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## REMOTE WORK DYNAMICS: ANALYZING THE INFLUENCE OF VIRTUAL TEAM COLLABORATION TOOLS ON EMPLOYEE ENGAGEMENT

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### ABSTRACT

*This study investigates the impact of virtual team collaboration tools on employee engagement specifically meaningfulness, safety, and availability within the context of distant work dynamics. A self-administered questionnaire was distributed to 300 remote employees of diverse positions and genders. Data were examined via SPSS, implementing correlation and regression analyses. Results demonstrate a robust positive link between the utilisation of virtual tools and employees' perception of meaningfulness, with regression analysis*

*revealing a significant predictive impact. Likewise, the utilisation of virtual tools is favourably associated with safety, exerting a substantial influence. Nonetheless, the utilisation of virtual tools exhibits a negative correlation with resource availability, suggesting a decline in perceived accessibility. A significant difficulty confronting HR practitioners pertains to employee engagement, particularly in the context of virtual team interactions. This study's findings offer significant insights for organisations, HR professionals, and policymakers aiming to expand virtual collaboration platforms to improve employee well-being and productivity.*

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**KEYWORDS:** Virtual Collaboration Tools, Remote Work, Employee Engagement, Meaningfulness, Safety, Availability, Decent Job.

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## 1. INTRODUCTION

The advancement of digital technology has profoundly transformed conventional corporate operations, modifying staff communication, collaboration, and task execution (Shafique, 2024). Organisations have modified their operations in response to globalisation and the progression of communication technologies. During periods of market volatility, business continuity planning is imperative. The emergence of the gig economy has transformed workforce planning into a virtual paradigm. Virtual teams, linked by technology, assist firms in minimising travel expenses and maintaining operations. Nonetheless, sustaining employee engagement in a virtual context is arduous, as it diverges from conventional work contexts. As an increasing number of individuals favour remote work for enhanced flexibility and improved work-life balance, telecommuting has become essential for organisations. Managers must design ways to enhance team efficacy in this new configuration (Majumder & Kunte, 2022). Human Resources today confronts the difficulty of supplying appropriate tools and technology to facilitate remote work. Despite the implementation of good engagement activities, inadequate communication or technical difficulties may result in disengagement. The COVID-19 epidemic has exacerbated workforce management difficulties, underscoring the need of human resources. The crisis compelled numerous organisations to use remote work, which, despite being endorsed by HR, posed distinct obstacles. Human Resources has become increasingly vital in maintaining corporate continuity while emphasising employee safety. Organisations such as Infosys, Paytm, and TCS have adopted remote work to sustain operations (Majumder & Kunte, 2022). The transition to remote work has established a novel learning environment for employees (Vercic & Vokic, 2017).

### 1.1. Problem Statement

As employees gain proficiency with digital work tools, these technologies have been smoothly incorporated into their regular routines. A primary advantage of these instruments is their versatility; they provide flexibility and accommodate various work methods without necessitating technological alterations. This has resulted in the development of novel virtual interactions, including online coffee breaks and after-work social events using video conferencing. For leaders, remote work has transitioned from a tentative trial to an established standard. Fears that remote work will diminish

productivity or reduce employee engagement outside the workplace have mainly been unwarranted. This study seeks to investigate the baseless apprehension.

### 1.2. Background

Prior to the pandemic, remote work and digital communication tools were frequently regarded as non-essential rather than integral to company operations (Al-Habaibeh et al., 2021). The sudden requirement for social distancing and lockdowns compelled organisations to swiftly adopt digital solutions, enabling employees to operate remotely while preserving communication with their colleagues and supervisors. This transition resulted in the extensive utilisation of digital instruments. While these technologies were implemented to enhance communication and efficiency, they also transformed the manner in which employees engage with their roles and execute activities in distant environments (Majumder & Kunte, 2022). Therefore, the current study is conducted with the following objectives:

### 1.3. Research Objectives

- To evaluate the impact of virtual team collaboration tools on the perception of meaningfulness in workers' work.
- To evaluate the impact of virtual collaboration tools on employees' perception of safety in self-expression.
- To evaluate the impact of virtual collaboration technologies on employees' access to resources (physical, emotional, psychological) necessary for optimal job performance.

### 1.4. Statements of Hypotheses

#### Hypothesis 1

H0: Virtual team collaboration tools do not have a significant impact on employees' sense of meaningfulness in their work.

H1: Virtual team collaboration tools do have a significant impact on employees' sense of meaningfulness in their work

#### Hypothesis 2

H0: Virtual team collaboration tools do not significantly enhance employees' sense of safety when expressing themselves at work.

H1: Virtual team collaboration tools do significantly enhance employees' sense of safety when expressing themselves at work.

#### Hypothesis 3

H0: Virtual team collaboration tools do not significantly improve employees' availability of physical, emotional, and psychological resources to perform their jobs effectively.

H1: Virtual team collaboration tools do significantly improve employees' availability of physical, emotional, and psychological resources to perform their jobs effectively.

## 2. LITERATURE REVIEW

### 2.1. Employee Engagement

Scholