returns when nothing new is being added”(Marshall et al., 2013, p. 11). The study intended to interview 16 participants, across 8

organisations i.e. two participants per organisation in line with Marshall et al. (2013) recommendation. Participants were selected based on the researcher's professional network.

4.9. Sample frame

Aligned to the sample section 4.7, sampling method and criteria, table one below denotes the sample collected for the study. Furthermore. the sample size of each industry and organisation is aligned with the sample size discussed in section 4.8.

Table 1: Summary of participants for the study

Industry / Sector	Organisation	Respondent Position Description	No. of Respondents
Consulting	Organisation A	Virtual Team Manager: Junior Manager	1
		Virtual Team Member: Management Consultant	1
Banking	Organisation B	Virtual Team Manager: Head of Process Optimization	1
		Virtual Team Member: Investment Banking Transactor	1
Insurance	Organisation C	Virtual Team Manager: Product development Manager	1
		Virtual Team Member: Actuarial Analyst	1
Telecoms	Organisation E	Virtual Team Manager: PMO Head	1
		Virtual Team Member: Project Lead	1
Logistics	Organisation F	Virtual Team Manager: Business area manager	1
		Virtual Team Member: Engineer	1
Tourism	Organisation G	Virtual Team Manager: PMO Head	1
		Virtual Team Member: Business Analyst	1
Information Technology	Organisation H	Virtual Team Member: CIO	1
		Virtual Team Member: Developer	1
Healthcare	Organisation I	Virtual Team Manager: Project Management Head	1
		Virtual Team Member: No participant	1
		Total	**16**

A total sample of 15 of the 16 respondents was successfully included for the study. While efforts were made to complete the sample size of the study. The researcher failed find a second respondent for organisation H. This responded was expected to fulfil the role of team member (individual) within the described sample. Due to this failure considerations were made

on whether to exclude the lone participant in organisation H, however, due to saturation being established after 11 participants, the implications for the study in including the single respondent were deemed less significant. Boddy (2016), argues that saturation is the point that no additional new information or themes are observed in the data. That is, the single participant from H did not influence provide any new themes for the study and value in excluding them was reduced.

4.10. Research and measurement Instrument

The research instrument (method of data collection) for the study were semi-structured, in-depth face-to-face interviews with participants in line with the exploratory nature of the study – requiring deep insight (Cypress, 2018). This will be supported by an interview guide that includes open-ended semi-structured questions that explore the focus of the study, namely, explore how heightened virtuality impacts the collaboration, creativity and innovation of virtual teams.

The interview guide and questions are designed to probe and elicit rich insights from participants, rather than rigid shortened answers, in line with the exploratory nature of the study. See Appendix B for the interview guide.

Furthermore, the use of a pilot interviews to test the appropriateness of the instrument and questions i.e. are the questions clear and understandable, with a qualitative research expert (professor, or similar), provided the appropriate insight to ensure a productive gathering process.

First it provided the researcher insight on the expected length of time that the research would require when arranging time with potential participant. The interview lasted approximately thirty-five minutes, which indicated that participants who would not be able to avail at least thirty-five minutes for the interview, could not be considered for the study. Furthermore, it supported the improved framing of questions by the researcher, as it showcased which questions required better framing or additional context.

4.11. Data collection and analysis approach

Data for the study will be collected through face-to-face, semi-structured interviews where participants will be asked a set of pre-determined probing questions about the said phenomena in line with the interview guide. Creswell (2012) and Mohajan (2018) argue that this method of collection is well aligned with qualitative studies and is a common method of data collection for exploratory studies. Interviews are planned to last for between 30 and 45

minutes, with provision made for additional time should it be required. Each interview was recorded using a recording device (laptop) after prior consent has been obtained from each participant to conduct the recording. Participants were also be offered the opportunity to stop recordings and/or withdraw from the interview at any point during the interview. Written and verbal consent was required from each participant. In addition, an explanation was given on how confidentiality will be maintained during the study – including codifying participants' responses and password-protected data storage. Cypress (2018), states that informed consent and appropriate sampling are also key steps in managing ethical considerations for the study. Due to the current COVID-19 pandemic and geographic dispersion of participants – provision was made to conduct all of the interviews via virtual video through Microsoft Teams and Zoom based on participants' preferences and prevailing COVID restrictions when interviews are conducted. Similar protocols will be followed for virtual interviews as those conducted in person.

For analysis, the 15 interviews were transcribed and accessed for completeness by the researcher. Care was taking to remove any error in the transcription including any spelling and phrasing errors that were not appropriately captured by the Microsoft Teams transcribing solution. The raw transcriptions were uploaded into AtlasTi software, a qualitative data analysis software. Further correcting of errors was performed on the transcriptions in AtlastTI. First, key phrases were identified and coded for each transcript, and then iteratively recoded (first-order concepts and second-order concepts) to develop 120 code (first order). These were then further grouped considering naming through a combination of frequency or uniqueness of insight which resulted in 29 category groupings (second order codes). These were then aggregated into 11 themes that emerged for the three construct of the study. This thematic analysis was based on the Gioia et al. (2013) method of analysis and coding (Gioia et al., 2013). The detailed thematic analysis and coding process is described in chapter 5, section 5.3, labelled coding process. In addition Figure 1, depicts the process followed for thematic analysis of participants response.

4.12. Research quality and Rigour

Research quality and rigour for the study will be determined and mitigated using the trustworthiness criteria as suggested by Bell et al, (2019). It considers four dimensions to be considered, namely, (i) Credibility; (ii) Transferability; (iii) Dependability ;(iv) and Confirmability. These dimensions are now discussed in the context of the study.

First, the credibility of the study will be established using triangulation, which focuses on the use of varied sources and methods to obtain information (Creswell, 2012). For the study,

triangulation will be obtained through varying participants (Employees, Managers) and varying organisations. By limiting the number of participants per organisation to two, considering participants at different levels of the organisation, ensuring managers and individuals do not work in the same team, and lastly varying the industries in which the organisations operate, the heterogeneity of the data collected will provide improved ability to triangulate, ensuring the credibility of the study.

Transferability in qualitative research focuses on establishing depth instead then breath (Bell et al., 2019). That is, can the findings of the study be generalised to a different context. Hellstrom (2008), states that transferability is highly dependent on the judgement of the research and the ability to apply the insights to more than one context. They argue that transferability is better obtained by ensuring thick descriptions of the setting and assumptions in which the research was conducted (Hellström, 2008). To ensure appropriate levels of transferability are established in the study, through the richness of the discussion, the number of questions for the study will be reduced to provide participants with sufficient time to provide thick descriptions (richer responses). Furthermore, in selecting the organisations in which participants work, this will be varied to capture broad responses across multiple industries and regions for the constructs of the study gaining a large context in which insights can be applied to.

The third would be addressing dependability (trustworthiness of the study) (Bell et al., 2019). Initially, the collection and storage of data in an electronic password-protected environment will contribute to the dependability of the study. In addition, the testing of the interview guide and protocol during the pilot interview will ensure that the interview protocol does not affect the dependability of the study. Post data collection, the use of recordings and transcriptions to ensure that data collected during interviews is complete and accurate will be used in the study. Furthermore, transcriptions will be compared to field notes collected by the researcher to ensure accuracy.

Lastly, addressing confirmability, which deals with the researcher's bias and objectivity (Bell et al., 2019). This will be addressed by noting any bias that may occur during data gathering and disclosing these as part of the final report. Bias may occur during the defining of the research questions, compiling the interview guide, conducting the interviews and analysing and interpreting the results. This will be addressed by ensuring research questions are derived from literature, conducting a pilot interview to reduce any bias in the way questions are compiled, strict interview protocols followed when conducting the study, all interview questions posed to participants in a similar order and using the respondent’s data to derive results in line with protocols discussed in section 4.10. Furthermore, the use of direct verbatim quotes from

participants during the report write-ups and analysis further strengthens the confirmability of the study.

4.13. Ethical considerations

The ethical considerations for the study centre around maintaining the confidentiality of participants through informed consent (Cypress, 2018). The consent protocols are discussed in section 4.11 and are described in detail in the proforma Letter of Informed Consent which is provided as a separate attachment. Data collection and analysis protocols, as outlined in section 4.14, will ensure ethical breaches are limited. Furthermore, the methodology and interview protocols of the study will be evaluated by the Gibs Ethical Clearance committee before any data is collected to further manage potential breaches.

4.14. Data handling

The interviews will be video recorded using Microsoft teams and stored in a password-protected environment backed up on Google one drive (cloud storage) accessible only to the researcher. The recordings will then be transcribed utilising a transcription application, like Otter or similar, with care taken to compare transcription to the researcher's interview notes. In addition, the data will be stored electronically for a period of 10 years. The analysis will be performed using Atlas.Ti in accordance with the qualitative nature of the research. Aligned to section 4.9, sampling frame, organisations will be given generic names (i.e. Organisation A and Respondent A1), with no personally identifiable information included in the description and analysis of the document. This is to ensure both organisation and respondent confidentiality is maintained.

4.15. Limitations of the research design and methodology

The chapter concludes by considering the potential limitations of the study.

First, the research focuses on gaining insights on high virtuality on collaboration, creativity and innovation of virtual teams by interviewing employees and managers of virtual teams individually, taking care not to sample managers and individuals from the same team. While this is expected to provide appropriate insights for the study and limit bias of the sample, from a methodological perspective future research could consider conducting the study through focus groups where multiple members of the same virtual team are interviewed, or a case study of a few organisations considered. However, care needs to be taken to avoid any bias that may derive from team dynamics and groupthink in the same interview. This may provide more insights into the interactions between team members as it relates to constructs. In

addition, the time horizon in which the study is conducted may be further extended to a longitudinal study to observe behaviours over a more sustained period.

A further limitation of the study, it largely focuses on knowledge workers within virtual teams. Future research could consider the impact of high virtuality on other workers in the organisation, with research citing that organisations have extended virtual work to a wider group of employees(Bernstein et al., 2020).

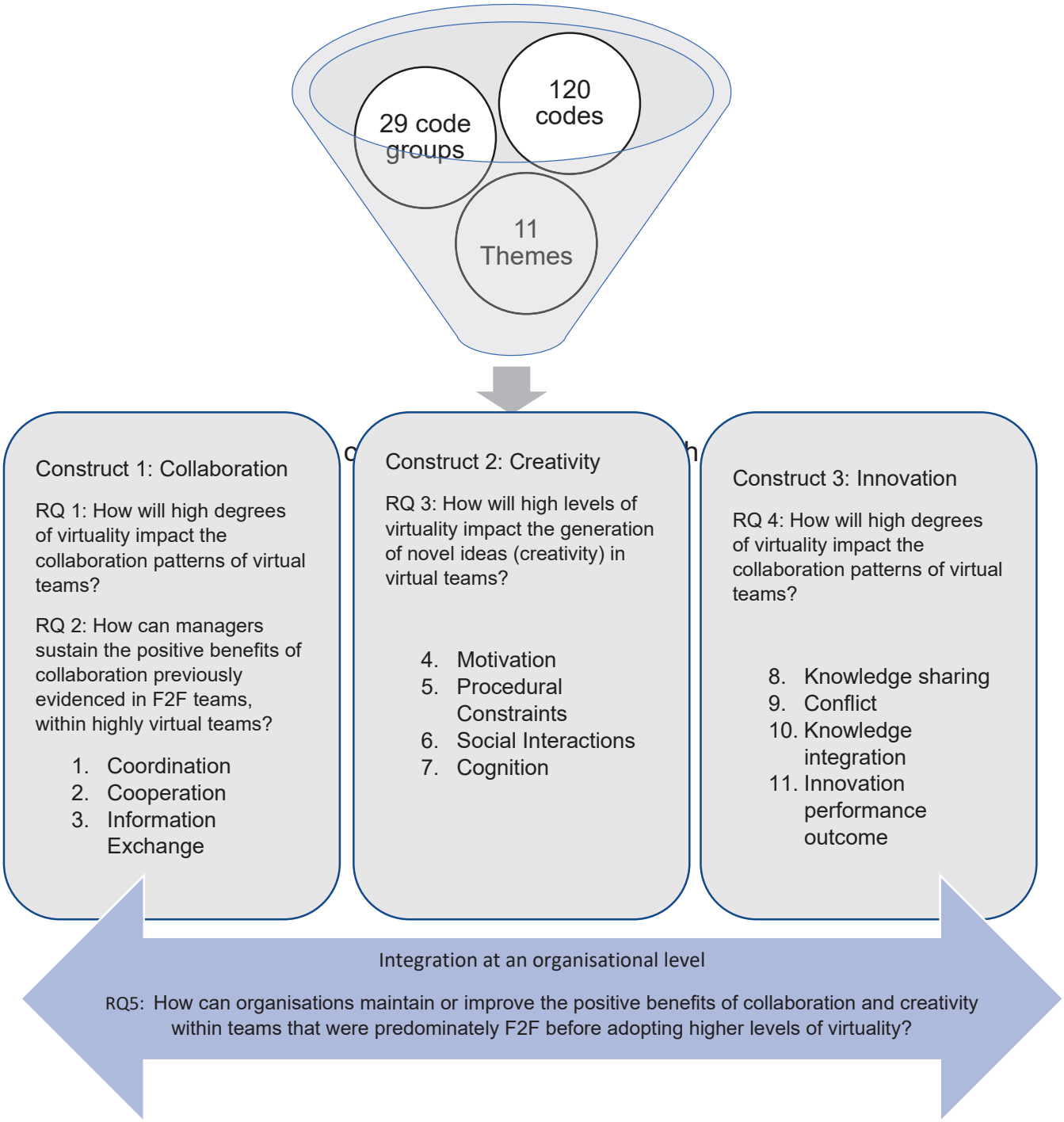
Chapter 5: Research Findings

5.1. Introduction

This chapter follows on from chapter four, research methodology, and presents the findings from the semi-structured in-depth interviews conducted for the study. In line with the focus of the study, participants responses and perceptions were solicited on the implications of virtual work on the collaboration, creativity, innovation of teams. Fifteen of the sixteen targeted participants were interviewed. This chapter begins with discussing the participants and groups in the study, then discusses the findings of the study based on the research questions of the study summarised in Chapter three. It then concludes with a summary of the findings. The below diagram depicts the process followed for the analysis of the study that will be discussed further in the chapter.

Figure 1 below, depicts the Inductive analysis process detailing thematic analysis from interviews the 15 interviews conducted.

Figure 1: Inductive Analysis process detailing thematic analysis from the 15 interviews



5.2. Interviewed participants

A total of 15 of the envisaged 16 participants were interviewed for the study. Participants had been selected based on interview list discussed in Chapter four and were knowledge workers who had experienced virtual work. Two groups of individuals were selected per organisation: 1) A participant who managed a virtual team, 2) participant within a virtual team. In addition, the two participants need not be in the same team. Furthermore, only one organisation was considered per industry to further enhance the heterogeneity of the sample and associated findings. Each respondent was allocated a participant identifier code based on the organisation and role in the team (Manager or Individual). For example, Virtual Team Manager Organisation, A (VTMA). For the study these identifier codes will be used to discuss each respondent going forward.

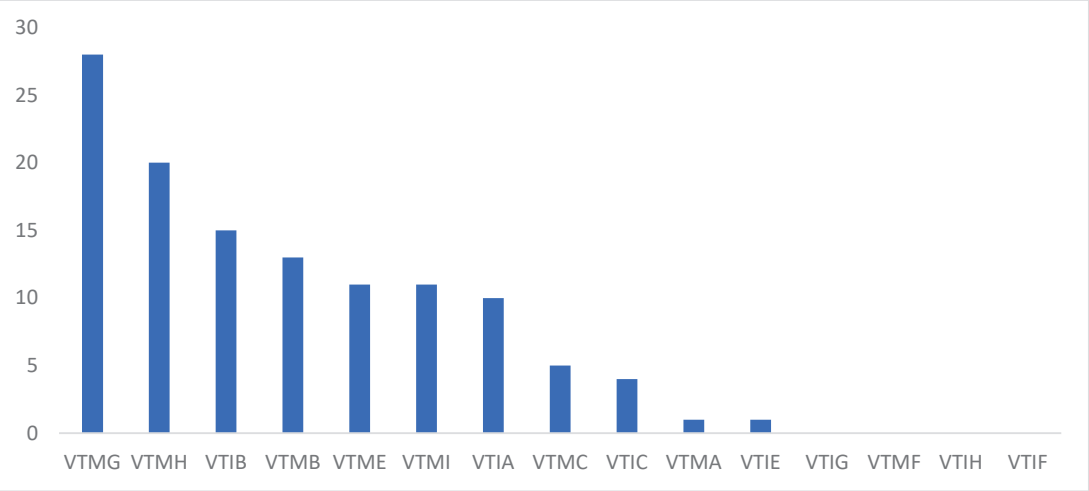
Table 2: Summary of the participants of the study

Industry / Sector	Organisation	Respondent Position Description	Respondent Identifier Code
Consulting	Organisation A	Virtual Team Manager: Junior Manager	VTMA
		Virtual Team Member: Management Consultant	VTIA
Banking	Organisation B	Virtual Team Manager: Head of Process Optimization	VTMB
		Virtual Team Member: Investment Banking Transactor	VTIB
Insurance	Organisation C	Virtual Team Manager: Product development Manager	VTMC
		Virtual Team Member: Actuarial Analyst	VTIC
Telecoms	Organisation E	Virtual Team Manager: PMO Head	VTME
		Virtual Team Member: Project Lead	VTIE
Logistics	Organisation F	Virtual Team Manager: Business area manager	VTMF
		Virtual Team Member: Engineer	VTIF
Tourism	Organisation G	Virtual Team Manager: PMO Head	VTMG
		Virtual Team Member: Business Analyst	VTIG
Information Technology	Organisation H	Virtual Team Member: CIO	VTMH
		Virtual Team Member: Developer	VTIH
Healthcare	Organisation I	Virtual Team Manager: Project Management Head	VTMI
		Virtual Team Member: Non-participant	VTII

The researcher failed to secure the second respondent for Organisation H. However, consideration was made to exclude participant VTII from the sample, but due to the size of

the sample collected and saturation having been achieved after 11 respondents, it was determined that the inclusion of participant VTHM responses would have a limited negative impact on the findings of the study.

Figure 2: Saturation Graph for study



Saturation was reached by the eleventh participant, but further interviews were conducted to ensure completeness of sample.

5.2.1. Diversity of participants

Participants represented various types of knowledge work including data, information technology, project management and process engineering. The participants also had various levels of experience in their respective roles including participants who had recently joined their respective organisations from institutions of higher learning.

This is my this is my first formal job after varsity (Participant VTIG)

it's been my first year in industry and I find coming from a degree where there isn't much collaboration with other, you know entities, it's very much like you do your work and you know you set your tasks up for yourself (Participant VTIC)

Other participants displayed extended tenure in engaging in virtual work

I have been involved with teams that are effectively virtual for the past 12 years. So, the concept of being virtual, in as much as in modern terms it is creating a sense of being a new term, but we have always dealt with geographically dispersed subordinates where virtual teams are just a natural way of doing things. (Participant VTMI)

So, I mean I've stayed within the same organization, but worked for two teams during this virtual age and the teams are quite different. Maybe it's because in the previous team I was there for longer, I was there for about three years, so I could run by myself a lot more. (Participant VTIB)

5.2.2. Degrees of Virtuality

The participants of the study demonstrated high levels of virtuality across the dimensions discussed in Chapter two, literature review, during the interviews. These dimensions included the level of geographic dispersion (distance and proportion of the team working virtual), proportion of virtual engagements, electronic communication (synchronous and asynchronous). Table 3 below evidences the participants levels of virtuality.

Table 3: Evidence of High Virtuality

Theme	Participant	Evidence of high virtuality
Geographic dispersion of team members	VTMA	*"So I mean like right now I'm on a two-week engagement thing and the leadership team I'm working with is in Morocco, my one associates is in Lagos and then it's me in South Africa. And then last year I did a study for a month with my client who was a banking client in the ground that we never met. I've never met anyone on the team."*
	VTIA	*"…it allows you to connect with people in a plethora of different jurisdictions and locations. Whereas historically [you]' would have looked for an expert, maybe locally, now I can call someone in the US and set up a meeting that works for us and we can try and solve those problems"*
	VTMI	*"So, at a personal, level I have been involved with teams that are effectively virtual for the past 12 years. So the concept of being virtual, in as much as in modern terms it's creating a sense of being a new term, but we have always dealt with geographically dispersed subordinates where virtual teams are just a natural way of doing things."*
Virtual communication	VTMC	*"E-mail is a questionable means of communication with tons of inefficiency and ineffectiveness versus something*

		like just using teams exclusively. So I think some people approached it like that, it works. There's the other part of it in that people would set up meetings to discuss things, to ask a question. I found myself within COVID having far more meetings than what I would have before COVID, and a lot of those meetings were ineffectively things, you know, when people book up 30 minutes, they feel the need to use 30 minutes in this virtual setting."
	VTMG	*"In our organization, specifically in my team , I have two people and when we are working online one of the things that I do is to allocate task by area of speciality. Even though some of the work that they do is similar, I try to separate those, but how I do it online is I do it in front of both of them so that the other one knows exactly what the other one is doing. This obviously started when COVID hit us, so we had to find ways to still work online and connect."*
Proportion of Virtual	VTIB	*I think [what] going virtual has done is actually enabled that sort of integration, it makes it easier to because everyone is virtual.*
	VTIE	*"I mean, we've been on a virtual wall since COVID started, so we've seen the impact that it actually has on working away from the office, not necessarily been designated at the actual desk."*
	VTMA	*" I feel like what my experience of it [was] when it started was hard because you would just be on zoom calls the whole day. So, what that means is you've been [in] meetings and only at like five o'clock or six o'clock will we actually have space and time to do your work."*
	VTMH	*"I like what organizations have done in that we've come from two years of no contact at all and we're now looking back and saying, hang on it it's good to work remotely, but there's benefit in us coming together."*

It was also noted that, most participants still participated in some level of in-person virtual work (blended work arrangements), which included times of lower virtuality. For example, participant VTMH stated:

it works when you find the sweet spot between virtual and FaceTime (Participant VTMH)

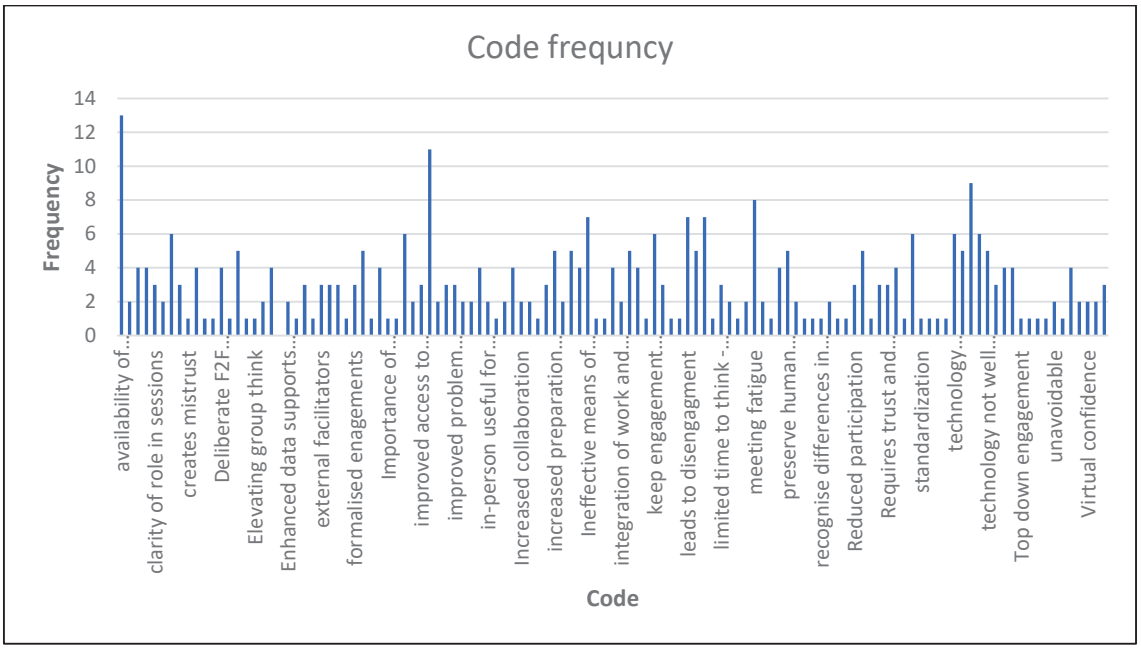
5.3. Coding process

Using purposive snowball sampling, a total of 15 semi-structured interviews were conducted through online Microsoft teams interviews. The interviews were recorded and subsequently transcribed using Microsoft teams' transcription services, with care taken to correct any transcriptions errors to ensure that they accurately reflected the responses of each participant. Once transcriptions were accurately captured, they were uploaded to AtlasTi, a thematic analysis software used for the analysis of qualitative data. Key phrases were summarised using codes. The codes were then tallied to determine the frequency to which they were discussed by respondents, with similar codes merged to ensure that similar themes were discussed together. The initial codes identified totalled 140, and post review and merging of similar codes, these were reduced to 119.

The graph below summarised the codes used in the study and their associated frequency count.

The graph below summarised the codes used in the study and their associated frequency count.

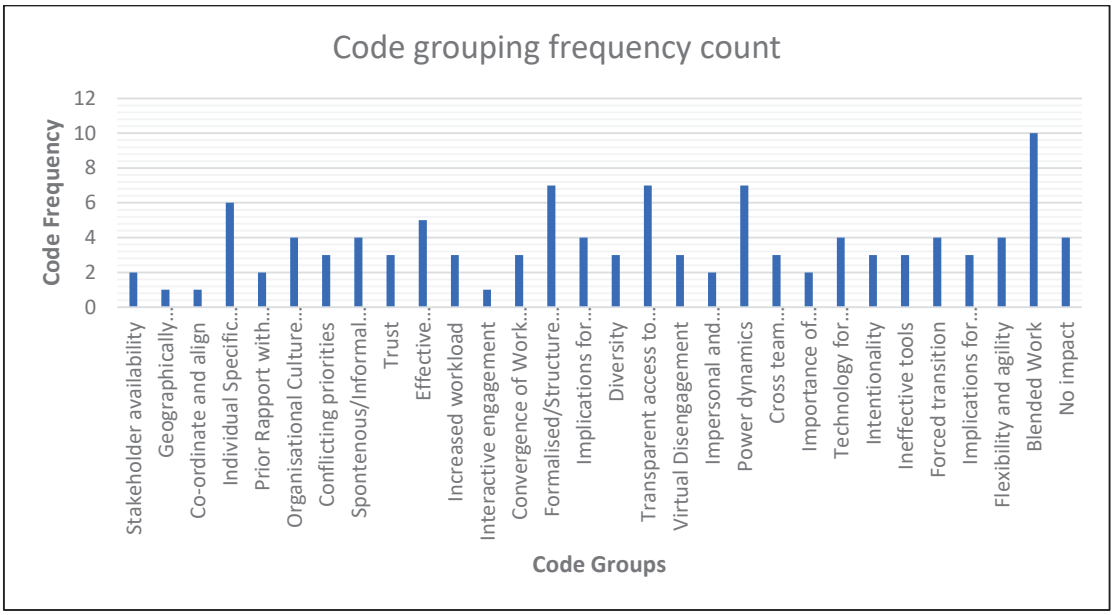
Figure 3:Distribution of Codes



Once coding was concluded, codes were combined into similar groups based on the frequency in which they were discussed by respondents. The highest frequency codes provided the foundation for each group, with smaller frequency codes then included into the higher category groups based on appropriateness of themes. Care was taken to ensure that codes that had lower frequency counts but did not align with larger code groups would be included in separate groups to preserve minority views that were not shared by most respondents. A total of 29 groups emerged from the thematic analysis process.

The graph below summarised the codes and the associated groups that were determined.

Figure 4: Distribution of Code groupings



The codes groups that demonstrated the highest frequency were then grouped and considered to be primary themes that emerged for the study through a deductive process.

The table below highlights the key code groupings generated, showcasing the two groups interviewed in the study. The highlighted groupings showcase the larger discrepancies in mentions compared to other groups, with green showing less severe discrepancies, and orange show extreme discrepancies – one group having no respondents within the category.

Table 4: Split of Code groupings by participant groups

Code Groupings	Individuals	Managers
Blended Work	14%	86%
Co-ordinate and align	50%	50%
Conflicting priorities	83%	17%
Convergence of Work and Personal	0%	100%
Cross team collaboration	50%	50%
Effective communication	29%	71%
effective tools	33%	67%
Flexibility and agility	14%	86%
Forced transition	11%	89%
Formalised/Structured Processes & Procedures for idea generation	35%	65%
Geographically dispersed collaboration	45%	55%

Impersonal and transactional	22%	78%
Implications for Problem Solving	20%	80%
Importance of preparation	13%	88%
Increased workload	38%	63%
Individual Specific Influence	50%	50%
Intentionality	43%	57%
Interactive engagement	31%	69%
No impact	0%	100%
Organisational Culture and Rituals	20%	80%
Power dynamics	47%	53%
Prior Rapport with contributors	100%	0%
Processes & Procedures for decision making	50%	50%
Spontaneous/Informal Engagements	69%	31%
Stakeholder availability	57%	43%
Technology for problem solving	20%	80%
Transparent access to knowledge	21%	79%
Trust	29%	71%
Virtual Disengagement	38%	62%

The findings are structured in line with the research questions and key constructs of the study as discussed in Chapter 3.

5.4. Construct 1: Research findings on the Implications of high virtuality on Collaboration of Virtual Teams

The first construct of the study related to the collaboration of virtual teams. This was investigated through two research question:

RQ 1: *How will high degrees of virtuality impact the collaboration patterns (across coordination, cooperation and knowledge sharing) of virtual teams?*

RQ 2: *How can managers sustain the positive benefits of collaboration previously evidenced in F2F teams, within highly virtual teams?*

Participants were asked five questions which related to this construct and the research questions focussing largely on i) how work was allocated, ii) decision making in virtual teams, iii) the use of technology, and iv) engagement with new collaborators. The last question sought to solicit insight on, v) what could be done by teams to improve collaboration, in line with RQ2.

The outcomes of these questions resulted in three themes that emerged that impacted the key dimensions of collaboration, namely 1) Co-ordination, 2) Co-operation, 3) Information Exchange. These will will now be discussed.

5.4.1. Co-ordination:

Co-ordination focussed on the ability for participants to gain access to collaborators and included responses related to the availability of stakeholders, access to geographically disperse collaborators and the effectiveness of the use of technology in facilitating collaboration through co-ordinated engagements. Table 5 below, summarises the codes and groupings for co-ordination.

Table 5: Summary of code groupings for coordination theme

Theme	Category Group	Codes	Code
Co-ordination	Stakeholder availability	2	availability of stakeholders increased engagement
	Geographically dispersed collaboration	1	improved collaboration for geographically dispersed teams
	Co-ordinate and align	1	technology used to co-ordinate and align

5.4.1.1. Evidence from theme groupings

Evidence 1: stakeholder availability

Availability of various collaborators and stakeholders emerged as the single largest perceived implication for virtual collaboration, with most participants citing the availability of stakeholders as a key challenge for virtual collaboration when compared to in-person collaborations.

Table 6: Evidence of Stakeholder availability code group 1

Participant	Response
VTIA	*"It creates an extended timeline, so you find that you go and have the alignment session much closer to when deliverables are due, and if it's a very powerful stakeholder all of a sudden, we need to rejig everything after having done the work for like 6 weeks because we couldn't get time*

	in their calendar. Where's in the physical realm?[ISEP]Literally at some points would do alignment sessions over lunch be like, OK, cool. We'll come to lunch with you and let's go and have the conversation. So it was easier to get that alignment across multiple stakeholders than it is now virtually."
VTIB	*"the generation of ideas I think has been sort of affected by the virtual because I mentioned the availability factor that you know you never know who's in the meeting or someone shows us busy and they actually not busy. So you tend to not call."*
VTME	*"I think ever since we started working virtually, we haven't had much of the same kind of way of doing things because people are triple booked, quadruple booked. So, it's kind of difficult to have people in one in one session because of what I highlighted earlier, remember earlier I said now because of there's no impromptu chat, there's a lot more meetings"*
VTMH	*"…whereas when I go to the office on a Tuesday and Wednesday, I get things done very quickly because people are there. I can just pull them together; we make a decision and life goes on."* *"…But having to wait on this electronic communication you call somebody, they're not available, you send an e-mail, they take time to respond."*
VTMB	*"So, for me, yeah it takes slightly longer especially in the operations world. For example, if we had to discuss whether we refund a customer or are processing the operational loss, previously we'd just get into a room, discuss it and then we process the loss but now it's like we have to send two and fro emails and then struggle to get into people's diaries. And then next thing you know it's taken yeah longer than what it should have."*

Despite the largely negative sentiment around the availability of stakeholders, there was a minority of participants who perceived that increased virtuality resulted in slightly improved availability of contributors. This was however, viewed as largely for more simpler tasks and the availability was minimal. The table below highlights evidence of this contrasting views:

Table 7:Evidence of Stakeholder availability code group 2

Participant	Response
VTIB	*"I think people are much more responsive now in a virtual age versus before. So, if I do send something on teams or WhatsApp, I'm sure that I'll get a response within a couple of hours. So, I do think that drives sort of idea generation as well."*
VTMA	*"I think there's a piece of me that says it's a little bit better because you can actually get people onto a zoom or a team's call more quickly, if I could put it that way or people have more availability because they just kind of in back-to-back meetings, so then you can get people on a zoom call and make the decision"* *"if I make an example, I probably don't necessarily see our office manager often when I'm in the office because in the, I'll call it real world, he's out meeting clients. But in the virtual world everybody's kind of like stuck where they are, so you get more access to senior people slash information."*

Evidence 2: Geographically dispersed collaboration

The other key grouping that emerged within the theme of co-ordination for virtual collaboration is the benefit of engaging with geographically dispersed collaborators. Participants displayed uniform similarity in their views that virtual collaboration enhanced access to contributors

Table 8: Evidence of Geographically dispersed collaboration code group

Participant	Response
VTIC	*"I think on that like it's fantastic that teams you know it's you can have a video call with anybody around it doesn't matter you know what building they are or where they are scattered across the country…"*
VTIA	*"it allows you to connect with people in a plethora of different jurisdictions and locations. So, whereas historically would have looked for an expert, maybe locally? Now I can call someone in the US and set up a meeting and that works for us, and we can try and solve those problems"*
VTMB	*"I think it makes its easier like I explained, like for example regions. If you think about it previously, in order for us to maybe have a discussion with the*

	particular region and I'll also make an example with Cape Town because we recently had issues with Cape Town, we will have to fly down like and go and have that meeting and then also looking at the costs, sometimes it wouldn't happen, etcetera. So now if I want to speak to the guys in Cape Town, I just called them on teams and that conversation happens."

Evidence 3: Coordinate and Align

This grouping focussed on the effectiveness of technology in co-ordinating stakeholders. Participants displayed evidence of utilising technology to co-ordinate with collaborators. The table below provides some evidence of the participants who found working virtually enabled better collaboration.

Table 9: Evidence of Coordinate and align code group

Participant	Response
VTMC	*"Look, I think what it does enable multiple people to work on a singular item a lot easier, right? If you have teams, you can post things in the Teams chat or a channel or something like that. It does facilitate collaboration better than just normal OneDrive."*
VTMI	*"..,often because we use computer based models you find that if you are on a virtual team unlike sitting around the boardroom we will be working off one base where we can pull in any of the tools that are already available on the system to work"*
VTIB	*"So beforehand anyone could just get into the drive, the team drive and work from there would send the documents to each other via e-mail as well. But now there is no need for sort of e-mail traffic and we just all work concurrently on the on the document of simultaneously on the document that's been uploaded."*

5.4.1.2. Analysis and discussion of theme findings

Co-ordination as a theme and its influence on the collaboration of virtual teams was perceived as one of the largest implications for high virtuality. Codes that related to stakeholder availability and geographic dispersion were also the highest recorded codes raised by all participants in the study.

The perception that virtual work has reduced stakeholder availability due to the proliferation of meetings by key collaborators was one that was shared by most participants, best evidenced

by one participant who stated that " *I think ever since we started working virtually, we haven't had much of the same kind of way of doing things because people are triple booked [or] quadruple booked. So, it's kind of difficult to have people in one in one session because of what I highlighted earlier, because of there's no impromptu chat, there's a lot more meetings* "(Participant VTME).

Furthermore, this view was also expected to have negative spill over effects for engagements related to decision making, brainstorming and implementation of new processes by participants including participant VTIB who indicated that "*the generation of ideas I think has been sort of affected by the virtual because I mentioned the availability factor".* While in contrast, some participants found that there was potential benefit in improved availability, this was marginal, with a participant stating "I think there's a piece of me that says it's a little bit better because you can actually get people onto a zoom or a team's call more quickly, if I could put it that way or people have more availability because they just kind of in back-to-back meetings, so then you can get people on a zoom call and make the decision" (VTMA).

One of the positive benefits for co-ordination that participants expected to scale due to high virtuality is increased collaboration with geographically dispersed collaborators. This is expected yield positive collaboration benefits for problem solving through access to global expertise with Participant VTIA stating that, "*I think there's a piece of me that says it's a little bit better because you can actually get people onto a zoom or a team's call more quickly, if I could put it that way or people have more availability because they just kind of in back-to-back meetings, so then you can get people on a zoom call and make the decision*". This view is further supported by participant VTMI stating that "*Before I join my current employer, my previous employer was equally a multinational that is actually found almost in all corners of the globe. It has enhanced the standardization. That whether I am in Australia or whether I am in South Africa, whether I'm in Spain, we [are] able to work off the standard platform, we [are] able to use the standard tools so what it has done it has actually breached issues of skill gaps."* Other perceived benefits extended to increased team engagement with geographically dispersed team members. This was indicated by Participant VTIC stating that "*I think on that, it's fantastic that teams can have a video call with anybody around it doesn't matter you know what building they are or where they are scattered across the country"* (Participant VTIC).

The final implication in the co-ordination theme for virtual collaboration is its importance effectiveness of technology to support co-ordination efforts for collaborations. The ability to work synchronously on topics utilizing technology has meant collaboration has been perceived as improved by virtual work. "*Look, I think what it does enable multiple people to work on a singular item a lot easier, right? If you have teams, you can post things in the Teams chat or*

a channel or something like that. It does facilitate collaboration better than just normal OneDrive." Stated Participant VTIC. In addition, the ability for teams to be given more autonomy to investigate technologies that would enhance co-ordination was also cited as a key enabler for virtual teams.

5.4.1.3. Conclusion

Based on responses from participants, it is evident that there exists an increased demand on stakeholders through increased virtual meetings, which is expected to reduce virtual individual's abilities to collaborate with collaborators. However, the ability to source and engage expertise outside of their geographic locations will bridge vital knowledge gaps and have positive spill overs for activities like problem solving. This can be achieved asynchronously, due to appropriate technology the enables better collaboration, like working on documents simultaneously. Participants indicated that organisation need to further expand on current technology to support this.

5.4.2. Co-operation

Co-operation as a theme focussed on those code groupings and factors that influenced a participant's willingness to collaborate with virtual team members. It extended to several code groupings including individual and organisational level drivers of co-operation. The table below summarises the key category groupings that emerged from the inductive analysis process.

These will now be discussed.

Table 10: Summary of Code groupings and Codes for cooperation theme

Theme	Category Group	Codes	Code
Co-operation	Individual Specific Influence	6	Collaboration dependent on individual engagement influenced by tenure in team Previous experience helps technology effectiveness person dependant technology not well understood type of work performed

	Prior Rapport with contributors	2	challenges incorporating new collaborators Effectiveness dependent on prior F2F relationship
	Organisational Culture and Rituals	4	Encouraged Participation introduce virtual traditions and norms organisation support critical Organisational culture and online traditions
	Conflicting priorities	3	lack of time to engage limited time to think - conflicting priorities recognise multiple distractions
	Spontaneous/Informal Engagements	4	create opportunity for spontaneous virtual engagement limits informal engagement reduced agility reduced spontaneous conversations

5.4.2.1. Evidence from theme category groupings

Evidence 1: Individual Specific influence

This grouping captured the variability in drivers that participants cited as influencing their ability to collaborate with stakeholders. These drivers were largely specific to the participant including tenure in working in virtual teams, ability to engage with technologies used for virtual work and the type of work executed by the individual.

Table 11: Evidence of Individual-specific influence code group

Driver	Participant	Response
Individual specific context	VTIC	*"I think it comes down to the person and how willing the person is to collaborate, and there's only so much [you can do]. I mean, you can't force somebody to have their camera on it. That's up to the person"*

Role specific	VTMH	*"... people in roles that have got sort of repetitive tasks in that people go disappearing."*
Technology understanding	VTME	*"I don't think it's too effective because we work in organizations where not all of us are tech savvy "*
Technology understanding	VTIG	*"Improves the look. So, like the team familiarizing themselves on these virtual tools or platforms that are suggested being the first thing and also looking at if these virtual tools make their lives easier than complicated because you'll find that in the organization a different department needs a certain virtual tool and then it gets implemented into the whole organization, whereas it may not be relevant to us and actually makes us do double the work."*
Technology understanding	VTMI	*"my recommendation to other guys working on virtual teams starting from the ability to do the work is that we need to practice often to and be mindful and have the knowledge of the tools that are embedded on."*
Previous Experience	VTIC	*"on the other side of the coin, I think in particular my experience. It was very difficult to collaborate because a lot of the grads had studied virtually and graduated virtually. It created a very closed off situation and it was very, very difficult to get them to involve themselves and collaborate and to innovate. And while it might be, you know, just a few, I think in the situation it was almost like the virtual environment was almost negatively impact the ability to innovate because when we met in person, then the thoughts really flowed and there was much more productivity and we could come up with seriously cool solutions and this virtual [environment] created this hinderance to reaching the end goal"*

Evidence 2: Prior Rapport with contributors

This dimension focused on the impact that prior engagements had on collaborators and the influence on co-operation outcomes. Some participants noted that it was easier to collaborate with team members due to previous in person engagements. This led to a higher willingness

to collaborate in virtual settings. The table below evidences some responses from participants related to their perceived importance of prior relationships with collaborators.

Table 12: Evidence of Prior rapport with contributors' code group

Participant	Response
VTIB	*"And again, I think it goes back to the point that I made around, you know, sometimes your virtual relationships are informed by how strong your in-person sort of relationships are."* *"They're obviously bad parts, but what matters, what counts more in some settings it's the in presence or in-person sort of relationships."*
VTIG	*"So, with my manager. We do, uh, talk about general stuff and personal stuff, but we I don't really feel like we have that relationship to see as well as with my other colleague, UM, who kind of sits like 2 chairs away from me, we are much closer and that relationship was formed over us channeling a lot since the covid locked down, regulations were eased, so I think it just also depends on the relationship you just have with that person. But yeah, you see like as I mentioned before. It's better when you are interacting with people in person, then it is online"* *"Developing relationships quickly so that people can be comfortable with sharing ideas and also knowing what exactly they are contributing to. So yeah."*

Evidence 3: Organisational culture and rituals

This dimension of the co-operation theme focused on the importance of the organisation culture, virtual practices, and rituals in influencing collaboration. Participants noted that traditions like" switching on your camera" during settings influenced their willingness to collaborate in highly virtual settings. However, some participants perceived these rituals as intrusive and hindering collaboration. The table below highlights some of the key views shared by participants.

Table 13: Evidence of Organisational culture and rituals code group

Participant	Response

VTIG	*"It helps having your camera on we would be forced to have our cameras on during our engagements and also just contributing to the those engagements also helps a great deal because you never know maybe you you'll bring a solution to the table that no one thought of that makes everyone's life easier. So yeah, that's my closing point."*
VTMH	*"But what we what we missed or what we often miss, and we haven't done quite effectively is to say how do we overlay the soft culture or the hard technology to make these better engagements much better you know. So, I think every organization should probably have an element of culture either when we walk into a meeting, we spend the 1st 5 minutes connecting"*
VTMI	*"It is those rules which I have observed. The change in rules such as keep your camera on or keep your camera off. It is one typical example where someone in the organization has been off a view that even if you are in a virtual office or virtual space, you need to be visible you must be dressed up you must be in your tie whatever people preferred as a policy issue. My believe has always been, I do not need to see your face. I do not need to see whether you are sitting in the lounge or sitting on the porch of your house because I am intruding terms of policy adjustment, there had been two opposing polar positions around what other organizations see as enhancement of the culture and other organization have seen as a corrosion of a culture. When it comes to policy issues, those divergent views remain until today."*

It is worth noting that the interviewer observed a heightened reference to the virtual engagements with video camera enabled. This may suggest that participants viewed this as a key influence on impact collaboration.

Evidence 4: conflicting priorities

The conflicting priorities dimension of co-operation theme, sought to capture all the participant responses that reflected the limited ability to engage critical stakeholders. Like stakeholder availability this dimension spoke to the changes in ability for collaboration with collaborators. However, it focussed on stakeholders having an inability to properly collaborate due to multiple priorities driven by increased virtuality.

Participant VTIA response on the availability of senior stakeholders in his organisation that:

> *We come in there, they download this very quickly, and they're out. And whereas typically in the team rooms, you'd be able to like what do you think, OK, cool. Does this make sense? And let's draw it out. So, it provided a bit more of an open space to throw everything at it, whereas now it's very defined time periods*

This was further supported by other participants, indicating that the lack of quality collaboration was due to:

> *I think the proliferation of other types of meetings means that by the time you get to these types of sessions, you're not really fully engaged. You are thinking about something else, or you exhausted from all of the prior sessions (Participant VTIA)*

> *what I've come to know is that it's very easy to do other things when on virtual calls (Participant VTIC)*

Participant VTMG, further indicated their support for this view when stating that:

> *one of the things that one needs to realize is that when you're online, you attention span is not going to be that tolerant and therefore you cannot expect people to, just focus on one thing the whole time*

Lastly, participant VTIA an additional view highlighted the need for preparation to accommodate this multiple stakeholder priorities which limited collaboration.

> *typically we try and get pre reads out to the client and so that at least they can engage with the material beforehand and we I think we overcompensate a bit more now with the actual content itself, because now instead of dedicating a full day out for a board meeting, people will try and squeeze it into a 3 hour session right online, which means that there's not enough time to go through all of the content .*

Evidence 5: Spontaneous/Informal Engagements

The last dimension of the co-operation theme, related to the ability to facilitate continuous collaboration amongst virtual collaborators. This dimension was raised by various participants, all highlighting lack of informal and spontaneous virtual collaboration. This is evidenced by the table below.

Table 14: Evidence of Spontaneous/ Informal engagement code group

Participant	Response
VTME	*"…we don't see each other in corridors. So, we don't have those impromptu chats…"*
VTIA	*"Typically not, and I'd probably say what the virtual world has done is it's made it a little less, let's say agile and what do I mean by that? Like when we be working in team rooms, it's much easier to call everyone around the table and say, hey, we actually need to turn the specific area of the work stream. Can we all provide a capacity to that and let's push and let's just get it through and then we can revert back to our different work streams."*
VTIB	*"I think again it goes to my view on not having formalized sort of discussions all the time. So, some of the things could be just at this spur of the moment where we want to discuss an idea and we've got a Teams platform where Teams chat, where we can just discuss what people's views are on a certain idea or innovative sort of product that we're putting forward"*
VTMH	*"…we lose the innovation because people are not having those side water cooler conversations anymore."*
VTMH	*"Because like I say, when you are, when you are in in an office environment, there's power in there's effectiveness in all of those corridor conversations, water cooler conversations, because then you engage outside of the boundaries of your teams. But when you're working virtually, it's business. You sit at your chair; you switch your computer on. It's very difficult to have like a side chat or a casual conversation with people that are not in your team. You generally will have a routine for the day. You have a list of what needs to be done on that particular day, and that's the business that you get on with."*

5.4.2.2. Analysis and discussion of theme findings

The co-operation theme for collaboration discusses focusses on the key code groupings and dimensions that were inductively derived from participant responses. That is, what were the drivers that influenced collaborators willingness to participate in collaboration. Participants identified this as not being uniform and dependent on several factors. The first factor related to individual specific preferences and context, which included tenure, type of role, experience in virtual work and understanding technology. This is evidenced by participant VTIC, stating that "it comes down to the person and how willing the person is to collaborate, and there's only

so much [you can do]. I mean, you can't force somebody to have their camera on. That's up to the person". Another factor participant VTME highlighted, which was also prevalent, was the lack of understanding of the technology used to facilitate co-operation and is discussed by Participant VTME stating "I don't think it's too effective because we work in organizations where not all of us are tech savvy ". Thus, these factors highlight the role of the individual in influencing collaboration.

Furthermore, the influence of previous in-person engagements with stakeholders was identified as an influence for co-operation within virtual collaboration to occur. Participant VTIB stating that "*sometimes your virtual relationships are informed by how strong your in-person sort of relationships are*." In addition, some younger participants, who had recently joined their organisations and their virtual teams, highlighted the difficulty in collaborating due to limited experience in the team with participant VTIG suggesting a focus on "*developing relationships quickly so that people can be comfortable with sharing ideas*".

The third dimension focused on culture and virtual traditions and the type of rules implemented to encourage co-operation. This included "switching one your camera during a meeting", as stated by various participants. The response and impact of the implications varying between participants. For example, participant VTME stated about collaboration that "so, maybe to help with that engagement virtually would be to implement the cameras on policy. I would think. At least you can see the other person on the on the screen "*whilst on a similar point participant VTIC stating that "you can't force somebody to have their camera on* ". Displaying conflicting views. However, both participants supported the importance of culture and virtual traditions as important for supporting collaboration.

The other key dimension was spontaneous and informal engagements, which all participants found to be limited by high virtuality. Participant VTMH suggesting that "we lose the innovation because people are not having those side water cooler conversations anymore". This implication further supported by the perceived views by participants of collaborators having limited time for co-operation, and in turn collaboration due to multiple conflicting priorities brought on by additional virtual work.

This theme combines several dimensions and responses from participants and represents, and was represented in most participant responses, highlighting its importance for collaboration.

5.4.2.3. Conclusion

All participants agreed that co-operation would be impacted by higher virtuality and has influenced virtual collaboration. The introduction of cultures and virtual norms is expected to support or diminish collaboration, with participants having diverging views on the required traditions to succeed. However, all participants agreed that it is required for collaboration to occur. Participants perceive that those collaborators who have previously established relationships prior to virtual collaboration, and have a strong ability to use virtual tools, were well positioned to be able to positively collaborate. Lastly, participants viewed the ability to maintain opportunity for spontaneous and informal co-operation, was a key requirement for collaboration to occur more continuously and sustainable.

5.4.3. Information Exchange

Information exchange emerged as the final theme that respondents expected to influence collaboration within highly virtual teams. This focused on the effective sharing of knowledge to collaborators and included two category groupings: (i)Effective communication and (ii) Trust. The table below summarizes the code and code groups the informed the theme.

Table 15: Summary of Code groupings and Codes for Information Exchange theme

Theme	Category Group	Codes	Code
Information Exchange	Trust	3	creates mistrust Requires trust and engagement Visibility
	Effective communication	5	enhanced knowledge sharing Increase communication Ineffective means of communication less natural engagement less non-verbal cues

5.4.3.1. Evidence from theme category groupings

Evidence 1: Effective communication

Effective communication contained groupings that participants considered as influences on consequences of high virtuality on knowledge sharing and information exchange. Participants highlighted several themes they considered to be negatively impacted by high virtuality as it related to communication, including the difficulty in accessing non-verbal cues during virtual engagements, the ineffectiveness of virtual technology for communication, and the unnatural

nature of virtual communication. The table below summarises the key evidence collected through the interviews to support these codes:

Non-verbal cues:

Table 16: Evidence on Effective communication code group (non-verbal cues)

Participant	Response
VTIB	*"You also can't necessarily see people face to face. Therefore, you can't really ascertain if they really listening or are focusing or paying full attention. So again, speaking for myself, I think I zoom out quite quickly. So, the digital route hasn't really worked [I] guess as effectively as face to face or physical meeting would work and, in some instances,"*
VTIC	*"I think collaboration has a lot to do with like what you see in the other person and reading the body language and understanding who they are, when they interact from a collaboration perspective"*
VTMB	*"Whereas if it's face to face for me it's much easier and then you can also gauge like people's expressions and what they're thinking. If you're face to face compared to teams."*
VTMC	*".. where it becomes an issue is that sometimes debate is not as constructive and you know, because I think sometimes, if you're there, you get a bit of view of what people are thinking when you're in person with them. Especially when you're doing a presentation of sorts, you can kind of see somebody's face and you can kind of see, OK, they look a bit confused, you know. Then you can have more facial cues. Like you know, if you think of communication, so much of it as visual and not just tone or so it makes it better that because not everyone has their camera on and chat can sometimes always be misconstrued."*

Un-natural engagement

Table 17:Evidence on Effective communication code group (un-natural engagement)

Participant	Response
VTMB	*"…sometimes if I want to ask a question or if I want to comment on something because we are virtual and then we are raising hands and then there's multiple hands, then I even lose my train of thought while waiting for my turn, right"*

VTIA	*"I think it removes that intimacy. I think at the heart of the work that we do, it's a relationship-based type of working environment.I've seen projects where it was difficult then we went and had a team dinner with the client. All of a sudden, the following day, things are less hostile and clearly all it needed was as going over a good steak, having some wine , laughing and realizing that we all human and we're not there to fire anyone. We just tried to come to a solution that works for the organization and ultimately all of our goals are aligned with typically in this type of setting, it's very in intimate like it's not intimate by, it's very nature."*

Furthermore, the perceived effectiveness of virtual communication was uniform, with majority of participants considering it ineffective. The table below highlight the evidence from participants.

Virtual communication ineffective:

Table 18:Evidence on Effective communication code group (virtual communication ineffective)

Participant	Response
VTME	*"Look, ideas is about communication, right? I think when you are online you kind of also lose some communication aspect"*
VTIC	*" I think we lost that since being virtual I and I've noticed it specifically in our team. So we go into the office once a week and because I don't necessarily talk to one of my team members for a few days, it's like you've got all this information to unpack in one day and you come up with all these fantastic ideas because cool you're communicating now. You know, be communicating openly honestly all the time, or at least a little bit every day. I think that keeps, you know, fresh new thoughts open and flowing and you can bounce ideas off each other"*
VTMB	*"So if someone is maybe not understanding the concept then you can explain what bit more because you can see that they probably last way as on teams. It's like you continue and someone sometimes wouldn't raise their hands even if they lost right? So I in the in in summary I prefer face to face"*

VTMC	*"e-mail is a very rigid type of communication. You can't send files over a certain size otherwise some you know via OneDrive. It's not the best form of communication, just from how people perceive it. You know then what some other things are like. It is sometimes much easier to communicate over WhatsApp like a chat versus e-mail. You know, things get lost."*

Evidence 2: Trust

Another category grouping that emerged as influencing information exchange in virtual collaboration was trust. Participants highlighted that trust influenced the amount and type of information shared with collaborators. The table below highlights some of the responses from the studies participants.

Table 19:Evidence on Trust t code group

Participant	Response
VTIA	*"now it's very transaction based and I think it just creates a bit of mistrust with everyone because we're not really sure why are you here, what you want from me. Am I going to get in trouble for anything that I'm saying? Are you going to say that I'm just get fired, like, what's happening type of thing?"*
VTMA	*"But like there's a lot of push for people to be in the office, come to the office. Come three times a week etcetera, etcetera, which a part of me understands, but part of me is just like you trusted your employees to work virtually for two to three years. Everybody was trying their best. We clearly can work. It might not be the best all the time, but there's clearly part of it that's work really well. Why can't we have a hybrid situation? Why is there this big push to have people in the office every day all the time? because we've established that we don't need FaceTime to actually get things done.For me, I feel like virtual world introduced new means of doing things that people are now letting go of and I think doing that is moving backwards. I feel like there's such an element of the virtual world that we could incorporate that would just give everyone a lot more flexibility, right?"*
VTMB	*"I think maybe the one thing that as an organization we also had to do, is just trust people as well. That's the one thing that I would add because previously we used to manage people by seeing that they're sitting at their desk and then doing their work. Whereas now you have to trust that*

	even though you're not seeing the person, the work must still move and you trust that the person is doing the work. So I think we as an organization had to put up more trust in our employees."

5.4.3.2. Analysis of theme

All participants expressed a uniform view that effective communication had been negatively impacted by high virtuality of teams. The lack of non-verbal cues and the unnatural (impersonal) way virtual communication had occurred, had limited effective communication. This aligned closely with the findings raised around virtual traditions and cultures, where teams had begun to encourage the switching on of cameras – suggesting a focus to bridge the gap in non-verbal cues. Lastly, effective communication was cited as a key enabler to facilitate brainstorming (creativity) and activities related to the implementation of ideas(innovation), which suggests this might result in spill over effects for the remaining constructs. This is summarised by participant VTME when stating that *" ideas is about communication, right? I think when you are online you kind of also lose some communication aspect"* .

The other dimension of trust for effective information exchange and collaboration is one that highlighted a perceived shift in the relationship between virtual teams, and between individuals in virtual teams and their organisations. Participant VTIA articulated this shift as “very transactional”. There is further evidence from participant VTIA there is an emergence of mistrust that has formed with virtual work, stating that, *“I think it just creates a bit of mistrust with everyone because we're not really sure why are you here, what you want from me. Am I going to get in trouble for anything that I'm saying? Are you going to say that I'm just get fired, like, what's happening type of thing?". This is supported by participant VTMB for organisations to “just trust people” and “you have to trust that even though you're not seeing the person, the work must still move and you trust that the person is doing the work. So I think we as an organization had to put up more trust in our employees”*

5.4.3.3. Conclusion

The theme of information exchange was highlighted as a key influence and outcome of collaboration within virtual teams by the study’s participants. Participants have highlighted the perceived negative impacts that are introduced by high virtuality amongst virtual teams, with participants citing the lack of non-verbal cues, the unnatural nature of virtual communication and the ineffective manner of communication as limiting virtual collaboration. Furthermore, they suggest a transition of relationships to become more transactional leading to a further reduction in information exchange due to a deficit in trust across collaborators.

5.4.4. Finding for research sub-question 1

How will high degrees of virtuality impact the collaboration patterns of virtual teams?

Research sub-question one sought to understand the implications of high virtuality on the collaboration patterns of teams. From the findings it can be concluded that participants perceived that it significantly impacted collaboration and its dimensions.

Research sub-question one sought to understand the implications of high virtuality on the collaboration patterns of teams. From the findings it can be concluded that participants perceived that it significantly impacted collaboration and its dimensions.

First implications focussed on those related to coordination. It can be concluded that stakeholder availability was reduced due to high virtuality of work due to perceived increase in workload (especially meetings) for key collaborators. This was expected to also have negative spill over effects for decision making and problem-solving outcomes. However, access to geographically dispersed stakeholders was perceived has significantly improved due to virtual work. This was expected to improve access to global experts and standards through information exchange, which positively contributed to the quality of collaboration efforts, with similar positive spill over effects expected for the creativity and innovation processes. The role of recent technology was also perceived to provide outcomes for synchronous communication – where earlier virtual engagements only support asynchronous communication which was limiting and ineffective.

Secondly, findings that related to co-operation efforts for collaboration were considered – collaborators willingness to participate in collaboration efforts. Again, participants consented that higher virtuality of work influenced co-operation and the factors associated with it. However, this varied across respondents and factors (positively and negatively). Individual-level drivers influenced how co-operation would be influence and they included tenure, experience and understanding of technology. For example, higher tenure in the team, was perceived as positive for co-operation, while lower tenure was perceived to negatively influence collaboration. Similarly for the other individual factors. In addition, prior rapport with collaborators, largely gained through in person engagement, was considered a key driver of co-operation. Another implication related to the role of organisational culture, traditions and virtual norms introduced by organisations to support collaboration like camera's switch on/off, length of engagements, and other to improve collaboration. These were agreed to be

necessary, but there was diverging views – by industry and seniority in virtual team (individual and manager) - on those that were required to improve collaboration, with some traditions cited as diminishing the ability for some to collaborate. For example, camera's negatively impacting introverts. lastly a strong ability to use virtual tools is expected to have positive outcomes for collaboration. Lastly, participants viewed the ability to maintain opportunity for spontaneous and informal co-operation, was a key requirement for collaboration to occur more continuously and sustainable.

The third dimension of findings to answer the research question, was the implications for information exchange. It was determined that the were negative impacts for information exchange due to heightened virtuality of work. Key to this was the lack of non-verbal cues, the unnatural nature of virtual communication and the ineffective manner of communication as limiting virtual collaboration. Furthermore, there was a transition of engagement towards a more transactional relationship leading to further reductions in information exchange. Trust was also viewed as vital for information exchange to occur successfully, but this was limited amongst virtual collaborator, due to lack of visibility and pre-disposition of mistrust.

5.4.5. Finding for research sub-question 2

How can managers sustain the positive benefits of collaboration previously evidenced in F2F teams, within highly virtual teams?

This research question sought to understand how collaboration benefits previously established in F2F teams, could be sustained in highly virtual teams. The first suggestion related to a more deliberate method to introduce new collaborators within virtual teams. Participants suggesting that new collaborators required some level of in-person bond to have successful virtual collaborations. Additional suggestions were to reduce the amount and length of meetings to improve stakeholder availability for more spontaneous engagements and collaborations. Engagements should be supported with pre-work for participants to come prepared to preserve engagement of teams. External facilitators were also recommended to reduce and manage any power dynamics brought on by virtual work environment.

Additional implications that were cited during questions related to creativity and problem solving, however, with implications for collaboration was the need to improve virtual social interactions to build trust and rapport between collaborators. This was suggested to incorporate elements of in-person engagement, which were deemed as most effective to build social interactions.

Lastly, regular deliberate engagements (Check-in and check-out) sessions, were suggested to ensure broad team alignment and opportunity any support requirement from team members to not inhibit or delay innovation and creativity.

5.5. Construct 2: Research findings on the Implications of high virtuality on Creativity of Virtual Teams

The second construct of the study related to the creativity of virtual teams. This was investigated through one research question:

RQ 3: How will high levels of virtuality impact the generation of novel ideas (creativity) in virtual teams?

Participants were asked four questions during the interview, which related to the construct and associated research question. These questions mainly address; 1) How had participants experienced brainstorming in virtual teams, 2) What process had they followed for problem solving, 3) the effectiveness of the current tools and technology they used, and 4) suggestions on how brainstorming could be improved for virtual teams.

The outcome of the interviews resulted in the emergence of 4 themes for the construct, namely: 1) Motivation, 2) Procedural constraints, 3) Social Interactions, 4) Cognition.

The themes will now be discussed and analysed.

5.5.1. Motivation

This theme referred to the team's attitudes and willingness to engage in creative activities and ideas. This included code category groupings that discussed workload, processes and procedures and the impacts of blended work – a combination of virtual and in-person work.

The table below summarises the themes the codes and category groupings for motivation.

Table 20: Summary of Code groups and codes for Motivation theme

Theme	Category Group	Codes	Code
Motivation	Increased workload	3	increased workload Introduce flexibility and time to collaborate meeting fatigue
	Interactive engagement	4	keep engagement interactive increase diversity of collaborators

			limits diversity of contributions Reduces diversity of idea's
	Convergence of Work and Personal Settings	3	increased need to disengage from virtual integration of work and personal Respecting boundaries

5.5.1.1. Evidence for theme

Evidence1: Increased Workload

Participants highlighted that one of the consequences of high virtuality was an increase in workload. This included the increase in meetings, reduced time to collaborate and the general perception that people were tired. This was then perceived to negatively influence people's motivation to partake in the generation of new or novel ideas (creativity) in virtual engagements. The table below displays evidence of these views. Furthermore participants, suggested the increased need to promote dedicated times to facilitate idea generation, further supporting the limited motivation to engage.

Table 21: Evidence of Increased workload code group

Participant	Response
VTME	*"General commentary is that virtual work is a lot more than normal work.So what I mean by that is. Before, when you are not in the office you are not in the office. People don't bug you. Now in the virtual world, you are almost on call 24/7."* *"There's certainly a lot more meetings than what there was before. And that might be because of we don't see each other in corridors"*
VTMA	*"I feel like the on the one side virtual world has given people flexibility, but on the other side it's just means you are constantly plugged in, which is not what you have in the real world."* *"I also think people spend more time, which is either good or bad, more time in meetings in the virtual world than they do when they in person, which then means you wouldn't necessarily have access to the people you could actually have access to in a virtual world"*

VTMC	*"There's the other part of it in that people would set up meetings to discuss things, to ask a question. And I found myself within COVID having far more meetings than what I would have before covered. And a lot of those meetings were ineffectively things, you know, when people book up 30 minutes, they feel the need to use 30 minutes in this virtual setting"*
VTIA	*"But over and above blocking our time I think bringing everyone together after if we went to provide dedicated time. After like every second week or every month dedicated towards just coming up with new ideas on how we can improve processes in the next, I think we need to then have sessions where we actually then just align on what are some of the ideas that people have on the table, and I think everyone should be able to contribute effectively to that. So, if we wanted to carve out time for you and you literally will say, I'm taking this time because I actually just want to think and then brainstorm around certain ways and approach, then you need to be able to feedback to the product team around.What are you thinking? What did you use that time for? What do you think we can improve in our processes, and we can sit around the table and actually and see whether that works. See how we can improve it. See how we can effectively operationalize whatever it is that we do. So, I think being able to come out with time and allow people to take a step back and just think through things. I think that'll probably help."*

Evidence 2: Interactive engagement

The ability to keen participants engaged during virtual ideation session was a theme that was raised by a large group of participants across the various most industries represented in the study. It was discussed by participants in multiple questions during the semi-structured interviews across all the constructs of collaboration, creativity and innovation. This grouping also captured how the diversity of contributors could be improved to influence positive idea generation. The below table includes evidence of this code grouping specifically as it relates to theme of motivation and the construct of idea generation and creativity. Further evidence will be included under other themes.

Table 22: Evidence of Interactive engagement code group

Participant	Response

VTMG	*"So, people that really know how to design these sessions, they do them in such a way that there is a lot of breaks in between. It's interactive, there's a lot of fun stuff in between. If you don't do that, then of course people are going to drop off and it's not so much the result of technology"* *"Then some of them drag I think online you have to keep it short. 30 minutes Max 40 and then you leave them. Unless if it's a workshop. Even then, if it's a workshop, keep it very short or have a lot of breaks in between and a lot of exciting stuff in between. Otherwise, you know, people just say, you know, the famous nothing from my side. Thanks. Nothing from. Yes. Otherwise, you get that the whole time."*
VTIG	*"And also I think giving each person something to do after the engagement to also like, you know think about what was said and any ideas that they, they get off the they engagement also helps. And then maybe meet again and see if there's anything new that"*
VTIA	*"And again, as we bring everything together, we're able to synthesize these different viewpoints that people have had. And we've all put into the document…"*
VTMG	*"It can't be head of the department just because he runs the team necessarily, sometimes it doesn't work you know and especially in Teams there's always dynamics you know, especially so then you have that boss driving it and you don't go far, you really don't go far, and sometimes it's even better when the boss is not in the room, rather to say we will consult you when we're done, and get an outside person think about it come up with ideas and then take it up.Otherwise, they are dynamics that gets introduced that really limit and you know that process."*

Evidence 3: Convergence of work and personal

This category grouping discussed the influence the convergence of work and personal settings in influencing the motivation of Virtual teams to engage in idea generation. This view was raised by two participants (minority of respondents). Despite this, the code grouping introduced a view that gave in-depth insight around motivation potentially being diminished if work life balance and personal work settings were not respected by team members and organisations. The evidence below summarises the key evidence raised by the respondents:

Table 23: Evidence of Convergence of work and personal code group

Participant	Response
VTMI	*"Work life balance, but instead there is work life integration. Meaning that I need to be careful and be mindful that during work life integration in my terminology I remain respectful and hold on the value"* *"So narrowing it down to virtualize and reference to a person's sitting in their own personal spaces, lounges, kitchen does not matter where they are, what has become important in terms of rules of engagement or policy decision is that I needed to we need to recognize the need for respect for personal space. The recognizing and the realization that once called virtual space is personal in private*
VTMA	*"Fridays I tried to only do check-ins and not do checkouts and the last check-out is about planning for the week ahead, and if we do have a check out on Friday, I try to make it earlier so everyone can have the Friday afternoon slash evening."*

5.5.1.2. Analysis of Theme

The emergence of the motivation of virtual teams in influencing the generation of new ideas, follows on from the collaboration theme of co-operation. Participants cite reduced willingness to engage in generating new ideas due to heightened workloads and increased meetings as a result heightened virtuality of work. Furthermore, participant VTME indicates that “there's certainly a lot more meetings than what there was before. And that might be because of we don't see each other in corridors”. This view was shared by many participants highlighting the largely negative sentiments that participants associate with virtual creativity and idea generation.

Additionally, a existed a minority view related to the from participants around the potential negative impacts to motivation of participants if personal settings were not respected, especially as there we heightened amounts of virtual work which was performed in home (personal) settings. This perceived view was considered in the overall analysis of the study due to its potential to negatively impact the creativity of teams.

Lastly, participants including VTME, perceived the need to ensure that motivation is maintained during idea generation virtual sessions through deliberately designed sessions. Furthermore, they highlight that failure to consider this results in potentially negative outcomes for creativity of virtual teams. They state that “people that really know how to design these

sessions, they do them in such a way that there is a lot of breaks in between. It's interactive, there's a lot of fun stuff in between. If you don't do that, then of course people are going to drop off". Participants also highlighted the importance of encouraging diversity during the idea generation process, where differing stakeholders should be deliberately included and encouraged to participate in virtual debates. Participant VTMG stated that "It can't be head of the department just because he runs the team necessarily, sometimes it doesn't work you know and especially in Teams there's always dynamics you know, especially so then you have that boss driving it and you don't go far, you really don't go far, and sometimes it's even better when the boss is not in the room, rather to say we will consult you when we're done, and get an outside person think about it come up with ideas and then take it up. Otherwise, they are dynamics that gets introduced that really limit and you know that process" in support of this perceived view on diversity of stakeholders.

5.5.1.3. Conclusion

The motivation theme for virtual teams is one that emerged as a key determinant of the implication for creativity in virtual teams during heightened virtuality. This supports the category groupings and themes that emerged for collaboration of virtual teams, with willingness to participate in collaboration or idea generation having a high perceived influence on these constructs. The theme also introduced individual specific factors like workload, meeting fatigue and respecting of personal boundaries as influences of creativity. It also captured the required focus on interactive engagements to keep all participants motivated and encourage diverse views to support appropriate idea generation and creativity within virtual teams.

5.5.2. Procedural constraint's theme

The second theme that emerged as a key influence of idea generation from the thematic analysis done for the study, was procedural constraints. This theme captures those perceived changes in virtual processes and procedures that have influenced the generation of ideas in virtual teams including processes for decision making and procedures for decision making. Furthermore, the rigidity of virtual engagements was highlighted by majority of participants.

The table below summarises the category code groupings for the theme:

Table 24: Code groupings and codes for Procedural constraints theme

Theme	Category Group	Codes	Code

Procedural Constraints	Formalised/Structured Processes & Procedures for idea generation	7	cumbersome processes to facilitate virtual engagement Encouraged formalised frameworks formalised engagements formalised engagement sessions Formalised process easy to migrate to virtual Rigid Innovation processes standardization
	Processes & Procedures for decision making	4	decision making objective dependant increased autonomy in decision making Increased processes for decision making increased time to decision making

5.5.2.1. Evidence for theme

Evidence 1: Formalised/Structured Processes & Procedures

This category grouping discusses the potential changes in the idea generation process within virtual teams, discussing how procedures that form part of ideation influence creativity. Furthermore, participants contrasted the virtual processes to those which were previously experienced during in person engagements (lower virtuality engagements). The table below provides evidence of participants responses to the theme.

Table 25: Evidence of Formalised/structured processes and procedures code group

Participant	Response
VTIA	*"If you have an idea around something and you just wanted to bounce it off them, that provides that setting without necessarily having to go and try and find time in someone's calendar. Set up a whole session by the time we get there, we probably forgot what we actually wanted to discuss, and it proves to be ineffective"*

	"But now? You have to set up a session which takes up time and calendars fill up, so I think it hasn't really aided value for us, at least as an organization."
	"I'm not just talking in my department and the entire organization where these kind of models were investigated. A team actually was sent to GIBS just for design thinking so that they can come back and help the organization. So, I think it was one of those short courses. So, we had about maybe plus minus 5 to 10 people going there and so whenever you have a situation or problem that you wanted to solve, you would then tap into one of them to say, guys, this is the situation or the problem that I want to solve help coordinate"
VTIB	*"we would brainstorm as you mentioned, but those brainstorming sessions have become a lot more formalized now"*
VTMC	*"…there always needs to be a set of requirements that need to be drafted and those things need to be specified and, that's generally done on like word documents and people obviously determine what needs to be built that gets approved. And then obviously these things need to be built by IT teams and that kind of thing and then that needs to be monitored through testing until it gets implemented and then they sort of post implementation monitoring as well. So yeah, there's many stages to something and each thing has its associated levels of approval. Things generally work via e-mail and Microsoft Word that makes sense from a platform perspective."*
VTMA	*"Umm. So, two processes or maybe it's one process. I have check-ins and checkouts. So, chick-ins would be around 9:00 in the morning where the full team will meet and will talk about the priorities for the day. Umm, they will escalate or flag things where they need help and then if they need one-on-one time with me. So that's kind of how we kick off the day and then at the end of the day which is usually five or six o'clock, depending on where everybody is in the world, we will then have a team check-out where it's like. This is what I've covered today. This is what's done. This is what I need you to look at overnight and these are my priorities for the next 2-3 hours and then we'll align on what the next day looks like. So we'll run that usually Monday to Thursday. I do check-ins and check outs."*

Evidence 2: Processes & Procedures for decision making

Similar to grouping two, this category group focuses on the implications of changes in processes and procedures for decision making. Participants also perceived that there were large changes in decision making processes due to the heightened virtuality of team engagements. The table below summarises the evidence captured from respondence.

Table 26: Evidence of Processes and Procedures for driving decision making code group

Participant	Response
VTIA	*"So I think I've typically seen the decision making process tends to elongate a bit more"*
VTIB	*"So, I think there's a lot more autonomy since we've moved to virtual because decisions have to make be made quite quickly."*
VTMA	*"I think people are more ready to make calls or decisions in a virtual platform"*
VTIA	*"we overcompensate a bit more now with the actual content itself, because now instead of dedicating a full day out for a board meeting, people will try and squeeze it into a 3 hour session right online, which means that there's not enough time to go through all of the content. "*
VTMF	*"I believe that the decisions have gotten worse because you're not. You're not bouncing the ideas of multiple people. We do not make 100% sure with decision, you just going all I'm pretty comfortable with this, especially if it's not a big decision. So, I'll just make the decision and say let's make it red. Where in the past you would have bounced off people and had discussions and actually made it blue."*
VTIG	*"I think it's prolonged the process of things getting approved because you'll find that you report to your manager and then your manager also can't really make those very big decisions without him reporting to his superior. So, because everyone is just too busy and trying to figure things out in this new environment? I think it's just something that just happens to take longer than it should whereas if we are in person and I run into you in the office, I can get things approved in that moment."*

5.5.2.2. Analysis of Theme

Participants indicated that the introduction of high virtuality of work has resulted in changes in the ideation and decision-making processes and procedures. Participants cited an increase

the need for more rigid and formalised processes compared to in-person engagements. Participant VTIB stated "*sessions have become a lot more formalized now",* which may negatively impact the spontaneous engagements required for ideation.

Participants also highlighted extended timeframes for decision making, due to stakeholder availability and increased processes to get all stakeholders into a virtual session to make decisions, participant VTIA stating that "I think I've typically seen the decision making process tends to elongate a bit more" and they further explain by stating that "I think it's prolonged the process of things getting approved because you'll find that you report to your manager and then your manager also can't really make those very big decisions without him reporting to his superior. So, because everyone is just too busy and trying to figure things out in this new environment". Similarly, this view was shared by the majority of participants (VTIB and VTMA), with Participant VTMF questioning the rigor of virtual decisions, citing less thought being made for decisions. However, there was a minority of participants who expressed that in their virtual teams, ideation and decision-making processes had improved due to "increased autonomy" facilitated by virtual work.

This contrast in experience, may allude linked to perceived manner in which organisations have adopted and implemented virtual work, with some teams focusing on introducing more structured and formalized decision-making processes, while others have look to entrust and empower employees to compensate for any deficiencies in the idea generation and decision-making process.

5.5.2.3. Theme conclusion

Participants all agreed that there had been changes in the processes and procedures related to idea generation and decision making of virtual teams due to high virtuality of teams. Team members highlighted that process were largely more rigid and formalised, reducing spontaneous idea generation. Availability of stakeholders and the procedures required to obtain approvals or key decision had also been largely negatively impacted, with virtual teams using more rigid procedures to manage this. However, in the minority of cases, participants indicated they were able to improve decision making due to increased autonomy given to team member to making decisions more speedily.

5.5.3. Social Interactions Theme

The social interaction's themes emerged from the thematic analysis based on participants citing impacts in the dynamics that influence knowledge transfer for idea generation in virtual teams. These implications included influences between team individuals including power

dynamics during virtual engagements, the shift in relationships to more transaction exchanges and the transparent access to knowledge.

We provide evidence of these influences from respondents and provide analysis.

5.5.3.1. Evidence of Theme

Evidence 1: Power Dynamics in virtual relationships

This category grouping focussed on the influence of interpersonal relations between participants, which influenced the generation of ideas within virtual teams. Both Manager and Individual participants, cited this as a key inhibitor of virtual creativity, with participants viewing idea generation as an activity linked to discretionary effort, and thus could not be achieved if not successfully encouraged through participation of all individuals.

The table below provides evidence from some respondents on their views of these interpersonal relations as they relate to creativity of teams:

Table 27: Evidence of Power Dynamics in virtual relationships code group

Category Grouping	Participant	Response
Power Dynamic	VTMG	*"another thing I didn't mention is that some of these things are driven by execs. So, an example come this is what I want. This is the product that needs to be introduced and then run with it. You know, so it didn't really allow much room for things to come up with new products, to be honest with you, you know "*
Power Dynamic	VTIA	*"I think what it has done is that It disadvantages certain types of personalities as an example, so if you're a very introverted person, it's very easy to like. Switch off your camera, go on mute, and never have to engage in that session"*
Power Dynamic	VTMH	*"And then there's one person who is dominating the discussion and everybody else is just quiet and at the end of the conversation,"*

External Facilitators	VTIG	*" I call it a mediator to say that actually was there helping us navigate this new virtual way of doing things.They would ensure that everyone is participating. Everyone is adding on to the engagement and also another thing I liked about also having mediators is that they would mediate at that point in when we start the session we'd have like an ice breaker where we schedule or would be made to pick something from the room and all of that and also having those breaks in between because being in a session for like 2 hours straight just absorbing it and taking in all that information is a bit draining and I don't think it's effective so."*
External Facilitators	VTIA	*"…have someone who facilitates the conversation"*
Improved Confidence	VTMA	*"I just feel like it levelled the field a little bit because I think in person, the senior people show up. You can almost tell the difference very clearly between like a senior person and a junior person. And that creates a dynamic where you don't necessarily get the best out of the junior people in the team, right, because they're just like, oh, let me wait and see what this person says, etcetera, etcetera. There is something about everybody's sitting camera on, not necessarily formally dressed, that levels the playing field a little bit and I did feel that for certain junior people it made them come out of their shell and share a little bit more. So, there is something to be said about, just like making it a lot easier for people who don't necessarily speak up in team rooms to speak up in the virtual world."*
Power Dynamic	VTIC	*"You know, virtual definitely has the collaboration and people also feel less threatened. I think in a team's environment, they're able to share whatever it is that they that comes to mind. You know, some people don't. If you're in a group, some people you know prefer not to public speak in in a real-life situation, I think teams allows for people that wouldn't necessarily share a thought in a big group"*

		" It allows them on teams to still share with the group, whether it share the thought, whether it be, you know, a message in the chat or. Raising their hand and getting the opportunity to speak. So, I think from that perspective it allows more people to contribute as well. I think people have become a lot more brave with teams and are much more willing to share than you know if there was sitting in a massive boardroom with 20 people."
Improved Confidence	VTIB	*"it makes it easier to because everyone is virtual, it makes it easier to just reach out to someone who you ordinarily would not perhaps have reached out to had you just seen them across the corridor with no introduction being made"*

The above table showcases that participants were not uniform in their view of how internal team dynamics would change with the increase in high virtuality. This view suggests that there may be positive and negative benefits for creativity depending on pre-existing team dynamics.

Evidence 2: Impersonal and transactional relations

The other key grouping within the theme was the insight from participants that they perceived virtual creativity having been stifled due to the impersonal nature of the relationship – this when contrasted against previous in person engagements which were perceived as more human. The table below provides some evidence from respondents:

Table 28: Evidence of Interpersonal and transactional relations code group

Participant	**Response**
VTME	*"People don't know each other, even though they talk in meetings. They are within the same teams, but they have never met each other. They really don't know each other"* *"I think they can improve it by having some sort of connection. What I mean by connection is more often the more often than not, on Teams, we just have a bubble with just somebody's initials"*
VTIA	*"We come in, it's very transactional. Hey, we have an onboarding session. These are the things that I quickly want to go through.*

	Cheers. Bye. And there's very little time to actually understand how that person is doing."
VTMH	*"So if you're going to make a decision and I think a lot can be found and the there's just a lot of richness that comes from going beyond the bounds of just working together and having a particular connection at another level."* *"However, don't lose the spark and the connection"*

Evidence 3: Transparent access of knowledge

Participants also highlighted the importance transparent access to knowledge to improve interactions between virtual team members. This included access to appropriate tools for idea generation, insight into how the tools were utilised and the ability to share knowledge with team members to improve idea generation and creativity. This captures the views of many participants on the effectiveness of technology. It is important to note that, these views were largely only referenced by managers of teams. Only a single individual discussed their view of technology in the context of this theme. The table below provides evidence of participant responses.

Table 29: Evidence of Transparent access of knowledge code group

Participant	**Response**
VTMC	*"If you can disseminate information faster like I think that's the main challenge for any businesspeople most errors that happen in any businesses because that information was not clearly articulated to import and stakeholders like issues that we've seen recently on where people didn't realize that something was built, and people didn't realize"*
VTMG	*"It helps a lot actually because then they see it, they build, they're not drowning in the facts. You know this, it's a straightforward thing for them..."*
VTMI	*"Quite often you find that the activities that are done by my department are either influenced or influences another department so collaboration irrespective of technology in certain types of jobs that we do, it is embedded in what we do. However, what technologies such*

	as these two, it just improves that efficiency, it improves the effectiveness of it. Learn like instead of us creating a secluded opportunity to collaborate, we can in a matter of seconds, bring in collaborations. And because it enables the shared data with ease we can engage and share information and keep record of the shared engagements."

5.5.3.2. Analysis of theme

The implications of changes in social interactions due to heightened virtuality of work was highlighted by many participants and a key impact for the creativity of teams. Most participants indicated that there exists power dynamics between team members (individuals and managers) and virtual engagements tended to elevate these, with meetings being "dominated" as suggested by participant VTMH. Individuals within teams however, found that it increased their ability to contribute to idea generating due to the improved confidence provided by operating in a virtual setting – this was largely raised by Virtual team individuals as compared to managers. Participant VTIB stating that *"It helps a lot actually because then they see it, they build, they're not drowning in the facts. You know this, it's a straightforward thing for them and then the other thing I think the facilitator was really, really cool."*

An addition view from participants, was the perceived shift of virtual teams to more "transactional" engagements where human connection was significantly diminished due to the virtuality of teams. Participants who raised this were uniform in agreeing that to maintain appropriate levels of idea generation, human connection would need to be preserved and encouraged, often suggesting more in-person engagements for idea generation. Participants who shared this view did not suggest any additional way this could be achieve virtually, which, gave insight that they perceived idea generation through enhanced human connection as something that could only be achieve in a low virtuality setting.

Lastly, Manager participants of virtual teams, all raised the importance of having transparent access to knowledge through effective technology to enable creativity. Technology that could synthesise complex data and focus ideation attempts, with participant VTMG stating that "*It helps a lot actually because then they see it, they build, they're not drowning in the facts". This* suggests that there is a disproportionate value given by managers for access to knowledge, potentially due to them having limited time and increased workload due to high virtuality.

5.5.3.3. Theme conclusion

The theme of interactions is one that emerged due to the perceived increased requirement for virtual teams to maintain and improve social interactions for idea generation. There is contrasting views on what individuals and managers have observed as valuable for this to be improved where, virtual individuals within teams focussed on addressing power dynamics and the improved confidence of anonymity the comes with virtual work, while managers cited benefits of improved access to technology preserving human connections as key requirements to maintain social interactions within virtual teams.

5.5.4. Cognition theme

The fourth theme that emerged as having an influence on creativity of highly virtual teams was Cognition. That is, the process of idea generation.

The theme category groupings are summarised in the table below.

Table 30: Summary of Code grouping and codes for Cognition theme

Theme	Category Group	Codes	Code
Cognition	Cross team contributions	3	Challenging cross team collaboration Increased collaboration increased cross team collaboration
	Importance of preparation	2	clarity of role in sessions increased preparation required
	Technology for problem solving	4	insufficient technology infrastructure select appropriate technology technology a moderator the use of technology to solicit ideas and problem solve

5.5.4.1. Theme evidence

Evidence 1: Cross team contributions

This category grouping focused on the role of team collaboration within virtual teams for idea generation. This captures those responses in which the process of cross team engagement for idea generation, brainstorming and problem solving was discussed. Responses were divergent, with various participants providing contradicting views on the effectiveness of cross team collaborations. The table below summarises the key evidence obtained from participants.

Table 31: Evidence for Cross team contributions code group

Participant	**Response**
VTIC	*"I can't say that I have, I think my team in particular, we've all sort of gone off with our different functions and I don't think we are virtual environment has been encouraged as it should have been. And I think that stems down from, you know, we all have very specific functions that don't necessarily overlay between us."*
VTIB	*"What does make it complex is that obviously with that we have multiple team members working on one client"*
VTMC	*"I think it happens more now than what it used to just because of ease of doing this. You know, like for them to get information from me is a lot easier. You know, like if it's an e-mail people you know things get lost in e-mail you know. But now it's a lot easier to bug someone"*
VTIA	*"Typically, you'd hear that problem solving that takes place with another team member where you might be in conversations with the client. Now online, you don't necessarily attend all of the clients and so it's very hard to be up to date with what's happening in different work streams."*

Evidence 2: Preparation

The category of preparation within the cognition theme captured the perception of participants for the increased need for prepare for virtual ideation sessions due to high virtually. Participants raised that. virtual engagements required elevated preparation to be effective for themes linked to creativity. The below table summarises key views.

Table 32: Evidence for Preparation code group

Participant	**Response**

VTMG	*"Pre-work also matters, little things that they need to do because now you're in an online space. Not that prework doesn't matter if you are face to face, but more so when you're online because you really need to get that. You know the with the middle time that you have online, you have to get the best of their contributions and because it is a new space for everybody."* *"if you if you invite people online, everybody must have a role and you tell them in an upfront what their role is so that they know so that they can contribute also, and you don't waste time and that that that's one thing"*
VTIA	*"we try and get pre reads out to the client and so that at least they can engage with the material beforehand and we I think we overcompensate a bit more now with the actual content itself, because now instead of dedicating a full day out for a board meeting, people will try and squeeze it into a 3 hour session right online"*
VTMB	*"I'd also say maybe prepping people before they join the meeting and then inviting the relevant stakeholders to that meeting"*

Evidence 3: Technology for problem solving

This grouping discusses the effectiveness of technology as it relates to the processes of creativity. Responses were mixed with participants focussing on limited infrastructure to support technology (load shedding, the availability of internet connectivity), appropriateness of technology for idea generation and the role that technology facilitates in the generation of ideas.

Table 33: Evidence of Technology for problem solving code group

Participant	**Response**
VTIB	*"So I think that also should help with idea generation where you do have a question, you either ask it on WhatsApp or on a Teams chat in terms of if someone has seen something similar to what you're working on or something that you stuck on and get guidance there"*
VTMG	*"technology in this in this case then would enhance the experience, enhance the experience even more than what we would get in the office you know because you know some of them were well run you actually were looking forward to the part of those sessions because I*

	mean we had you know this white board they would have mini breaks and games that have nothing to do with projects, quizzes in-between and people enjoyed those"
VTMC	*"Look, I think firstly like see what platform works best for your team. You know what are people familiar with? What types of things do you need to do, you know, like when I dealt with some external providers, they had quite cool brainstorming software. Things to put ideas just like you put bubbles and you could draw lines between things, and you know, cause like a white board is finite whereas a computer, you know, digital black"*
VTME	*"infrastructure is lacking in the country whereby some connectivity is poor, so you find there are more challenges than anything else, right? So, somebody struggling to connect as somebody's being loadshedded and we struggle to hear them, you know that Robocop i.e. it Robocop when you speak and we can only hear like two or three words at a time."*
VTMH	*"I mean, load shedding doesn't even make it any easier, right? Because someone can say I was not at work for eight for four hours because, you know, there was load shedding and stuf"*
VTIA	*"Typically, we use things like Myra boards as well where you can put like stickies and the likes If you have an idea, you can put it on the sticky and then we come back to it. And when we do our team check-ins and checkouts just to unpack and discuss. And some of those ideas, and typically what I've also seen is being able to create SharePoint where you all work on the same document at the same time. And so that when people have ideas, they can put it into the document"*

5.5.4.2. Analysis of the theme

Cognition as a theme sought to capture the role participants views on how the idea generation and problem-solving processes would be impacted by scaling virtual work. Participants focussed disproportionately on the role of technology to support creativity within the theme, compared to others discussed in the study. This provided insight that they perceived that the creativity process of virtual teams would be largely dependent on the impacts of technology

across impacts like connection stability, integration of technology and extending to cross team processes.

To this observation, the responses were mixed in the study, with participants recognising the improved ability to solicit ideas from team members through technology, but also highlighting reduced ability to adequately conduct the creative process when contrasted with previous, largely low virtual, engagements. Participant VTIB highlighting this by stating that:

"I mean the ease of sharing documents, the ease of sharing screens and sharing materials and taking over somebody else's computer, you know, and typing something out instead, it becomes a bit awkward in a real-life situation if you grab their laptop or their hands, you know, it's not sort of as blatant". This based on responses, these can be summarised as alluding to technology as a moderator, where it can enhance or diminish the process depending on the teams and how they utilised this.

The other dimension focused on the deliberate requirement to deliver prework to prepare participants of virtual problem-solving sessions. This increased work was perceived by participants because of limited engagement time, increased formalization of virtual engagement and to ensure availability of stakeholders. This supports previous discussion on limited availability of stakeholders due to increase workload – this, showing how virtual teams have responded to compensate within the creativity process.

5.5.4.3. Theme conclusion

The creativity process is perceived to be highly influenced by increased virtuality of teams with processes amended to compensate for limitations brought on by heightened virtual work. This includes added pre-work for virtual engagements, a focus on enhancing technology. The benefits of technology were considered as mixed by participants, with technology used as a moderator of the virtual creativity process.

5.5.5. Finding for research sub-question 3

How will high levels of virtuality impact the generation of novel ideas (creativity) in virtual teams?

This question sought to understand the implications for creativity of virtual teams due to high virtuality. The impact of motivation on the willingness for virtual team members to partake in

generation of ideas was cited as high. Like the findings for collaboration, individual specific factors meant perceived impacts varied by participants. Influences to individuals like increased workload, high meeting fatigue and respecting personal boundaries, were viewed is key influences for participants willingness to engage in idea generation. It was also identified that key focus was required by organisations and managers to ensure deliberate strategies to preserve interactive engagements to keep all participants motivated. Furthermore, these strategies needed to encourage diverse views to support appropriate idea generation and creativity within virtual teams.

Another implication for the creativity of teams was the influence of procedural constraints. There was uniform agreement that processes and procedures for creativity had been amended to accommodate high virtuality of teams. These new process for virtual creativity were perceived as more rigid, overly formalised and reduced spontaneous idea generation. Furthermore, the procedures supporting decision-making, had been ineffective due to increased time for decision making, availability of stakeholders (spill over from implications to collaboration) and the rigidity of processes. However, where participants were given autonomy, the implications were positive.

The implications on social interactions as it related to idea generation was also viewed as impacted by virtuality of work. There were contrasting views on its influences between mangers and individuals in teams, with individuals citing positive benefits for idea generation due to the positive ability to diminish power dynamics (improved confidence from anonymity provided by virtual work) with idea generation session (individuals gaining a form of “virtual confidence”). Managers, however, cited benefits of improved access to technology preserving human connections as key requirements to maintain social interactions within virtual teams. Implications for the effectiveness of technology in supporting virtual work was mixed, and technology is viewed as a moderator for virtuality. That is, technology would improve or dimmish the ideation process depending on other processes and procedures around it (including norms and traditions).

The final implication focussed on cognition, and the creative process and how high virtuality influenced it. Again, processes had been amended by organisations and teams to accommodate virtual work resulting in further need to provide pre-work to have successful virtual creativity engagements.

5.6. Construct 3: Research findings on the Implications of high virtuality on Innovation of Virtual Teams

The third and final construct of the study related to the innovation of virtual teams. That is, the ability for teams to successfully implement new processes and ideas. This was investigated through one research question:

RQ 4: How will high virtuality impact the implementation of ideas (innovation) in virtual teams?

Participants were asked three questions during the interview, which related to the construct and associated research question. The questions mainly addressed; 1) the processes teams followed to implement new products and processes, 2) how these processes had changed due to increased virtuality, and 3) how innovation could be improved through virtual work.

The outcome of the interviews resulted in the emergence of 4 themes for the construct, namely: 1) Knowledge sharing, 2) conflict, 3) Knowledge integration, and 4) Innovation performance outcomes. It is important to note that there is an interlink between collaboration, creativity and innovation and thus the overall innovation process and associated themes were discussed under the most appropriate construct for the purposes of the chapter.

The table summarises the themes that emerged for the construct including the relevant category groups determined in the thematic analysis.

Table 34: Summary of themes for Innovation

Theme	Category Group	Codes	Code
knowledge sharing	Intentionality	3	don't replicate F2F in Virtual intentionality of virtual engagements recognise differences in virtual vs in person
	effective tools	3	lack of integration technology forces rigid engagement technology functionality limitations for problem solving

Conflict	Forced transition	4	Enhanced virtual collaboration due to necessity Innovation driven from necessity unavoidable Virtual collaboration driven by necessity
Innovation performance outcome	Implications for Problem Solving	3	Enhances innovation implementation improved problem solving reduces cost of implementation
	Flexibility and agility	4	improved flexibility improved productivity measurement dependant
knowledge integration	Blended work	10	blended work Deliberate F2F engagements F2f easier for collaboration F2F easier for decision making importance of face to face for idea generation importance of face to face for problem solving In-person useful for brainstorming In-person useful for engagement in-person useful for feedback less productive for

			collaboration and creativity

The themes will now be discussed and analysed.

5.6.1. Knowledge sharing

The knowledge sharing theme as it relates to the innovation of virtual team's sought to capture the implications of high virtuality on the innovation of virtual teams. This included the intentionality of engagements and the effect of tools in facilitating knowledge sharing.

5.5.5.1. Evidence of theme

Evidence 1: Intentionality

Participants indicated the importance for problem solving and sharing knowledge in the context of implementing novel ideas. Two participants further suggested that virtual engagements should not replicate those previously used in less virtual environments, and focus be given to create new methods of engagement for virtual work. The evidence below only captures those views that were unique to knowledge sharing as it relates to innovation, and additional evidence was discussed in earlier sections (creativity and collaboration)

Table 35:Evidence of Intentionality code group

Participant	Response
VTIA	*"So, try and get them in early try and block out time that's explicitly dedicated to that and I think be intentional about facilitating the conversations across the team members to get diverse views of what we're trying to solve."*
VTMB	

	"I'd say keep your meeting shorts and straight to the point. Encourage people switching on videos. So, you can get people to be more engaged."
VTMG	*"I think firstly it comes with firstly the design of your program, because what we try and do, we just plug it, it's a copy and paste. OK in the office with means typically sit in the boardroom for an hour or two depending on how long and then we try to just migrate the same model to online and it doesn't work in my opinion"*
VTMA	*"When we run with virtual workshops with clients, you need to have like an agenda that says, OK, cool. We're going to run from 8:00 o'clock to 12:00. O'clock. We're going to have these presentations, and you need to think about your presentations in a way that gives people engagement. Right. So you need to say, OK, cool. This is what we want to get out of the workshop. We're going to put people into breakout rooms. And this breakout room. This is the template we're going to use. We're going to have one person who's facilitating. We're going to have one person. Who's the scribe? and we're going to need somebody to make sure that we get these outputs when we come back into the plenary or into the main zoom session or whatever it is. So, you just need to be a lot more thoughtful around like the outputs you want and what templates you put in place so that people actually engage. Otherwise, you just end like, I don't know, 4-hour workshop where there's a lot of talking and no outputs. "*

Evidence 2: Effectiveness of tools

The effectiveness of tools was discussed by participants as impacting effective knowledge sharing for implementation of process. Participants raised concerns around limitation of functionality and the lack of integration of tools to facilitate appropriate implementation of processes and ideas. However, this was not uniform, with some respondents more effective engagement due to available technology. The evidence of participant responses is summarised below.

Table 36: Evidence of Effectiveness of tools code group

Participant	**Response**

VTMH	*"I think what we don't do well is integrate technology and our culture, our culture into technology, I don't know. I don't know which way it needs to go, but you know the tools are tools. A big element of defining the effectiveness of the tool."*
VTMB	*"We also had a big incident in the past week in, in, in Cape Town and we quickly had to come together to discuss it and then we were able to do it on, on, on Microsoft Teams and everyone could join in and have the discussion. So, it made it fairly easy, I must say."*
VTMI	*"I'm able to actually go in into different innovative models with ease when I'm using these kinds of official environments because it is easy to just colour on them and pull them and use them live. And often you find that most of these platforms allows for live environment and the ease of modelling, it really becomes exceptional easy to model things in virtual environments"*
VTMF	*"I believe you struggle incredibly hard to firstly set your culture and then to keep your culture right. I mean, you know how culture is driven is driven by engaging with the people, seeing the people, being around the people, feeling those unfeeling things that you just don't know. Right? So at a strong part of innovation is culture, right? If you don't have a culture of innovation, you don't innovate."*

5.5.5.2. Analysis of theme and conclusions

The ability for teams to effectively share knowledge presents a key enablement for virtual team innovation processes, with participants citing more intentional processes supported by effective technology to promote effective implementation of ideas. Participant VTMG stating about the following on virtual processes for idea implementation, “then we try to just migrate the same model to online and it doesn't work in my opinion “.

The effectiveness of technology was viewed as divergent by participants during analysis, with some indicating that there were increased benefits to virtual knowledge sharing due to convenience of accessing multiple data sets, however, others indicated that limited functionality and integration, negatively impacted knowledge sharing.

5.6.2. Conflict

This theme emerged from the thematic analysis largely due to participants who had experienced virtual work because of a single event, that forced heightened virtuality – mainly COVID-19. Participants discussed the role it had on the innovation process, highlighting key perceived outcomes due to the "forced" implementation of heightened virtual work, as stated by responded VTIG. Participants also demonstrated that in some instances Virtual work motivated from conflict and necessity resulted in positive outcomes for innovations within teams and organisations.

5.6.2.1. Evidence for Theme

The table below summarises the responses captured during the interviews

Table 37: Evidence for Conflict theme

Participant	Response
VTMG	*"we understood that coming out of COVID the market or the landscape was not going to be the same. So, we have to then come up with those ideas now in that that's when we adopted the design thinking model to come up with those ideas because it was the first time, we had to do it"*
VTMA	*"So yes, I've been a victim. Ok, I don't actually play victim, but I've been a victim of the virtual world quite extensively."*
VTIG	*"…It helps having your camera on we would be forced to have our cameras on during our engagements and also just contributing to those engagements also helps a great deal because you never know maybe you'll bring a solution to the table that no one thought of that makes everyone's life easier. So yeah, that's my closing point."*
VTMA	*"I used to connect with people a lot more when everyone was in the virtual world. Now that some people are kind of back to being in the office, I don't know who is readily available in zoom like for example I would just like call one of my colleagues and if they're available they'll pick up if they're not available, they wouldn't. But since everybody's kind of moving around now, I don't do it as much."*
VTIE	*"It's been working well so far because those meetings, at least we get to bring out issues that we have management guests to share."*

5.6.2.2. Analysis of them

Respondents of this theme demonstrated an appreciation for healthy conflict during the innovation process, citing the positive benefits of outcomes that we necessitated by encouraged migration to heightened virtual team engagements. This conflict also presented when participants discussed team norms like switching on cameras during engagements, where participant VTIG also supported the positive outcomes of being "forced" to have their camera on. They further demonstrated this by stating "It helps having your camera on we would be forced to have our cameras on during our engagements and just contributing to those engagements also helps a great deal because you never know maybe you'll bring a solution to the table that no one thought of that makes everyone's life easier. "This view however, contradicted those raised by other participants when they discussed the social norms as intrusive and leading to potential reduced engagement. Furthermore, it is important to note that some participants cited feeling harm due to the migration to virtual, with participant VTMA perceiving themselves as "a victim of the virtual world".

5.6.2.3. Theme conclusion

The theme of conflict is one that emerged as a driver of positive innovation outcomes by participants, as it encouraged increased effort for innovation activities necessitated the by COVID-19 pandemic.

5.6.3. Knowledge Integration

Knowledge integration discussed those elements in the innovation process that participants raised as impacting processes and procedures that facilitated the implementation of new products and ideas. That is, those elements in the cognitive implementation process that heightened virtuality would affect when implementing ideas - including robust debate on ideas, their implementation and execution thereof.

5.6.3.1. Evidence from Participants

Participants provided several indications around the view that in-person engagements were still required to facilitate knowledge integration, despite heightened virtuality within the team. These views were largely grouped under the category grouping of blended work.

Table 38: Evidence for Knowledge Integration theme

Participant	Response
VTIA	*"…when we're in person, it becomes a bit easier to, like, facilitate those conversations and those brainstorming sessions and I think we're less*

	distracted when we're in person than what you typically find in the virtual setting and I think it just makes it a bit harder to collaborate."
VTMH	*"Whereas when you are in a physical office environment, you know your list is your list and if you get to the end of the day and you haven't taken everything, it's OK because you spend a good amount of time engaging on other matters that may or may not be important, but then you are connecting with people."*
VTMA	*"…I think the pace of virtual work, depending on the context of the project, can be faster, but I think the depth is definitely less. so, I think having people in-person in the team room, whiteboarding solution, or problem or whatever it is just means you get to the nuance of the problem a lot. Like in a lot more depth than you would in a virtual setting"*
VTMB	*"It has happened in my space and other spaces as well, where we've seen it happening where we now saying that we actually have to change that and if there's a new system that we introduce and we would rather have people sitting together in the office and then working through the system together or doing training together because this virtual teams is not working for training"* *"…so maybe just to summarize, we did it on teams before, but we are struggling and seeing that it comes with some issues. So now we prefer going back to the old method of face to face."*

5.6.3.2. Analysis of participants

The knowledge integration theme sought to capture participant views that related to how the process of implementing ideas within virtual teams was impacted by heightened virtuality. Participants indicated that it was largely ineffective and where possible, would resort to in person sessions to conduct critical innovation tasks. Participant VTMB explained this by stating that “we did it on teams before, but we are struggling and seeing that it comes with some issues. So now we prefer going back to the old method of face to face." This regression back to in person engagements, which largely represent lower virtuality, demonstrated that virtuality was driven due the limitations of covid-19 (or other) and not the preferred method of team engagements. A further insight from Participant VTMA, was the reason why virtuality

was perceived as ineffective in the innovation process and more effective for tasks that did not require depth and team participation within the knowledge integration process, , by stating that “if there's a new system that we introduce and we would rather have people sitting together in the office and then working through the system together or doing training together because this virtual teams is not working”. Furthermore, participants had recognized this drop in individual task productivity when engaging in person and focused on it being an avenue to execute only specific engagements like changes in processes, the introduction of new products or maintaining positive team connections with virtual members. Participant VTMH indicating, “whereas when you are in a physical office environment, you know your list is your list and if you get to the end of the day and you haven't taken everything, it's OK because you spend a good amount of time engaging on other matters that may or may not be important, but then you are connecting with people.

5.6.3.3. Conclusion

Knowledge integration during the innovation process, was determined by participants as ineffective in a virtual setting, due to the limited ability to execute in-depth problem solve with team members. Participants expressed a need for more in-person engagements, reserving virtual engagements for individual tasks, which were perceived as more efficient when done virtually. Lastly, this insight suggests the need for ongoing blended work (both virtual and in-person) to preserve the innovation processes of teams.

5.6.4. Innovation performance outcomes

The final theme that emerged from interviews with participants related to the implications on innovation of virtual teams was themed innovation performance outcomes. This sought to discuss those category groupings that participants perceived would be outcomes of heightened virtuality of teams.

5.6.4.1. Evidence

Evidence 1: Implications for problem solving

The below table summarises the participants view related to the implications for problem solving. Most responses suggested that heightened virtuality had overall positive benefits for problem solving and innovation.

Table 39: Evidence for Implications for problem solving code grouping

Participant	Response

VTMC	*"like the biggest thing that I think that's helped with innovation and process and like generally getting these things over the line is that's giving everyone more flexibility because if you're working more virtually, I can do things when it's most convenient and efficient for me."*
VTIC	*"I can just quickly, you know, bombing out myself instead of trying to get a hold of somebody and making sure that they're available and try to explain from our computer online and sharing my screen."*
VTMI	*"That's an advantage that comes with virtual engagement. And anyway, you are able to do virtual tours that that are sometimes not easy to do a physically and on top of that it just and it reduces cost where I would have flown down to Captain I'm able to actually do this product development or product run out having not to go out down to Cape Town you find that you are able to engage"* *"…because it's done collaboratively, it enhances and transparency, which is something that lacks in physical the engagements."*
VTMG	*"…I doubt we would have delivered those solutions in the office. So it helped. It helped quite a bit."*

Evidence 2: Flexibility and agility

The other category group that contributed to the knowledge integration them was flexibility and agility, which combined all codes that referenced the benefits to the knowledge process when it came to productivity and flexibility. Participants cited positive benefits to productivity and opined on the improved flexibility that came with virtual work in the innovation process for participants. The table below provides evidence from the key contributors to the group:

Table 40: Evidence of Flexibility and agility code group

Participant	**Response**
VTMC	*"You know, if I'm an evening person, I can go and review all those documents at home, you know, and then do my approvals. We can have later meetings like I've had sessions with my Boss Building solutions at like, 10 o'clock at night. You know? And then we're not at*

	work unsafe. I'm at home. What it has done is it has given everyone more flexibility which is made them more efficient in delivering those solutions. So, you can do things remotely, you can collaborate and discuss things remotely and then that's been a big help." *"It's been like people are able to do more because you can have virtual meetings. Not everyone needs to be person when we need to do things like I'll make an example where, you know, we were doing testing over a weekend. I could be at a shopping mall and reviewing the test results without having to constrain myself"*
VTMA	*" I feel like there has been an element of it that just gives you flexibility that you don't necessarily get when you go into the office. So, for example when I go into the office now, it takes me an hour to go from Lone Hill to like Sandton to go to the office that to me makes no sense when I could arguably be more efficient just spending that hour on a document or just spending that hour not being stressed about being in traffic. So, I think there is an element of it that gives flexibility that I'm surprised by the fact that a lot of corporates are starting to take that away, right, because there's a lot of, I don't know how you guys are"*
VTIG	*"So, it works out better because when you're working virtually you get to do more and you get to do more. You get to work a bit longer hours instead of wasting 4 hours in tracking going and coming back to work"*
VTMH	*"…in my situation we agree on outputs at the beginning of the year. So, we've got half yearly review in terms of our objectives and key results, right? So, in Jan, we agree by June, you need to have delivered X which we check-in every month and it's really output driven when you do it."*

5.6.4.2. Analysis of theme

The evidence from respondents suggested that they perceived that there were positive implications for virtual teams as it related to the innovation process. Participant VTMC stated. *“because if you're working more virtually, I can do things when it's most convenient and efficient for me* “. This suggested that the enhanced flexibility brought on by virtual work, improved the flexibility of team members on when they needed to participate in innovation activities. In addition, participant VTMC highlighted that this improved flexibility of virtual work

pair ed with the ability to work remoted, enabled them to fulfil critical process and product implementation activities including conducting testing remotely. Again, this was another category that was largely discussed by managers, with only one participant from the individuals discussing any positive benefits to Knowledge exchange – potentially linked to earlier points raised by managers on virtual work resulting in limited availability linked to increased workload.

Furthermore, participant VTMI cited that virtuality enabled the pro-typing process, a vital part of the innovation process, to be done more cheaply through simulation:

> *That's an advantage that comes with virtual engagement. And anyway, you are able to do virtual tours that that are sometimes not easy to do a physically and on top of that it just and it reduces cost where I would have flown down to Captain, I'm able to actually do this product development or product run out having not to go out down to Cape Town you find that you are able to engage. (Participant VTMI)*

The additional insight that was provided by participant VTMH, was the recognition that the improved benefits were also dependent on the type of output measured, and if virtual team members were measured on outputs, it provided less requirement to engage in person to fulfil activities and gave a level of autonomy to benefit from the flexibility. That is, work could be performed at their own pace and time, provided they delivered the output within the expected time. This is captured when they state *"in my situation we agree on outputs at the beginning of the year. So we've got half yearly review in terms of our objectives and key results, right? So, in Jan, we agree by June, you need to have delivered X which we check-in every month and it's really output driven when you do it".*

Lastly, there was a striking contradiction between this theme and the knowledge integration theme discussed previous, which provided insight that the virtuality of teams resulted in negative implications for innovation – especially as this theme cited largely positive benefits including flexibility, agility and others to the innovation process. This difference may allude to the view that there are specific components that are less ineffective in the innovation process, largely knowledge integration activities like team problem solving and in-depth discussions, however, once clarity has been established on solution, it is more flexible for participants to operate and execute tasks remotely, leading to enhanced flexibility and productivity for them. This presents a case for a focus on the division of activities across face to face and virtual interactions (blended) for optimal innovation processes

5.6.4.3. Theme conclusion

This theme highlighted those positive implications for heightened virtuality of teams within the innovation process, citing benefits to team members related to productivity and flexibility of

work. Furthermore, the increased autonomy provided by working virtually, meant participants could efficiently implement their individual tasks more efficiently, less so for group tasks, which suggests that virtual work is more efficient for individual tasks as compared to group tasks.

5.6.5. Finding for research sub-question 4

How will high virtuality impact the implementation of ideas (innovation) in virtual teams?

This question sought to answer the question around the implications of high virtuality on team innovation. The implications were grouped into four themes; namely: (i) Knowledge sharing, (ii) Conflict, (iii) knowledge integration, and (iv) Innovation performance outcomes.

First the implications for knowledge sharing implications were summarised. The ability to share knowledge for implementation of processes and products, was mainly viewed as positive with participants citing the positive benefits to training, prototyping and rolling out processes to the organisation and its customers as effective. However, they cited that the intentionality of knowledge sharing in virtual teams needed to be deliberate in order to support effective knowledge sharing, care taken not simply to replicate those processes that were effective in F2F knowledge sharing. Technology was also raised as a both positive and negative, where the ability to process large data sets effectively across teams viewed as positive and the lack of integration and multiple systems cited as inhibitors of innovation.

The second set of implications related to conflict. Participants cited that whilst there existed initial conflict during the move from largely face-to-face to more virtual teams for implementation of ideas, and the forced changes in processes procedure and online norms - this conflict encouraged more considered methods to execute the innovation process including upskilling of team participants on structured techniques of innovation. Furthermore, the innovation process was perceived as more deliberate and robust due to virtual work. However, some participants cited that enforced changes to team norms, like the requirement for cameras being on, felt intrusive and could result in less favourable outcomes for innovation.

The third implication related to knowledge integration during the innovation process. High virtuality was perceived as ineffective to its limited ability to support in-depth problem solving within team virtual team members. Participants opined that knowledge integration within the innovation process was something that could only be executed through in-person

engagements due to the level of engagement required. However, once initial engagements and occurred and tasks had been sub-divided, virtual work was more efficient for individual tasks.

The fourth implication related to innovation performance. Heightened virtuality was perceived to have positive benefits for individual task productivity due to the flexibility it provided to team members. The increased autonomy of working virtually meant team members could efficiently implement their individual tasks more efficiently. However, this was cited as less effective for team tasks related to innovation, which were also negatively influenced by availability of stakeholders, time for decision making, trust and other factors listed earlier the chapter.

5.6.6. Finding for research question sub-question 5

How can organisations maintain or improve the positive benefits of collaboration and creativity within teams that were predominately F2F before adopting higher levels of virtuality?

This question sought to understand any implications for organisations related to the migration from face-to-face to predominately virtual. This integrated views across all the constructs with three key findings emerging:

First was the clarity in the role of face-to-face as compared to virtual engagements. Participants cited how organisations had begun to introduce hybrid work. This work had positive benefits for team connection and spontaneous engagement, which was perceived as positive for collaboration, innovation and creativity of teams. However, due to the inefficiency and drop in productivity for task specific functions, Participants suggested that organisations encourage virtual work to be preserved for more focussed tasks, while in-person utilised to build human connection, collaborator rapport, building trust and complex group problem-solving and deliberation.

The second focussed on the enablement of virtual participants through resources including technology, infrastructure – high mentions on connectivity and load shedding – and the ability to select appropriate technology that is suited for the requirements of the virtual team, but it integrated to other organisational tools. This is suggested to enhance virtual engagements and support the innovation and collaboration process further.

The last recommendation was to promote increased autonomy for participants to execute decision making, in the absence of required collaborators. The increased time for decision making and stakeholder availability was perceived has a high inhibitor of collaboration. Participants suggested that in the cases where this was liberated the innovation process was faster. This likely to have positive benefits for organisational outcomes.

5.7. Conclusion for chapter

This chapter sought to discuss the findings of the study by summarising the views of the participants of the study. This was achieved through 15 semi-structured interviews that we thematically analysed using SPSS. Key phrases were coded to generate 120 codes, which were further grouped into 29 category groupings. These groupings were then further examined, and 11 themes emerged. These themes were then discussed, analysed and interpreted individually under the appropriate construct, with sections concluded by summarising the findings of each construct to answer each research question.

Chapter 6: Discussion of Research Findings

6.1. Introduction

This chapter continues from the previous one by discussing the research finding of the study. This is done by comparing the key finding of Chapter 5, with the literature presented in Chapter 2.

Table 41 below summarises the 5 research questions of the study, highlighting the associated 3 constructs they sought to understand. Furthermore, the key supporting literature for each construct as well as the derived themes from Chapter 2 and Chapter 5 respectively.

The structure of the chapter follows on from chapter three, where discussions will be presented by theoretical construct, where each theme within the construct will be discussed individually by, (i) introducing the key findings, (ii)discussing the key theme findings by considering literature, (iii) providing conclusions for each theme. Once all themes in the theoretical construct have been discussed, an overall conclusion for the construct and associated research questions is discussed.

Table 41: Summary of Research questions, Construct, Literature and theme link

Research Questions	Theoretical Construct	Supporting Literature	Theme
RQ 1: How will high degrees of virtuality impact the collaboration patterns of virtual teams? & **RQ 2:** How can managers sustain the positive benefits of collaboration previously evidenced	Collaboration	Choi & Cho (2019) Kniffin et al. (2021) Yang et al (2022)	Coordination Cooperation Information Exchange

in F2F teams, within highly virtual teams?			
RQ 3: How will high levels of virtuality impact the generation of novel ideas (creativity) in virtual teams?	Creativity	Acar et al. (2019) George et al. (2020) Anderson et al.(2014) Thayer et al., (2018). Kozlowski and Chao (2018) Asatiani (2021)	Motivation Procedural Constraints Cognition Social Interactions
RQ 4: How will high degrees of virtuality impact the collaboration patterns of virtual teams?	Innovation	Acar et al. (2019) George et al. (2020) (Thayer et al., 2018) Kozlowski and Chao (2018)	Knowledge sharing Conflict Knowledge Integration Innovation performance outcome
	implications of RQ 1 - 4 at the organisational level.	Hitt, Arregle, & Holmes (2021) George et al. (2020)	Enhanced autonomy Blended in human connection

6.2. Construct 1: Collaboration

The findings on the theoretical construct of collaboration sought to answer the first two research questions related to the implications for the collaboration of highly teams and the follow on by providing suggestions on ways in which collaboration, previously experienced in F2F, could be sustained and improved.

The key findings were categorised into three themes: (i) coordination, (ii) cooperation, and (iii) information exchange, which were all determined to have implications for the overall collaboration of highly virtual teams. These are now considered.

6.2.1. Coordination theme

The co-ordination theme focussed on those implications that influenced the ability for virtual teams to gain access to collaborators and included implications around stakeholder availability, access to geographically dispersed collaborators and the use of technology in facilitating and coordinating collaboration engagements.

6.2.1.1. Key theme findings

The first key finding for the theme related to the availability of stakeholders and collaborators. Across participants there was consensus that high virtuality had resulted in increased workload that consumed the time of collaborators and negatively influenced coordination attempts. This resulted in the reduced availability in the reduced ability of stakeholders to partake in collaboration efforts. The unavailability of stakeholders was expected to have negative spill over effects for decision making and problem solving which required collaboration.

However, there were perceived positive implications for coordinating with geographically dispersed collaborators. The findings highlighting the expected improved access to global expertise that would present positive spill over effects for idea generation and implementation. This access to global expertise was also expected to improve global best practice during problem solving, further elevating its implications in the study.

The last implication related to the role of technology in coordination for collaboration within highly virtual teams. Recent improvements in technology were perceived to provide positive outcomes for communication, due to their enhanced ability to facilitate synchronous communication - where earlier virtual engagements only supported asynchronous (email) communication which was limiting and ineffective for co-ordination efforts.

6.2.1.2. Discussion of key theme findings

The findings presented several similarities with the literature on virtual coordination and collaboration. First, the ability to co-ordinate with geographically dispersed stakeholders effectively, aligned with current collaboration literature. Asatiani and Penttinen (2019), arguing that with the advancement of telecommunication technologies, there was significant improvement in the collaboration of geographically dispersed collaborators. Furthermore, by definition, virtualisation – the collaboration of geographically dispersed teams working together across time – by its very nature, requires ability to collaborate with those in different locations is a critical requirement (Choi & Cho, 2019).

Jain and Huang (2020), further support the findings related to effective coordination of geographically dispersed participants, highlighting that there were positive benefits for

coordinating activities for knowledge workers to acquire new information and sharing new knowledge due to the introduction and scaling of virtual work.

Research findings on the effectiveness of technology to promote effective coordination were found partially inconsistent with the findings of the study. Participants had viewed positive outcomes for technology in supporting coordination. However, Kniffin et al (2021), had argued that communication richness available to face to face teams was lacking in virtual settings, which resulted in limited coordination in virtual teams. Furthermore, participants had cited these views as largely due to shifts towards more synchronous communication tools like Teams and Zoom. However, again, this was not supported by the existing literature, where it was argued that while technology had evolved to facilitate more real-time communication amongst collaborators, the positive benefits had stemmed from asynchronous communication, which enabled more reflective and considered collaboration contributions (Jarvenpaa & Välikangas, 2020). However, there remains general consensus within that the improvement in technology has yielded positive advancements in virtual coordination.

One the findings related to stakeholder availability and increased workload and meetings because of virtuality, literature was limited. Yang et al. (2022) provided some literature that posited that during heightened virtuality brought on by COVID-19, participants had focussed on utilising email communication, reducing reliance on virtual meetings. This contradicts the findings of the study's participants who raised stakeholder availability due to increased meetings as the highest recurring theme. When engaging earlier literature, Greer and Payne (2014), considering the challenges of telework using social exchange theory, they found that participants raised that accessibility was a challenge when working remotely. However, this challenge related to workers seeking to preserve the image of being accessible when working virtually as a form of reciprocity for organisations offering the privilege of remote work at the time. That is, the challenge related more to perceived accessibility (being viewed as available), rather than actual accessibility (genuine unavailability due to workload or other factors).

6.2.1.3. Theme Conclusion

The research findings are partly consistent with current literature. Improved coordination with geographically dispersed collaborations was consistent with literature, however, findings on the effectiveness of technology had some divergence with literature, despite being largely viewed as positive for supporting virtual co-ordination. Lastly, findings on stakeholder availability for virtual collaboration due to increased meetings was limited in the literature related to coordination or collaboration.

6.2.2. Co-operation theme

The cooperation theme focussed on the implications that influenced the willingness for participants to collaborate and included implications like individual-specific factors (tenure, understanding of technology, previous engagements with virtual work), prior rapport with collaborators, organisational culture and virtual norms.

6.2.2.1. Key theme findings

The first key finding related to the implications of high virtuality on cooperation of virtual teams was the influence on individual specific factors. That is, individual level characteristics and behaviours that would influence a participant's willingness to participate in collaboration. This included tenure (length of time in team) and understanding of technology. Where increased tenure in the virtual team was perceived as having positive implications for cooperation in highly virtual teams. Furthermore, the other key additional finding was the importance of prior rapport with collaborators, largely gained through prior in-person engagement, was considered a key driver of co-operation, having positive benefits for cooperation. This was also perceived as a barrier for introducing new contributors.

The second finding focusses on the implications of role of organisational culture, traditions and virtual norms introduced by organisations to support collaboration like camera's switch on/off, length of engagements, and other to improve collaboration. Participant aligned around it being necessary, however, had divergent views on which traditions were supportive for cooperation. Furthermore, some traditions were viewed as inhibiting for cooperation if not team appropriate. For example, camera's negatively impacting introverts.

The last finding related to spontaneous and informal cooperation, with participants citing that high virtuality had reduced opportunity to engage in spontaneous cooperation continuously and sustainably.

6.2.2.2. Discussion of key theme findings

The key findings had several similarities and alignments with existing literature. Individual specific characteristics and their how they influenced collaboration is argued by, Larson et al, (2017), as resulting in some participants of highly virtual teams being more successful than others. They cite motivation disposition and cultural background as additional influences for collaboration for positive team outcomes like creativity and innovation (Larson et al., 2017).

Furthermore, the role of tenure in the team, linked with the finding of prior relationships, as being positive for cooperation within virtual teams was supported by literature. Jiang and Chen (2018), posit that knowledge sharing needs to be integrated into the norms of group cooperation. Choi and Cho (2019), posit that there was reduced collaboration in virtual teams

due to the limited personal rapport and trust amongst collaborators, as compared to face-to-face teams. Personal relationships established with collaborators, tended to result in stronger trust, a pre-requisite for better cooperation and a stronger willingness to engage in sharing of knowledge and information (Choi & Cho, 2019). In addition, recent literature found that the shift to organisation-wide remote work resulted in employees spending more time engaging with collaborators which whom they had strong previous ties (driven by trust) – these types of collaborators were found to be beneficial for information transfer (Yang et al., 2022).

An additional finding was raised on the role of organisational culture in supporting and promoting the traditions and norms that support virtual cooperation. There were some similarities in what was presented in the literature. Asatiani, Rossi and Penttinen (2021), supported the view that higher virtuality would result in implications for navigating organisational culture in virtual teams. While the obvious lack of interactions with organisational artefacts was not raised by participants as a challenge for navigating culture, the inability to learn organisational rituals was raised and aligned to the findings (Asatiani et al., 2021). That is, learning about organisational practices (including conflict management, problem solving and similar) was impacted due to the lack of opportunity for face-to-face engagement. In addition, the deliberate actions by managers and organisations alike to promote more rigid engagement norms (switching camera on policies) to compensate for the lack of organisational culture socialisation practices, also demonstrates constancy with the current literature and findings (Asatiani et al., 2021).

The last finding on the reduced opportunity for spontaneous and informal engagements resulting in reduced collaboration is also aligned and supported by the literature findings. Yang et al. (2022), shares this view, by arguing that high virtuality has resulted in limited informal and spontaneous interactions with both internal and external stakeholders, which is a key method to acquire new information for virtual teams.

6.2.2.3. Theme conclusion

The research findings of the theme are consistent with those discussed in the literature. The findings on organisational culture, individual specific implications and the reduced spontaneous interactions demonstrated alignment with the literature findings.

6.2.3. Information Exchange theme

Information exchange emerged as the final theme that respondents expected to influence collaboration within highly virtual teams. This related to the effective sharing of knowledge specifically focused on effective communication and trust.

6.2.2.4. Key theme findings

The first finding of the theme focusses on the negative implications for information exchange within virtual teams' due ineffective communication brought on by the lack of non-verbal cues, the unnatural nature of virtual communication and the ineffective manner of communication as limiting virtual collaboration.

Furthermore, there was a finding that expressed changes in the relationship between virtual team members, resulting in a more transactional relationship resulting in further negative implications for information exchange.

The last finding related to trust, which was considered vital for information exchange to successfully occur amongst collaborations. Participants displayed a mistrust of team members due to a lack of visibility of what virtual team members were engaged with.

6.2.2.5. Discussion of key theme findings

Comparing the findings to literature, the were some congruencies. However slight differences were established with prevailing literature.

The first finding discussed the negative implications to communication, driven by a lack of non-verbal cues and the unnatural way information was exchanged virtually. Schmidt (2014) supports the findings of the study, highlighting that this has been a long-standing challenge of virtual work, where a lack of social cues and non-verbal communication has been argued as resulting in negative outcomes for information exchange amongst participants. One participant in the study highlighting the diminished value they derived from collaborations with global experts due to "strong accents" that were difficult read without verbal cues. Asatiani and Penttinen (2019), also contribute by arguing that organisations with highly virtual teams have more formalised communication management, which is less natural and presents inefficiencies for information sharing.

The second finding presented some insight into how the nature of the relationship has evolved to be more transactional as teams becoming more virtual. This had some congruence to current literature, where it is discussed within the motivation and social exchange theories on virtual engagement (Lin et al., 2019). Lin et al. (2019), suggest that virtual teams have heightened their need for incentives and extrinsic rewards (transactional incentives) for motivation to promote team collaboration and information exchange. Thayer, Petruzzelli, Mcclurg (2018), also allude to this shift to more transactional relationship in virtual teams, they argue that leadership behaviors to support collaboration need to evolve beyond traditional leadership styles that drive collaboration, like transformational leadership, to incorporate

transactive leadership to adjust to the demands of virtual teams and information exchange. Despite this literature, the study found that there were still some gaps in the literature to fully explain this shift by highly teams towards a more transactional relationship as described by participants in the research study.

Lastly, we discuss the implications of trust for highly virtual teams on information exchange. Similarities between the literature and findings were present, with the role of trust having been extensively researched for virtual teams (Choi & Cho, 2019; Lee et al., 2019; Schmidt, 2014). Choi and Cho (2019), posit that trust is vital for the knowledge sharing of teams, with goal congruence being a critical factor above others for establishing trust in virtual teams. This supports the view from participants that a lack of visibility may result in mistrust. That is, if team members are aligned on what each members goals and objective are, trust becomes easier to establish and has direct consequences for information exchange.

6.1.3.3. Theme conclusion

The findings on information exchange presented as aligned to the literature of the study on most finds of the theme. However, the finding related to the shift in the relationship of team members to become more transactional in nature, suggested that further literature was required to fully capture this shift that was presented in the study.

6.2.4. Conclusions for research sub-question 1

How will high degrees of virtuality impact the collaboration patterns of virtual teams?

Table 42: Summary of Conclusions RQ1

Theme	Finding summary	Literature	Potential new sub-theme
Coordination	**F1:** Positive outcomes for geographically dispersed teams	Asatiani & Penttinen (2019), Choi & cho (2019), Jain and Huang (2020).	
	F2: Technology advancement positive, but insufficient for effective coordination	Jain and Huang (2020), Choi & Cho (2019)	

	F3: Reduced due to stakeholder availability and meetings	Yang et al. (2022)	Limited stakeholder availability
Cooperation	**F4:** Dependent on individual-specific characteristics	Larson et al, (2017)	
	F5: Prior relationships improve cooperation	Jiang and Chen (2018)	Onboarding new team members
	F6: lack of Face-to-Face engagements negatively impacts organisational culture transfer vital for coordination	Asatiani & Penttinen (2019),	
	F7: reduced opportunity for spontaneous and informal engagements	Yang et al. (2022)	
Information exchange	**F8:** ineffective communication brought on by the lack of non-verbal cues	Asatiani & Penttinen (2019)	
	F9: Shift to transactional relations	Lin et al. (2019) Thayer et al. (2019)	Transactional nature of relationships
	F10: trust a pre-requisite for information exchange	Choi & Cho (2019) Lee et al. (2019)	

The first research sub-question sought to provide insight on the implications of high virtuality of teams on the collaboration. These implications and findings were presented through three dimensions of collaborations, namely: (i) implications for coordination, (ii) implications for cooperation, and (iii) implications for information exchange.

The first research finding of the study was that high virtuality of teams improves the coordination of geographically dispersed teams, by enabling the acquiring of new information and sharing new knowledge. This supported in literature by Jain and Huang (2020).

The second finding related to the implications of technology in supporting the coordination of virtual teams. The findings confirmed that advancements in technology had improved some of the coordination of highly virtual teams. However, there was contradiction with the literature as those improvements were still deemed insufficient, due to the inability to effectively

communicate, which required increased support for both synchronous and asynchronous communication. While the studies results suggested that technology had improved, literature viewed those improvements as insufficient for effective communication. A vital part of coordination across teams. Further work was still required to improve the synchronous communication of technology.

The third finding focussed on the implications of high virtuality on the availability of stakeholders. The findings in the study suggest that high virtuality of work has increased work demands of stakeholders resulting from increased meetings for participants, which has negatively impacted stakeholder availability for collaboration. Literature related to these implications was limited, with some literature discussing how virtual workers sought to manage perceptions of productivity by giving perceptions of increased busyness Greer and Payne (2014). This, however, did not adequately dismiss the findings raised by participants of the study, that virtual work resulted increased work with directly reduced their ability to collaborate with other collaborators. Importantly this was the theme with the most mentions from participant – illustrating its importance in participant perspective.

The next group of findings related to the implications on cooperation of collaborators in highly virtual teams. That is, the willingness for collaborators to engage in collaboration efforts.

The first finding was the implications that cooperation in highly virtual teams was dependent on individual-specific characteristics and behaviours and was not uniform. Considerations like tenure, personality and behavioural characteristics influenced the cooperation disposition of virtual team members. This was supported by literature from Larson et al. (2017).

The second finding was the implications that prior relationships with collaborators (largely developed in face-to-face engagements), positively influenced willingness to share information and engage in collaboration activities within highly virtual teams. Literature also provided some explanation around the role of personal relationships for developing trust, which then translated into more willingness to cooperate and collaborate with other team members (Choi & Cho, 2019). Importantly, the absence of trust also reducing the cooperation efforts of collaborators.

The third finding on the importance of the role of organisational culture in supporting and promoting the traditions and norms that support virtual cooperation. Organisational culture was considered vital for supporting cooperation. However, the lack of face-to-face engagements was expected to reduce the ability for managers to expose organisational norms virtual teams, which influenced how teams engaged in collaboration themes, would have negative implications for heightened virtuality of teams.

The last finding for cooperation was the reduced opportunity for spontaneous and informal engagements resulting in reduced collaboration. This was congruent with literature on collaboration Yang et al. (2022), and it was expected to have negative spill over effects for collaboration and innovation efforts of teams.

The last set of findings for the sub-question related to information exchange of virtual teams and collaborators.

The first finding related to the negative implications for information exchange within highly virtual teams' due ineffective communication brought on by the lack of non-verbal cues, the unnatural nature of virtual communication and the ineffective manner of communication for collaboration. Like the findings on the ineffective nature of technology to support communication, there was congruence with literature that high virtuality would negatively influence information exchange.

The second implication for virtual teams was the finding that there were changes in the relationship between virtual team members, resulting in a more transactional relationship resulting in further negative implications for information exchange. Elements of this finding were evidenced in literature related to the leadership changes required to support virtual teams – a shift to transact leadership (Thayer et al., 2018). Other, scant evidence discussed the motivation of virtual team members as becoming more extrinsic – alluding to the shift towards more transactional relations based on social exchange theory (Lin et al., 2019). However, literature was limited in understanding the phenomenon sufficiently, which presents opportunity for further exploration.

The last finding related to the implication of trust in promoting information exchange amongst virtual collaborators. The finds showed that collaborators displayed mistrust due to a lack of visibility of what virtual team members were engaged with resulting in reduction in information exchange. Literature supported the findings, with trust deemed as vital for information exchange within collaborators.

The findings for the sub-question were mixed, with many aligning with literature. However, implications for stakeholder availability for coordination and the implications of the shifting relationship in virtual participants provides distinct findings that required further understanding in literature.

6.2.5. Finding for research sub-question 2

How can managers sustain the positive benefits of collaboration previously evidenced in F2F teams, within highly virtual teams?

Table 43: Summary of conclusions RQ2

Theme	Finding summary	Literature	Potential new sub-theme
Cooperation	**F1:** onboarding new collaborators in- person & build interpersonal relations	Jiang and Chen (2018)	Face to face onboarding for new collaborators
Coordination	**F2:** reduce the amount and length of meetings	Yang et al. (2022)	Improve stakeholder availability

Research sub-question two sought to understand the how positive benefits of collaboration that we evident in face-to-face engagement, could be improved in virtual teams. We synthesis the recommendations from the themes provided by participants and literature.

The first finding related to the onboarding of new collaborators. It was recommended that new collaborators needed to be deliberately onboarded – through an element of face-to-face engagement to promote; (i) interpersonal relations and build trust amongst team members which will improve cooperation and information exchange during virtual engagements(Driskell et al., 2018), (ii) adequately provide organisational support through tools, structures, processes and sharing of norms to appropriately improve virtual collaborations (Larson et al., 2017).

The second finding and recommendation within the collaboration construct, was to reduce the amount and length of meetings to deliberately promote increased stakeholder availability for collaborations. This would also support the availability for spontaneous engagements(Yang et al., 2022). These themes considered as negatively influencing collaboration in virtual teams if not adequately addressed.

6.3. Construct 2: Creativity

The findings on the theoretical construct of creativity sought to answer the third research question which related to the implications for the creativity of highly teams, by considering the specific dimensions of idea generation, brainstorming and problem solving.

The key findings were categorised into four themes that emerged, namely: (i) motivation, (ii) procedural constraints, (iii) cognition, and (iv) social interactions. These are now considered individually.

6.3.1. Motivation theme

The motivation theme, focussed on the implications towards the team's attitude and willingness to engage in idea generation as part of the creativity of virtual teams. It included dimensions addressing workload, processes and procedures and discussions on the effectiveness of blended work arrangements.

6.3.1.1. Key theme findings

The first finding for motivation of teams related to the heightened willingness to engage in creative process. This was perceived, similar to the cooperation theme under the collaboration construct, as being individual specific and would vary depending on an individual's characteristics. In addition, individuals like increased workload, meeting fatigue, and their perception on whether team members were respecting personal boundaries would impact their willingness to engage in idea generation (positively or negatively). Furthermore, participant cited feeling harm due to extended work hours, one participant referencing themselves as "a victim" of virtuality.

The second finding focussed on the requirement for deliberate intervention and strategies to preserve interactive engagement of participants in sessions facilitating idea generation to keep all participants motivated. These strategies needed to encourage diverse views to support appropriate idea generation and creativity within virtual teams.

6.3.1.2. Discussion of key theme findings

This first finding related to the implications of individual specific factors that influenced highly virtual team members to engage in idea generation. There were similarities between the literature and study finding. These similarities aligned to the literature discussed under the cooperation theme within collaboration, cooperation cited as important for knowledge sharing, including idea generation (Choi & Cho, 2019). However, specifically on creativity, Lee et al. (2019), in their study of the role of HR systems in a team's creative processes, found that individual attitudes and behaviours played a significant role in influences the teams creative

process within virtual work. This supporting the findings that individual specific factors will influence the motivation and ultimately the creativity of teams. These individual specific attitudes included proactive behaviours driven from self-efficacy, personal responsibility for change and trust in their management (Lee et al., 2019). In addition, these factors may also be promoted by managers and organisations to overcome some of the other individual specific characteristics determined to negatively influence the motivation of virtual team members (workload, meeting fatigue, and exploitation of personal boundaries).

As noted, this finding also discussed the discussed the other individual factors that were impacting individuals' willingness to engage in creative processes, perceived to be brought on by high virtuality of team – for example findings noted that virtual work led to increased meetings, increased work demands (workload), and these had negative consequences for work-life balance. A study investigating work-life balanced brought on by increased virtuality of work brought on by COVID-19, found that there were both positive and negative implications for work-life balance, however, the negative outcomes ranking high in the challenges brought on by virtual work supporting the findings of the study (Subramaniam et al., 2021). This impact was argued to be brought on by team members engaging fellow team members outside office hours (Subramaniam et al., 2021) . However, there is slightly contradictory literature from Choudhury Foroughi and Larson (2021), arguing that virtuality has promoted flexibility for employees, providing them more control over the time they complete their work. In addition, the finding was raised only by managers in study, suggesting that flexibility may be reduced based organisational seniority. Furthermore, like cooperation, findings of increased workload influencing stakeholder participation remained scant in the literature.

The finding related on the intentionality of virtual engagements to encourage team participation and the soliciting of diverse contributions to idea generation. While these were largely recommendations - for example introducing external facilitators and making engagement "fun" - there was literature that supported these recommendations in the findings. First, the findings focussed on idea generation session creating an environment in which all participants could contribute, so it could promote willingness to participate. These all aligned with the literature in the study related to preserving psychological safety – which was summarised as an environment in which individuals are able to propose new ideas and solutions without fear of risk of adverse consequences (Thayer et al., 2018). Furthermore, it is argued that psychological safety is vital for virtual team members willingness to contribute and subsequent deliberation to select the best ideas. Furthermore, the reduction in physical signs of dominance is said to improve knowledge sharing, especially for new junior participant – who may still be seeking psychological safety (Kniffin et al., 2020).

6.3.1.3. Theme conclusion

The research findings for the implications of motivation for virtual teams displayed large similarities with literature. However, there existed some difference in the literature – where managers suggested that virtual work increased workload and impacted work-life balance negatively, resulting in reduced motivation to participate in idea generation. This contradicted the available literature stating that virtual work improved flexibility for participants. This deviation, suggest there may be varied consequences for senior participants within virtual teams, like managers. Literature on psychological safety was able to corroborate recommendations related to preserving engagement of participant in virtual work to improve idea generation of teams.

6.3.2. Procedural constraint's theme

The procedural constraint's theme focussed on findings related to perceived changes in virtual processes and procedures that influenced the generation of ideas within virtual teams including processes for decision making and procedures for decision making. It also discussed the implications of processes implemented to accommodate the high virtuality of teams in the context of creativity and idea generation.

6.3.2.1. Key theme findings

The key findings for the theme were as follows:

The introduction of new processes and procedures to accommodate virtual creativity had negatively influenced idea generation due to them being more rigid and formalised, reducing spontaneous idea generation.

The second finding discussed implications to the procedures supporting virtual decision-making, which was perceived as ineffective due to increased time for decision making, availability of stakeholders (spill over from implications to collaboration and the motivation theme) and the rigidity of processes. However, where participants were given autonomy, the implications were positive.

6.3.2.2. Discussion of key theme findings

The two findings that were highlights for the theme procedural constraints, related to the processes that support idea generation and decision-making. When compared to literature, they were found to differ.

First, on the rigid process for idea generation by organisations and managers, Kozlowski and Chao (2018), suggests that the rapid changes in technology, have resulted in organisations implementing large changes in the ways of work of teams to support collaboration and problem solving. Driskell, Salas and Driskell (2018), support these views, by discussing effective communication and information sharing processes for supporting information sharing amongst team members. They discuss that effective communication for example is lengthy, requiring exchanging of information timeously, confirming receipt of communications, clarifying ambiguity and appropriately understanding and utilising non-verbal communication (Driskell et al., 2018). These subcomponents of effective communication, align with the deficiencies and sub phrases that formed the foundations of the theme from participant. Thus, suggesting that the negative implications for idea generation have not been improved by the organisations processes, despite their positive intent. However, where literature is congruent with the finding is the lack of informal and spontaneous opportunities for idea generation in highly virtual teams, which is cited by Yang et al. (2022), as required for acquiring new information for idea generation.

The second finding on the implications for processes required for decision making of virtual teams, where participants of the study found decision making to be more effective where individual autonomy for decision making was support, is congruent with existing literature on virtual teams. Jaing and Chen (2018), posit that increased delegation of decision making by leaders supported information sharing and the team creativity. This suggests alignment with the finding, that decision making processes are restrictive, and liberating teams to process key decisions in virtual environments results in positive outcomes for creativity. This literature also further suggests that the leader may be the bottle necks for effective creativity processes in instance where they are constrained.

6.3.2.3. Conclusion of theme

The literature largely aligns with the findings related to the theme on procedures for idea generation and decision making. Processes introduced by organisations and managers have resulted in constrained decision making and idea generation processes, which are counter any effective processes required for creativity within virtual teams. However, leaders that provide appropriate autonomy to individuals and teams to share information, generate ideas and make decision, improved the creativity of virtual teams. Lastly, this suggests that leaders may be the main impeders of decision making in virtual teams.

6.3.3. Cognition theme

Cognition discusses the findings related to the process of idea generation in virtual teams. This included dimensions of cross team collaboration, the importance of preparation in idea generation processes, and the effectiveness of technology for problem solving.

6.3.3.1. Key theme findings

The key finding from the cognition theme related to how idea generation processes required appropriate pre-engagement work to successfully executed in highly virtual teams. This elevated requirement for preparation was found be more necessary in virtual teams than those which operated in an in-person environment.

The second finding in the theme focussed on the effectiveness of technology for facilitating the generation of ideas in highly virtual teams. After analysis divergent respondent's views, it was synthesised that technology had a moderating role in idea generation. That is, for teams which had conducive idea generation process, technology would enhance these processes however, those teams that did not have favourable idea generation processes, technology would further inhibit idea generation.

6.3.3.2. Discussion of key theme findings

The first key finding has some similarities with the investigated literature from Chapter 2. Guzman and Espejo (2018), argue that for individuals within virtual teams to have a willingness to engage through the concept of voice in the processes of idea generation and creativity, they require resources. These resources than encourage participants to devote time and energy towards the creativity process(Guzman & Espejo, 2019). In relation to the finding, information and context shared with participants prior to virtual engagements (notes, additional material and even expectations) can be considered as resources that will influence the level of participation and willingness to engage in the creativity process. In addition, the importance in goals alignment between participants of virtual teams was also shown to be a significant driver of establishing trust, which was determined vital for motivation to collaborate in virtual teams (Choi & Cho, 2019). The pre-work engagement and alignments captured in the finding can be considered as pre-alignment of expectations and goals before idea generation session and may result in the same effect for participants. That is, individuals will be more willing to participate in the creativity process if virtual members are clear on shared goals through prior engagement with those driving the sessions.

The second finding considering technology as a moderation for the creative processes of highly virtual teams. Larson et al (2017) provides literature that support this finding that, for

technology to be effective for virtual teams, organisations should provide appropriate technological resources, support, structures and formalised procedures, that can be adopted by virtual workers to succeed in their pursued outcomes. However, they also confirm that individual specific factors have a significant influence on the outcomes of virtual teams(Larson et al., 2017). That is, while technology can support the objectives of teams, the role of individuals in utilising the technology is viewed as more critical for creativity outcomes. This demonstrates congruence with existing literature.

6.3.3.3. Conclusion of theme

The findings of cognition as theme, were congruent with the literature investigated in the study. Increased focus on pre-engagement work for highly virtual teams is expected to provide positive benefits for virtual team creativity due to its positive influences in willingness to share ideas. Furthermore, the role of technology is on that is important for soliciting ideas in the creative process, however, individual specific factors and how teams engage with technology is still expected to have a more significant influence on teams.

6.3.4. Social Interaction theme

The social interaction theme deals with those influences of team interactions and dynamics related to knowledge transfer for idea generation of teams. This theme also captured findings including power dynamics during virtual engagements, the shift in relationships to more transaction exchanges and the transparent access to knowledge.

6.3.4.1. Key theme findings

The theme of interactions is one that emerged due to the perceived increased requirement for virtual teams to maintain and improve social interactions for idea generation.

The first key finding for the theme relates to the improved implications of power dynamics for junior virtual team participants. Individuals cites improved confidence (individuals gaining a form of “virtual confidence”) and willingness to participate in idea generation due to the anonymity that was provided in highly virtual environments.

The second finding, larging impacting managers of virtual teams related to preserving the benefits of human connections through appropriate technology to maintain social interactions within virtual teams.

6.3.4.2. Discussion of key theme findings

The findings of the theme were congruent with the studies literature findings. The first finding related to the positive benefits to social interactions and power dynamics that individuals of

highly virtual teams perceived as limiting for idea generation. Kniffin et al. (2020), provides literature that supports this finding, by arguing that high virtuality of teams encourages increased participation for idea generation by reducing key signs of physical dominance present in physical engagements – including age and seniority biases. Furthermore, literature on composition, suggests that individual characteristic like creative self-efficacy and personality (introversion and extroversion), are vital for the creativity of virtual teams (Thayer et al., 2018). This aligns with the bias of this finding towards more junior participants of virtual teams, as compared to managers of virtual teams interviewed for the study, due to their potential bias for reduced self-efficacy.

The second finding discussed the requirement for improved access to technology to support human connections in virtual teams. This is supported by Driskell, Salas and Driskell (2019), who suggest that there is a need for encouraging interpersonal relations in teams as it has benefits for cooperative behaviour including creativity and innovation. Furthermore, maintaining human connections by promoting activities like team building, review sessions, informal engagement (Driskell et al., 2018). Lastly, they argue the important role of organisations in supporting teams with appropriate modern technology to facilitate these interpersonal relations. Thus, demonstrating congruence with the finding.

6.3.4.3. Theme conclusion

All findings of this theme were aligned to the literature presented in the study's literature review. Findings related to bridging any negative effects of interpersonal dynamics was aligned to literature. Furthermore, the use of technology, supported by deliberate activities that preserved interpersonal relationships was also aligned to existing literature.

The first key finding for the theme relates to the improved implications of power dynamics for junior virtual team participants. Individuals cites improved confidence (individuals gaining a form of "virtual confidence") and willingness to participate in idea generation due to the anonymity that was provided in highly virtual environments.

The second finding, larging impacting managers of virtual teams related to benefits of improved access to technology for preserving human connections as key requirements to maintain social interactions within virtual teams.

6.3.5. Finding for research sub-question 3

How will high levels of virtuality impact the generation of novel ideas (creativity) in virtual teams?

Table 44: Summary of conclusions RQ3

Theme	Finding summary	Literature	Potential new sub-theme
Motivation	**F1:** Individual specific factors influence idea generation	Lee et al. (2019), Choi & Cho (2019)	
	F2: increased workload reduced motivation to collaborate	Choudhury Foroughi and Larson (2021), Subramaniam et al. (2021)	Workload impacting motivation to be creative
	F3: improve diversity of participants through psychological safety	Kniffin et al. (2020), Thayer et al. (2020)	
Procedural constraints	**F4:** rigid and formal nature of processes reduced idea generation	Kozlowski and Chao (2018), Driskell et al. (2018),	
	F5: ineffective decision making due to availability of stakeholders		Stakeholder availability
Cognition	**F6:** requires deliberate prework and pre-engagement with stakeholders	Guzman & Espejo (2018), Choi & Cho (2019)	Pre-alignment creating team buy-in
	F7: technology facilitated a moderating role to the idea generation	Larson et al (2017)	
Social Interactions	**F8:** Increased participation due to reduced power dynamics	Kniffin et al. (2020) Thayer et al. (2018)	
	F9: Preserving human connection through technology	Driskell et al. (2019)	

The third sub-question research question sought to answer the question of how high virtuality of teams impacted creativity, specified in the form of generation of novel ideas. Four themes of finding emerged and related to, (i) motivation, (ii)Procedural constraints, (iii) cognition and (iv) social interactions. These findings are now presented.

First group of findings related to motivation and the willingness of to engage in novel idea generation. There were clear similarities between this theme and the cooperation theme within collaboration due to both themes dealing with the participants willingness to engage other participants – required for collaboration and idea generation, a specific form of collaboration.

The first finding was that individual-specific factors influenced highly virtual team members to engage in idea generation. Virtual team individual-specific characteristics, personality traits and other, influence the willingness to participate in novel idea generation. This was like the findings for collaboration, this was supported in the literature by Lee et al. (2019).

The second finding related to the increased workload brought on by virtual work and extended to discussions on work life balance and perceptions of whether people were respecting boundaries. The key finding was that increased workload brought on by virtual work reduced motivation for idea generation. Literature was again limited on the increased workload, with Subramaniam et al. (2021) providing some evidence that team members engaging outside of work hours, had resulted in some negative outcomes. However, this point contradicted later findings that participants deemed virtual work to provide more flexibility for productivity – a finding that will be discussed later in the chapter. This again, presented an opportunity for further clarity in future literature.

The third finding (largely a recommendation) on the motivation of highly virtual teams on creativity related to intentionality of virtual engagements and encouraging team participation and diverse contributions. Diverse contributions suggested as key to ensuring a robust idea generation process. Increased pschological safety was highlighted as improving the participation and subsequent generation of novel ideas, especially for junior employees (Kniffin et al., 2020).

The next set of findings related to procedural constraints, which were implications on the processess and procedures that influenced idea generation in highly virtual teams.

The first finding was that new processes and proccedures introduced to support idea generation in virtual teams negatively influenced idea generation due the rigid and formal nature of processes. While there was some literary debate in the literature, there was consensus that the more formalised processes resulted in negative idea generation outcomes for teams, due to the inhibiting of informal and spontenous opportunities for idea generation Yang et al. (2022).

The second finding related to the negative implications for decision making in highly virtual teams. The findings stating that procedures supporting decision making were ineffective for team creativity due to extended time for decision making and lack of availability of

stakeholders. However, and additional finding related to this, was that decision making was improved in instances where managers delegated authority for decision making to team participants.

The next set of findings related to cognition, and the process of idea generation. The first finding was that successful idea generation in virtual teams required deliberate prework and pre-engagement with stakeholders. This was supported by literature from the discussing the concept of voice, that participants were more willing to contribute to idea generation if resources were availed. Pre-engagement documents and work could be perceived resources to encourage participation(Guzman & Espejo, 2019). Other literature, supporting this came from trust, where pre-alignment with collaborators would be seen as aligning towards shared goals, vital for the idea generation process.

The second finding was that technology facilitated a moderating role to the idea generation process, enhances creativity for virtual teams that had appropriate creativity processes, or diminishing creativity, for virtual teams that had not established appropriate processes for idea generation.

The last group of findings related to social interactions – addressing implications for social dynamics within virtual teams as it relates to idea generation. The first finding was related to the positive benefits to social interactions and power dynamics that individuals of highly virtual teams perceived as limiting for idea generation. That is, high virtuality improved the participation of team members who may be impacted by power dynamics – this achieved by reducing the physical symbols of power, evident in less virtual settings and the added benefits of anonymity Kniffin et al. (2020). This finding was mainly evidenced by junior members in the team that may be more directly impacted by power dynamics

The final finding for the question provided a recommendation to managers for improved access to technology that supported human connection and interpersonal relations. That is, the need for preserving human connection and interpersonal relations is vital for idea generation.

6.4. Construct 3: Innovation

The findings on the theoretical construct of innovation sought to answer the fourth research question which addressed the implications of the innovation of highly virtual teams, by considering the dimensions of idea and process implementation,

The key findings were categorised into four themes that emerged, namely: (i) Knowledge sharing, (ii) Conflict, (iii) Knowledge integration, and (iv) Innovation performance outcome. These are now considered individually.

6.3.6. Knowledge sharing theme

Knowledge sharing discusses the findings related to knowledge exchange as it relates to the innovation of virtual teams. This included the intentionality of engagements and the effect of tools in facilitating knowledge sharing.

6.4.1.1. Key theme findings

The first key finding related to the perceived requirement for more intentional processes to support effective knowledge sharing in virtual teams. Care needed to be taken not simply to replicate those processes that were effective in F2F knowledge sharing.

The second key find related to the effectiveness of technology, which was also raised as both positive and negative, where the ability to process large data sets effectively across teams, was viewed as positive and while the lack of integration and multiple systems cited as inhibitors of innovation.

6.4.1.2. Discussion of key theme findings

The first finding was assessed to be congruent with the literature reviewed for the study in two ways. First, there is broad agreement in the literature that knowledge sharing rituals for virtual teams have been replaced by digital interactions, which are expected to be different to those executed in F2F engagements (Spicer, 2020). Secondly, Jiang and Chen (2018), state that only those leaders that are able to adapt, promote and drive new norms for process for knowledge sharing will be able to positively influence virtual knowledge sharing and innovation. That is, to successfully drive knowledge sharing leaders will need to be intentional in amending processes to promote the knowledge sharing.

The second finding on the importance of technology for effective knowledge shared. First, these finding aligned to those discussed both in collaboration and creativity of virtual teams. Confirming the interconnections between collaboration, creativity and now innovation, which is also supported by literature (Acar et al., 2019; Anderson et al., 2014; Hughes et al., 2018). Secondly, the findings on the need for technology to be integrated and appropriate is also supported by Larson et al. (2017), who stated that technology is one of the vital things that organisations can do to support knowledge sharing and innovation of virtual teams.

6.4.1.3. Theme conclusion

The knowledge sharing theme findings were all once again aligned to the literature used in the stud for both findings. Recognising the differences of knowledge sharing in highly virtual teams and supporting it with appropriate process, that may differ to those used in previous face-to-face engagements was supported by the literature. In addition, the use of effective technology to promote positive knowledge sharing outcomes was also supported by the literature of the study.

6.4.2. Conflict theme

Conflict discusses the key outcomes that were driven on the back of, what respondents termed, the “forced” migrations to highly virtual work. This also included other instances where changes related to the adoption conflicted with the original dispositions of participants.

6.4.2.1. Key theme findings

The key theme finding in the study, was the emergence of conflict as a positive driver for innovation outcomes. That is, there were positive outcomes due to virtual activities necessitated by COVID -19. This included enforced changes on virtual traditions and norms, and others.

6.4.2.2. Discussion of key theme findings

The finding of the theme highlighted the important role of conflict and strict encouragement of virtual teams to deliver positive outcomes for innovation. That is, the role of conflict, in supporting innovation. This theme was completely aligned with the findings in literature that appropriate conflicted and enforced actions acted as a positive influences for the innovation of virtual teams (Thayer et al., 2018). Thayer et al. (2018) further posit that due to the requirement for virtual teams to appropriately sense making as part of problem solving, the ability to have norms and traditions that encourage appropriate conflict promotes better understanding of the problems to be solved. This discourse then supports the effective generation of ideas and implementation thereof. That is, conflict brought on to better fulfil tasks (enforcing camera’s on to better read verbal cues) and sense-making (challenging ideas, to ensure they are robust), supports the innovation of highly virtual teams.

6.4.2.3. Theme conclusion

The theme findings aligned with the literature on conflict – appropriate conflict within highly virtual teams has led to positive outcomes for team innovation.

6.4.3. Knowledge integration theme

Knowledge integration discussed those elements in the innovation process that participants raised as impacting processes and procedures that facilitated the implementation of new products and ideas. That is, those elements in the cognitive implementation process that heightened virtuality would affect when implementing ideas - including robust debate on ideas, their implementation and execution thereof.

6.4.3.1. Key theme findings

The key finding related to knowledge integration, where high virtuality was perceived as ineffective to its limited ability to support in-depth problem solving within team virtual team members. Participants opined that knowledge integration within the innovation process was something that could only be executed through in-person engagements due to the level of engagement required. However, once initial engagements and occurred and tasks had been sub-divided, virtual work was more efficient for individual tasks.

6.4.3.2. Discussion of key theme findings

The finding provided both similarities and differences in literature. Elsbach and Stigliani (2018), supported the view that physical and in person group interactions was vital for information sharing and group interaction, thus supporting the finding. Furthermore, it was easier to conduct deeper sensing and clarifying of ambiguity of complex tasks like problem solving and innovation during in-person engagement, due to the requirements for effective communication and knowledge exchange, which include the reading of non-verbal cues (Ratzmann et al., 2018). Lastly, for innovation and knowledge sharing to succeed within virtual teams Driskell et al (2019), suggests that teams must engage in deliberate team building activities to develop better interpersonal activities. These activities may be better facilitated in-person. However, the potential benefits of support complex innovation in face-to-face interaction, these must be traded-off against the reduced contribution of junior, less confident employees, or global experts who possess new information (external information) that may enrich the innovation process (Larson et al., 2017). Thus, the finding that innovations processes should only be executed in person is not completely supported in literature.

6.4.3.3. Theme conclusions

The knowledge integration finding presented some similarities with the literature of the study, however, there were some differences to literature related to the migration of innovation processes to largely in person environments due to the limitations presented by complex virtual team innovation activities in highly virtual teams. These implications need to be well considered to not lose the other benefits of virtual work.

6.4.4. Innovation performance outcome theme

Innovation performance sought to discuss those category groupings that participants perceived would be outcomes of heightened virtuality of teams.

6.4.4.1. Key theme findings

There were 2 key findings determined for the theme.

The first key finding related to the positive benefits brought on by high virtuality for innovation processes. These included positive benefits for individual productivity and improved flexibility.

The second finding was the increased autonomy provided by working virtually, meant participants could efficiently implement their individual tasks more efficiently, less so for group tasks, which suggests that virtual work is more efficient for individual tasks as compared to group tasks.

6.4.4.1. Discussion of key theme findings

The key findings of the theme will be compared to the literature considered in Chapter two.

The first finding related to improved productivity and flexibility benefits brought on by heightened virtuality of work. This finding showed high similarities in literature. The benefits of high virtuality for productivity brought on by increased flexibility for when and where tasks could be completed is cited by multiple authors in literature (Asatiani & Penttinen, 2019; Bernstein et al., 2020; Choudhury et al., 2021) . In addition, Choudhury etc al. (2021) found that, some employees found increased utility from remote work, which translated into addition productivity increases above those supplied by normal virtual work.

The second implication discussed efficiency benefits for virtual individuals for individual tasks compared to those requiring group tasks. There are some examples in literature where this finding is evidence. For example, Jarvenpaa & Välikangas (2020), posit that there was literature that showed that communication that was performed asynchronously, outside of group settings to contribute to collaboration efforts, resulted in more considered contributions as respondents had sufficiently reflected and ensured their contributions were sufficently unique. Further more, in studying the impact of advancement in technology on time to reflect (inner time) and time spent with others (social time), they found that over time both would be reduced. However, they supported the view that the current hightend virtuallity presented improved outcomes for inner time. That is, collaborators were better enabled to relect and provide more menaingful contributions (Jarvenpaa & Välikangas, 2020).

6.4.4.2. Theme conclusions

The innovation performance outcome findings presented some similarities with the literature of the study, especially for findings related to the benefits of productivity and flexibility of virtual work. Enhanced productivity results and flexibility when implementing novel process, means the innovation process will benefit from highly virtual teams.

6.4.5. Finding for research sub-question 4

How will high virtuality impact the implementation of ideas (innovation) in virtual teams?

Table 45: Summary of conclusions RQ4

Theme	Finding summary	Literature	Potential new sub-theme
Knowledge Sharing	**F1:** intentional processes to support effective knowledge sharing	Spicer (2020) Jiang and Chen (2018)	
	F2: technology	Larson et al. (2017), Acar et al. (2019)	
Conflict	**F3:** Appropriate conflict positive for innovation	Thayer et al. (2018)	
Knowledge Integration	**F4:** Virtual is ineffective for in-depth problem solving	Elsbach and Stigliani (2018), Larson et al. (2017), Driskell et al (2019), Ratzmann et al. (2018)	In-depth problem solving only for F2F
Innovation Performance outcome	**F5:** improved productivity and flexibility	Asatiani & Penttinen(2019), Choudhury etc al. (2021)	
	F6: increased autonomy &Efficiency of individual tasks	Jarvenpaa & Välikangas (2020)	

This question sought to understand the implications of high virtuality of teams on the implementation of novel ideas. The findings were grouped into four themes, namely: (i)Knowledge sharing, (ii)conflict, (iii) Knowledge integration, and (iv)Innovation performance outcomes. The key findings are now discussed.

The first group of finding related to the processes that influenced knowledge exchange for idea implementation within highly virtual teams.

The first finding was that deliberate processes were required to support virtual innovation of teams. Care taken not to simply transfer virtual processes.

The second finding was the positive and negative effects if technology in the virtual team innovation process. Technology positively supported positive processing of large data, required for knowledge sharing when implementing innovation. However, technology lacked integration which inhibited the knowledge sharing of important information in the implementation and innovation processes of virtual teams.

The next finding related to the role of appropriate conflict in the innovation process. The finding was that appropriate conflict resulted in positive outcomes for team innovation. This conflicted enabled robust debate and challenging of ideas in the innovation process and the clarifying of ambiguous insights, which lead to better outcomes for virtual creativity and innovation of teams (Thayer et al., 2018).

The next finding related to those of knowledge integration, where high virtuality was perceived as ineffective to its limited ability to support in-depth problem solving within team virtual team members. Important for this finding, was the perception that appropriate in-depth problem solving could only be fulfilled through face-to-face engagement. Literature supported some consideration of this finding; however, this would present trade-offs against other positive benefits of virtuality. That is, if in-depth problem solving is migrated to in person engagements due to benefits of effective communication and increased engagements, would it be worth the loss of positive benefits like access to geographically disperse global expert and participation of junior staff members who are negatively impacted by power dynamics?

The last group of findings related to potential outcomes of virtual work. The first finding was that high virtuality, has positive benefits for productivity and flexibility. This was extensively supported in literature Asatiani & Penttinen, 2019; Bernstein et al., 2020; Choudhury et al., 2021).

The second finding stated that the increased autonomy provided by working virtually, meant participants could efficiently implement their individual tasks more efficiently, less so for group tasks, which suggests that virtual work is more efficient for individual tasks as compared to group tasks.

6.4.6. Finding for research sub-question 5

How can organisations maintain or improve the positive benefits of collaboration and creativity within teams that were predominately F2F before adopting higher levels of virtuality?

Table 46Summary of conclusions RQ5

Theme	Finding summary	Literature	Potential new sub-theme
	F1: clarifying the role of F2F and virtual in teams	Driskell et al. (2018)	Blended work
	F2: Organisational support for virtual through technology support	Larson et al. (2017)	
	F3: promotion of increased autonomy in decision making of participants	Jarvenpaa & Välikangas (2020)	

This question sought to identify opportunities for organisations to improve and maintain benefits brought on by increased virtuality that related to virtual work.

The first finding was the clarity of the role of face-to-face engagements for highly virtual teams. The research findings demonstrate that there are benefits for both virtual and face-to-face engagements, and exclusive utility of a method of work may diminish or erode that of the other. Developing interpersonal relationships, which is done largely virtual, has spill over positive effects for trust in virtual settings (Driskell et al., 2018). However, some limitations in technology that limit complex problem solving in virtual environments, is better executed in person. And so, the findings across the themes suggest that a combination of virtual and in person engagement may be required. This presents an opportunity for organisations to increase the benefits of high virtuality of work.

The second finding related to the enablement of participants with appropriate tools. This finding aligns with the theory, that organisations have the ability to promote successful virtual outcomes like innovation and creativity, through providing modern technology, structures, processes and appropriate cultural norms that can enhance the benefits of high levels of virtualisation (Larson et al., 2017).

The last finding related to the promotion of increased autonomy in decision making of participants, especially with challenging across different findings of gaining access to critical stakeholders in various themes. Liberating collaborators to make decision in the idea generation and implementation process is expected to have increased positive benefits for organisations (Jiang & Chen, 2018).

6.5. Summary of new contributions for study

The table below summarises the additional new key sub findings that emerged from the research themes and literature. These provide some additional contribution to the literature on the collaboration, creativity, innovation of highly virtual teams.

Table 47: Summary of new contributions of study

Construct	Theme	Finding Summary	Potential new sub theme (contribution to literature)
Collaboration	Coordination	Reduced due to stakeholder availability and meetings	Limited stakeholder availability
	Cooperation	Prior relationships improve cooperation	Onboarding new team members
	Information Exchange	Shift to transactional relations	Transactional nature of relationships
	Cooperation	onboarding new collaborators in- person & build interpersonal relations	Face to face onboarding for new collaborators
	Coordination	reduce the amount and length of meetings	Improve stakeholder availability

Creativity	Motivation	increased workload reduced motivation to collaborate	Workload impacting motivation to be creative
	Procedural constraints	ineffective decision making due to availability of stakeholders	Stakeholder availability
	cognition	requires deliberate prework and pre-engagement with stakeholders	Pre-alignment creating team buy-in
Innovation	Knowledge integration	Virtual ineffective for in-depth problem solving	In-depth problem solving only for F2F

Chapter 7: Conclusions and Recommendations

7.1. Introduction

This chapter continues from the previous one, by highlighting the main conclusions from Chapter 6. Furthermore, concluding on the research outcomes that the study sought to explore and answer. First the principal theoretical conclusion of the study is discussed, followed by the research contribution and the implications of the study for business and managers is discussed. It then concludes with the limitations and recommendations for future research.

7.2. Theoretical conclusions

The study sought to explore the implications of high virtuality of work on the collaboration, creativity and innovation of virtual teams. We consider the theoretical implications by discussing the key findings for each research sub-question.

7.2.1. Conclusions for research question 1: Implications for collaboration

How will high degrees of virtuality impact the collaboration patterns of virtual teams?

The ability for teams to adequately collaborate required coordination, willingness for participants to collaborate (coordination's) and the exchange of new information amongst collaborators (Thayer et al., 2018). These dimensions aligned with that emerged from the study providing several findings for the study, which are summarised below:

Technological advances have positively influenced the coordination of highly virtual teams; however, they have not sufficiently progressed to facilitate effective real-time communication that is equivalent or better than the communication of traditionally face-to-face teams who possess communication richness (ability to get non-verbal cures, and others) (Kniffin et al., 2021). Furthermore, effective communication requires the evolution in both synchronous and asynchronous communication to be effective in virtual teams (reference).

The findings of the study show that high virtuality of work has increased the work demands on virtual stakeholders through increased meetings for participants. This has negatively impacted stakeholder availability for collaboration. Literature is scant on this finding, and has focussed on how participants have sought to manage the perceptions of their productivity when working

remotely, with early remote workers seeking to showcase their busyness to employers as repayment for the perceived privilege of working remotely (Greer & Payne, 2014). However, with the scaling of virtual work beyond a perceived privilege for a select few, perceptions of increased work by participants requires further understanding in literature due to its negative impacts on stakeholder availability, as raised by most participants of the study.

Prior, largely in-person relationships with collaborators has positive cooperation benefits for highly virtual teams due to the positive outcomes for trust (Choi & Cho, 2019). Furthermore, personal relationships resulted in stronger trust and willingness to participate in knowledge sharing and collaboration. Importantly, the lack of prior relationships negatively impacted the willingness to engage in sharing new information, thus positioning trust as a pre-requisite for successful collaboration (Yang et al., 2022).

High virtuality of teams has led to a shift in the nature of the relationship between team members (manager and individuals) to become more transactional resulting in changes in the way information exchange is incentive and encouraged. The need for extrinsic motivators and rewards to be exchanged for information exchange has implications discussed within the motivation and social exchange theories on virtual engagement (Lin et al., 2019). This adds to the literature of virtual teams by supporting the incorporation of deliberate transactive leadership traits to managing and leading highly virtual teams for successfully exchange information - prior research on leadership for motivating collaboration and creativity promoting transformational leadership traits like shared vision and goals, and utilising intrinsic motivators (Thayer et al., 2018). In addition, literature is scant in explaining why they relationship has changed, thus leaving opportunity for further research.

7.2.2. Conclusions for research question 2: recommendations for promoting positive benefits to collaboration

> How can managers sustain the positive benefits of collaboration previously evidenced in F2F teams, within highly virtual teams?

The key recommendations for this question derived from the discussions and findings within the construct of collaboration and follow on from the previous sub-question.

Firstly, the deliberate onboarding of new collaborators, by incorporating elements of in-person face-to-face engagement during onboarding was recommended. This was to recommend to promote:

(i) interpersonal relations and build trust amongst team members, which will improve cooperation and information exchange during virtual engagements (Driskell et al., 2018).

(ii) adequately provide organisational support through tools, structures, processes and sharing of norms to appropriately improve virtual collaborations (Larson et al., 2017).

The second recommendation was focused on increasing stakeholder availability by reducing the amount and length of virtual meetings to prevent the inhibiting of collaboration due to stakeholder availability. This was expected to support spontaneous engagements vital for collaboration outcomes linked to creativity and innovation, as findings suggested that stakeholder availability had some negative impacts on virtual outcomes (Yang et al., 2022).

7.2.3. Conclusions for research question 3: Implications for creativity

How will high levels of virtuality impact the generation of novel ideas (creativity) in virtual teams?

The implications for highly virtual teams to participate in the generation of novel ideas was considered in the study, with findings emerging under four themes of (i)motivation, (ii)procedural constraints, (iii) cognition and (iv)social interactions. This culminated in the following theoretic implications:

The increased workload brought on by high virtuality within teams reduced the motivation of participants to participate in novel idea generation. While literature was scant, the suggestions that highly virtual work resulted in diminished work life balance in addition to increased work, had some literary support(Subramaniam et al., 2021). Subramaniam arguing that virtual members found that in some instances team members would engage outside of traditional work, which would have been respected in face-to-face settings. This alluded to some extension of working hours which could explain the perceptions of increased workload and lack of work life balance brought on by virtual work. But again, further exploration and the exact cause and implications was required to enhance knowledge for academia and business.

This finding on motivation for idea generation, linked to a further finding on procedural constraints, where it was found that the processes for decision making in virtual teams was rigid and ineffective for decision making resulting in extended timing for idea generation. However, participants who had autonomy to make some decisions yielded positive benefits for decision making in the idea generation process. From literature, Jaing and Chen (2018),

supported this view that availability of stakeholder was impeding decision making, supporting the view that increased autonomy to make decisions through appropriate delegation of authority by leaders, would generate the opposite results for this finding and improve decision making.

An additional finding was the increased requirement for prework and pre-alignment for successful idea generation processes in highly virtual teams. This introduces some theoretical implications for the concept of voice. The prework required by for virtual creativity engagements like documents and other material, can be considered as equivalent to resources (Guzman & Espejo, 2019). Literature on voice – which is described as willingness to share ideas – suggests that participants require pre-commitment of resources to encourage the sharing of ideas. The sharing of prework (resources) by virtual team participants resulting in increased engagements can be explained by literature on voice(Guzman & Espejo, 2019). The other contribution of this finding is on trust literature, where it is argued that virtual teams mainly build trust based on understanding the shared goals and shared motivations (Choi & Cho, 2019). Pre-work may represent a sharing of these goals in a transparent manner prior to the idea generation process, resulting in stronger willingness to participate by collaborators.

7.2.4. Conclusions for research question 5: Sustaining positive benefits for collaboration and creativity

How can organisations maintain or improve the positive benefits of collaboration and creativity within teams that were predominately F2F before adopting higher levels of virtuality?

The key findings for this question derived from the discussions and findings within the constructs of collaboration, creativity and innovation, and thus follow on from the previous sub-questions. This had a deliberate focus on finding implications for organisations.

The first finding was the clarity from organisations on the role of face-to-face engagements for highly virtual teams. With other findings of the study showcasing positive benefits from both face-to-face (in-depth problem solving, effective communication, and others) (Driskell et al., 2018) and highly virtual engagements (Asatiani et al., 2021; Jiang & Chen, 2018). The importance of appropriately determining which team activities would be better suited for which in-person will ensure positive outcomes for organisations, who seek to exploit opportunities to generate competitive advantage (Acar et al., 2019).

The second finding related to the enablement of participants with appropriate tools. This finding aligns with the theory, that organisations have the ability to promote successful virtual outcomes like innovation and creativity, through providing modern technology, structures, processes and appropriate cultural norms that can enhance the benefits of high levels of virtualisation (Larson et al., 2017).

The last finding focussed on increasing autonomy of decision making within virtual teams to support idea generation and decision making(Jiang & Chen, 2018).. This implications for leaders would improve spend of decision making, enabling organisations to respond more quickly to changing environments.

7.3. Research contributions

The contributions of the research study.

The study sought to explore the implications of high virtuality of work on collaboration, creativity and innovation of teams. By inductively analysis responses from semi-structured interviews and comparing the emergent themes to literature, it was determined that most themes were like existing literature. There were some opportunities to refine and extend literature on highly virtual teams, collaboration, creativity, and innovation. These will now be offered.

7.3.1. Refinement of literature

Literature of the study was extended through the key finding that related to the importance of in-person onboarding of new collaborators in order to improve their ability to promote willingness from other collaborators to engage in collaboration processes. Previous literature had discussed the importance of trust and psychological safety for promoting collaboration and creativity in virtual teams (Thayer et al., 2018). The challenge of onboarding new virtual collaborators due to ineffective virtual communication (Asatiani & Penttinen, 2019; Kozlowski & Chao, 2018; Thayer et al., 2018) and lack of trust had also been discussed separately Choi & Cho (2019). Lastly, the knowledge that virtual teams required in-person activities to build interpersonal relations vital for the information exchange and developing methods to manage conflict (Jiang & Chen, 2018). This study's findings integrated these insights and provided further insight that, for new collaborators joining virtual teams, trust and psychological safety could be developed quicker through in-person engagements at onboarding resulting in better outcomes for team collaboration, creativity and innovation.

7.3.2. Extension of literature

The study was able to extend the literature on virtual teams through two finds discussed in section 7.2.

The first related to the findings on stakeholder availability due to increased workload (meetings, prework, and other factors) because of the high virtuality of teams. This mostly negative implication for the motivation of collaborators (cooperation and information exchange) and their availability for collaboration and creativity process (decision making, idea generation) shed some light on the some of the reasons why high virtuality had been considered as ineffective in those themes. Literature on these implications scant or insufficiently considered in literature.

The second extension of literature was the findings related to the transaction nature of virtual team member relations. While this had some support in literature, it was not adequately captured by current studies. For example, the findings of the study provided insight on how it influenced collaboration and creativity processes of teams, focusing on dimensions of cooperation and information exchange within collaboration, and knowledge exchange within creativity themes. However, this theme requires further research to understand its implications which may be far reaching, outside of the domain of this study.

7.4. Implications for Manager and Organisations

The implications of high virtuality of work for collaboration, creativity and innovation of teams is under explored (George et al., 2020). Through the study's findings, further clarity was derived on these implications. We now discuss the implications of the findings of our study for managers and organisations.

For organisations, three findings were derived by exploring research question 5 of the study. First, it is important for organisations to clarify what activities, if any, should be fulfilled through in person engagements. The study and literature confirm that there are benefits for some activities being executed in-person despite high virtuality of work, these include complex problem solving (Ratzmann et al., 2018), building interpersonal relationship vital for trust within team members(Driskell et al., 2018) and the transferring of organisational norms and principles to support virtual work (Asatiani et al., 2021). In addition, these activities often have positive spill over effects for virtual collaboration, creativity and innovation (Driskell et al., 2018). For example, trust built during face-to-face engagements leads to improved motivation and cooperation for virtual knowledge exchange in idea generation. Thus, if organisations can clarify these elements for teams, it will improve virtual team collaboration, creativity and

innovation which have positive benefits of organisational outcomes like establishing a competitive advantage (Acar et al., 2019).

Secondly, the provision of organisational support in the form of appropriate tools is said to support virtual teams in becoming more collaborative. Modern integrated tools, provide some positive benefits for information exchange and idea generation (Larson et al., 2017).

For manager, the importance of increasing autonomy for participants to make key decision is high. The study's findings on decision making and innovation, show that decision making is improved when leaders delegate authority to other participants in the virtual team(Jiang & Chen, 2018). Furthermore, managers should look to adapt their leadership in incorporate components of transactional leadership in line with the changes in relationships within highly virtual teams (Lin et al., 2019).

Additionally managers should look to create time and opportunity for highly virtual team members to have spontaneous discussions which promote idea generation and team cohesion (Yang et al., 2022). Team builds are also critical for building trust that is vital for virtual teams to succeed. Lastly, due to the diversity of teams, care must be taken to avoid dominance of some participants, recognising that highly virtual teams are susceptible to disengagement and potential power dynamics, especially for junior or new team members Kniffin et al. (2020).

7.5. Limitations

The limitations of the research study are initially discussed in chapter 4.15 and are further discussed now.

First there are limitations to the chosen methodology. The time horizon in which the study was conducted may be further extended by presenting a longitudinal study where behaviours of respondents are observed over a sustained period. Secondly, care was taken in selecting the sample to ensure insights from the study limit bias – only two participants were considered, industry diversity was also considered, as well as avoiding the interviewing of people in the same team – future research can consider conducting the research through focus groups where multiple members of the same virtual team are interviewed, or a case study of a few organisations are considered. However, this my drive group think or be biased by team dynamics which would need to be mitigated in the designs of that study. Another limitation of the study is the specific focus on knowledge workers. Future research could consider this study for other types of virtual employees, aligning with Bernstein (2020)'s argument that virtual work has been extending to other, less traditional roles in the organisation.

Further limitations of the study are related to the study's focus on multiple construct (collaboration, creativity, innovation), which meant each was studied more broadly. Future research could consider the reconfiguring of the study to focus more in depth on one on each construct in depth. This may present an opportunity for additional insights. Lastly, the context of the study largely included participants based in South Africa, where local specific context emerged as influencing collaboration, creativity and innovation – for example participants citing load shedding and connectivity as key challenges for highly virtual teams. Future research may consider broadening the study to additional regions to capture wider insight.

7.6. Recommendations for future research

Future research can consider the following avenues of study:

Understanding the reasons for changes in team relations towards transactional relations due to high virtuality. One of the key findings of the study discussed earlier in this chapter and previous ones is the change in team participants of highly virtual teams to become more transactional. While some literature existed theory (Lin et al., 2019), it was scant on why this shift occurred and what were the other drivers of it occurring. This left room for future exploration.

The second opportunity for future research was the need to explore the impact that virtual work had resulted in increased work, which diminished stakeholder availability for collaboration and idea generation. Literature was limited, which left gaps for further exploration. This finding was significant and was cited as the root cause of several key negative findings that related to virtual work across collaboration, creativity and innovation, and so future research should explore the reasons for increased workload for highly virtual teams (meeting and others).

References

Acar, O. A., Tarakci, M., & van Knippenberg, D. (2019). Creativity and Innovation Under Constraints: A Cross-Disciplinary Integrative Review. *Journal of Management*, *45*(1), 96–121. https://doi.org/10.1177/0149206318805832

Anderson, N., Potočnik, K., & Zhou, J. (2014). Innovation and Creativity in Organizations: A State-of-the-Science Review, Prospective Commentary, and Guiding Framework. *Journal of Management*, *40*(5), 1297–1333. https://doi.org/10.1177/0149206314527128

Asatiani, A., & Penttinen, E. (2019). Constructing continuities in virtual work environments: A multiple case study of two firms with differing degrees of virtuality. *Information Systems Journal*, *29*(2), 484–513. https://doi.org/10.1111/isj.12217

Asatiani, A., Rossi, M., & Penttinen, E. (2021). Constructing continuity across the organisational culture boundary in a highly virtual work environment. *Information Systems Journal*, *31*(April 2020), 62–93. https://doi.org/10.1111/isj.12293

Barney, J. (1991). Firm Resources and Sustained Competitive Advantage. *Journal of Management*, *17*(1), 99–120. https://doi.org/10.1177/014920639101700108

Bell, E., Bryman, A., & Harley, B. (2019). *Business Research Methods* (Fifth Edit). Oxford University Press.

Bernstein, E., Blunden, H., Brodsky, A., Sohn, W., & Waber, B. (2020). The Implications of Working Without an Office Photography by Marcus Cederberg Photography by Marcus Cederberg. *Harvard Business Review*, 2–11.

Bloom, N., Liang, J., Roberts, J., & Ying, Z. J. (2015). Does working from home work? Evidence from a Chinese experiment. *The Quarterly Journal of Economics*, 165–218. https://doi.org/10.1093/qje/qju032.Advance

Burak, O. (2018). Contextual leadership : A systematic review of how contextual factors shape leadership and its outcomes. *The Leadership Quarterly*, *29*(1), 218–235. https://doi.org/10.1016/j.leaqua.2017.12.004

Choi, O., & Cho, E. (2019). The mechanism of trust affecting collaboration in virtual teams and the moderating roles of the culture of autonomy and task complexity. *Computers in Human Behavior*, *91*(August 2018), 305–315. https://doi.org/10.1016/j.chb.2018.09.032

Choudhury, P., Foroughi, C., & Larson, B. (2021). Work-from-anywhere: The productivity

effects of geographic flexibility. *Strategic Management Journal*, *42*(4), 655–683. https://doi.org/10.1002/smj.3251

Creswell, J. (2012). Choosing Among Five Approaches. In *Qualitative Inquiry and Research Design* (Second, Vol. 3, Issue June). Sage Publications.

Cypress, B. (2018). Qualitative research methods: A phenomenological focus. *Dimensions of Critical Care Nursing*, *37*(6), 302–309. https://doi.org/10.1097/DCC.0000000000000322

Das, M., Tang, J., Ringland, K. E., & Piper, A. M. (2021). Towards Accessible Remote Work : Understanding Work-from-Home Practices of Neurodivergent Professionals. *Proceedings of the ACM on Human-Computer Interaction*, *5*(CSCW1), 1–30. https://doi.org/10.1145/3449282

Driskell, J. E., Salas, E., & Driskell, T. (2018). Foundations of teamwork and collaboration. *American Psychologist*, *73*(4), 334–348. https://doi.org/10.1037/amp0000241

Duerr, S., Holotiuk, F., Wagner, H.-T., Beimborn, D., & Weitzel, T. (2018). What Is Digital Organizational Culture? Insights From Exploratory Case Studies. *Proceedings of the 51st Hawaii International Conference on System Sciences*, 5126–5135. https://doi.org/10.24251/hicss.2018.640

Elsbach, K. D., & Stigliani, I. (2018). Design Thinking and Organizational Culture: A Review and Framework for Future Research. *Journal of Management*, *44*(6), 2274–2306. https://doi.org/10.1177/0149206317744252

Felstead, A., & Henseke, G. (2017). Assessing the growth of remote working and its consequences for effort, well-being and work-life balance. *New Technology, Work and Employment*, *32*(3), 195–212. https://doi.org/10.1111/ntwe.12097

George, G., Lakhani, K. R., & Puranam, P. (2020). What has changed? The Impact of Covid Pandemic on the Technology and Innovation Management Research Agenda. *Journal of Management Studies*, *57*(8), 1754–1758. https://doi.org/10.1111/joms.12634

Gioia, D. A., Corley, K. G., & Hamilton, A. L. (2013). Seeking Qualitative Rigor in Inductive Research: Notes on the Gioia Methodology. *Organizational Research Methods*, *16*(1), 15–31. https://doi.org/10.1177/1094428112452151

Greer, T. W., & Payne, S. C. (2014). Overcoming Telework Challenges : Outcomes of

Successful Telework Strategies. *Psychologist-Manager Journal*, *17*(2), 87–111. https://doi.org/10.1037/mgr0000014

Guarte, J. M., & Barrios, E. B. (2006). Computation Estimation Under Purposive Sampling. *Communications in Statistics - Simulation and Computation*, *35*(2), 277–284. https://doi.org/10.1080/03610910600591610

Guzman, F. A., & Espejo, A. (2019). Introducing changes at work: How voice behavior relates to management innovation. *Journal of Organizational Behavior*, *40*(1), 73–90. https://doi.org/10.1002/job.2319

Harley, B., & Cornelissen, J. (2020). Rigor With or Without Templates? The Pursuit of Methodological Rigor in Qualitative Research. *Organizational Research Methods*, 1–23. https://doi.org/10.1177/1094428120937786

Hellström, T. (2008). Transferability and naturalistic generalization: New generalizability concepts for social science or old wine in new bottles? *Quality and Quantity*, *42*(3), 321–337. https://doi.org/10.1007/s11135-006-9048-0

Hitt, M. A., Arregle, J. L., & Holmes, R. M. (2021). Strategic Management Theory in a Post-Pandemic and Non-Ergodic World. *Journal of Management Studies*, *58*(1), 257–262. https://doi.org/10.1111/joms.12646

Hoch, J., & Kozlowski, S. (2014). Leading Virtual Teams : Hierarchical Leadership , Structural ... *Journal of Applied Psychology*, *99*(3), 390–403.

Hughes, D. J., Lee, A., Tian, A. W., Newman, A., & Legood, A. (2018). Leadership, creativity, and innovation: A critical review and practical recommendations. *Leadership Quarterly*, *29*(5), 549–569. https://doi.org/10.1016/j.leaqua.2018.03.001

Issahaka, A. W., & Lines, R. (2021). Research literature on leadership of knowledge workers: where are we, and where should we be heading? *Journal of Intellectual Capital*, *22*(1), 122–148. https://doi.org/10.1108/JIC-10-2019-0240

Jain, A., & Huang, K. G. (2020). Learning from the Past: How Prior Experience Impacts the Value of Innovation After Scientist Relocation. *Journal of Management*, 1–34. https://doi.org/10.1177/0149206320979658

Jarvenpaa, S. L., & Välikangas, L. (2020). Advanced technology and end-time in organizations: A doomsday for collaborative creativity? *Academy of Management*

Perspectives, *34*(4), 566–584. https://doi.org/10.5465/AMP.2019.0040

Jiang, Y., & Chen, C. C. (2018). Integrating Knowledge Activities for Team Innovation: Effects of Transformational Leadership. *Journal of Management*, *44*(5), 1819–1847. https://doi.org/10.1177/0149206316628641

Kniffin, K. M., Anseel, F., Antonakis, J., Ashford, S. P., Bakker, A. B., Bamberger, P., Choi, V. K., Creary, S. J., Demerouti, E., Flynn, F. J., Gelfand, M. J., Greer, L. L., Johns, G., Klein, P. G., Lee, S. Y., Petriglieri, J. L., Rudolph, C. W., Shaw, J. D., & Whillans, A. (2021). COVID-19 and the Workplace : Implications , Issues , and Insights for Future Research and Action. *American Psychologist*, *76*(1), 63–77.

Kniffin, K. M., Narayanan, J., Anseel, F., Antonakis, J., Ashford, S. P., Bakker, A. B., Bamberger, P., Bapuji, H., Bhave, D. P., Choi, V. K., Creary, S. J., Demerouti, E., Flynn, F. J., Gelfand, M. J., Greer, L. L., Johns, G., Kesebir, S., Klein, P. G., Lee, S. Y., … van Vugt, M. (2020). COVID-19 and the Workplace: Implications, Issues, and Insights for Future Research and Action. *American Psychologist*, *76*(1), 63–77. https://doi.org/10.1037/amp0000716

Kozlowski, S. W. J., & Chao, G. T. (2018). Unpacking team process dynamics and emergent phenomena: Challenges, conceptual advances, and innovative methods. *American Psychologist*, *73*(4), 576–592.

Kumar, S. (2018). Analysis in a Business Research. *Journal of General Management Research*, *5*(2), 70–82.

Larson, B., Makarius, E., Gibbs, J., Boyraz, M., & Makarius, E. E. (2017). Changing the perspective of virtual work: Building virtual intelligence at the individual level. *Academy of Management Perspectives*, *31*(2), 159–178.

Lee, H. W., Pak, J., Kim, S., & Li, L. Z. (2019). Effects of Human Resource Management Systems on Employee Proactivity and Group Innovation. *Journal of Management*, *45*(2), 819–846. https://doi.org/10.1177/0149206316680029

Lin, C. P., Chiu, C. K., & Liu, N. T. (2019). Developing virtual team performance: an integrated perspective of social exchange and social cognitive theories. *Review of Managerial Science*, *13*(4), 671–688. https://doi.org/10.1007/s11846-017-0261-0

Mak, S., & Kozlowski, S. W. J. (2019). Virtual teams: Conceptualization, integrative review, and research recommendations. In *The Cambridge handbook of technology and*

employee behavior (pp. 441–479). Cambridge University Press.

Marshall, B., Cardon, P., Poddar, A., & Fontenot, R. (2013). Does sample size matter in qualitative research?: A review of qualitative interviews in IS research. *Journal of Computer Information Systems*, *54*(1), 11–22. https://doi.org/10.1080/08874417.2013.11645667

Meng, J., & Berger, B. K. (2019). The impact of organizational culture and leadership performance on PR professionals' job satisfaction: Testing the joint mediating effects of engagement and trust. *Public Relations Review*, *45*(1), 64–75. https://doi.org/10.1016/j.pubrev.2018.11.002

Nyberg, A. J., Shaw, J. D., & Zhu, J. (2021). The People Still Make the (Remote Work-) Place : Lessons from a Pandemic. *Journal of Management*, *47*(8), 1967–1976. https://doi.org/10.1177/01492063211023563

Oyemomi, O., Liu, S., Neaga, I., Chen, H., & Nakpodia, F. (2019). How cultural impact on knowledge sharing contributes to organizational performance : Using the fsQCA approach. *Journal of Business Research*, *94*(February 2018), 313–319. https://doi.org/10.1016/j.jbusres.2018.02.027

PWC. (2021). *US Remote Work Survey*. PWC. https://www.pwc.com/us/en/library/covid-19/us-remote-work-survey.html

Ratzmann, M., Pesch, R., Bouncken, R., & Climent, C. M. (2018). The Price of Team Spirit for Sensemaking Through Task Discourse in Innovation Teams. *Group Decision and Negotiation*, *27*(3), 321–341. https://doi.org/10.1007/s10726-018-9561-2

Saunders, M., & Lewis, P. (2018). Doing research in business and management. In *Pearson* (Second). Pearson Education Limited.

Schein, E. H. (1991). What Is Culture? In M. Godwyn & J. H. Gittel (Eds.), *Sociology of Organizations: Structures and Relationships* (pp. 311–314). Sage Publications.

Schein, E. H. (2010). Part One: Organizational Culture and Leadership Defined. In *Organizational Culture and Leadership* (Third Edit). Jossey Bass.

Schmidt, G. B. (2014). Virtual leadership: An important leadership context. *Industrial and Organizational Psychology*, *7*(2), 182–187. https://doi.org/10.1111/iops.12129

Spicer, A. (2020). Organizational Culture and COVID-19. *Journal of Management Studies*,

57(8), 1737–1740. https://doi.org/10.1111/joms.12625

Subramaniam, R., Singh, S. P., Padmanabhan, P., Gulyás, B., Plakkeel, P., & Sreedharan, R. (2021). Positive and negative impacts of covid-19 in digital transformation. *Sustainability (Switzerland)*, *13*(16), 1–18. https://doi.org/10.3390/su13169470

Thayer, A. L., Petruzzelli, A., & Mcclurg, C. E. (2018). Addressing the Paradox of the Team Innovation Process : A Review and Practical Considerations. *American Psychologist*, *73*(4), 363–375. https://doi.org/10.1037/amp0000310

Tsai, S. (2018). Innovative behaviour of knowledge workers and social exchange attributes of financial incentive: implications for knowledge management. *Journal of Knowledge Management*, *22*(8), 1712–1735. https://doi.org/10.1108/JKM-07-2017-0293

Tu, Y., Lu, X., Choi, J. N., & Guo, W. (2019). Ethical Leadership and Team-Level Creativity: Mediation of Psychological Safety Climate and Moderation of Supervisor Support for Creativity. *Journal of Business Ethics*, *159*(2), 551–565. https://doi.org/10.1007/s10551-018-3839-9

Yang, L., Holtz, D., Jaffe, S., Suri, S., Sinha, S., Weston, J., Joyce, C., Shah, N., Sherman, K., Hecht, B., & Teevan, J. (2022). The effects of remote work on collaboration among information workers. *Nature Human Behaviour*, *6*(1), 43–54. https://doi.org/10.1038/s41562-021-01196-4

Appendix A: Interview Guide

Theme	Interview Questions	Alignment to the research question
Consequences to the collaboration of virtual teams.	1. What process do you follow to allocate tasks within your virtual team? 2. In your opinion, how has the decision-making of teams changed due to prolonged virtual work? 3. What is your opinion on the effectiveness of technology like Microsoft Teams and Zoom generating sharing new knowledge? 4. How often do you interact with other colleagues outside of your direct team for a general discussion? 5. In your opinion, how can virtual teams improve collaboration between individuals?	Sub-question 1 & Sub-question 2
Consequences to the Creativity of virtual teams.	1. How have you experienced brainstorming in your virtual team? 2. What process did you follow for brainstorming or problem solving before you started working more virtually with your team? 3. What is your opinion on the effectiveness of technology like Microsoft Teams and Zoom for generating new ideas for your team? 4. From your experience in generating new ideas, what suggestions would you have for other teams who will begin to work more virtually so they can be more effective?	Sub-question 3
Consequences to the Innovation of virtual teams.	1. What is the process that you follow when you implement new processes or products in your team? 2. How has this changed since you started working virtually? 3. From your experience in implementing innovations, how can innovation be improved through virtual work?	Sub-question 4
Implications of SQs 1 - 4 at the organisational level.	Thematic integration of IQs 1 – 12 during the study's analysis phase.	Sub-question 5

Appendix B: Informed Consent

Letter of informed consent

Dear Madam/Sir

I am conducting research on the implications of high virtuality on the collaboration, creativity and innovation of virtual teams. Our interview is expected to last between 45 and 60 minutes, and will help us understand how high degrees of virtual work impact the collaboration, creativity and innovation of teams. Your participation is voluntary and you can withdraw at any time without penalty. By signing this letter, you are indicating that you have given permission for:

- The interview to be recorded;
- The recording to be transcribed by the researcher.
- Verbatim quotations from the interview may be used in the report, provided they are not identified with your name or that of your organisation;
- The data to be used as part of a report that will be publicly available once the examination process has been completed; and All data to be reported and stored without identifiers.

If you have any concerns, please contact my supervisor or me. Our details are provided below.

Researcher:	Research Supervisor:
Senzosenkosi Nsibande	Colin Rowley
Email: 13094590@mygibs.co.za	Email: colinrowley@vodamail.co.za

Signature of participant: _____

Date: _____

Signature of researcher: _____

Date: _____

Appendix C: Consistancy Matrix

Research Question (RQ)	Literature Review	Data Collection Tool	Analysis
RQ 1: How will high degrees of virtuality impact the collaboration patterns (across coordination, cooperation and knowledge sharing) of virtual teams?	Yang et al (2022) Choi & Cho (2019) Kniffin et al. (2021) George et al. (2020)	Semi-structured, in-depth interviews	Coding and identifying Code category groupings then themes about the impacts on collaboration patterns in virtual teams. Analysing themes to determine findings.
RQ 2: How can managers sustain the positive benefits of collaboration previously evidenced in F2F teams, within highly virtual teams?	Choi & Cho (2019) Kniffin et al. (2021) Jain & Huan (2020) George et al. (2020)	Semi-structured, in-depth interviews	Coding and identifying code category groupings and themes about the enablers of collaboration patterns in virtual teams. Analysing themes to determine findings.
RQ 3: How will high levels of virtuality impact the generation of novel ideas (creativity) in virtual teams?	Acar et al. (2019) George et al. (2020) Anderson et al.(2014)	Semi-structured, in-depth interviews	Coding and identifying code categories groupings then themes about the impacts on creativity in virtual teams. Analysing themes to determine Findings.
RQ 4: How will high virtuality impact the implementation of ideas (innovation) in virtual teams?	Acar et al. (2019) George et al. (2020)	Semi-structured, in-depth interviews	Coding and identifying code category groupings then themes about the impacts on innovation and idea implementation in virtual teams. Analysing themes to determine Findings.
RQ 5: How can organisations maintain or improve the positive benefits of collaboration and creativity within teams that were predominately F2F before adopting higher levels of virtuality?	Hitt, Arregle, & Holmes (2021) George et al. (2020)	Semi-structured, in-depth interviews	Coding and identifying code category groupings and themes for recommendations that promote collaboration patterns in virtual teams. Analysing themes to determine conclusions.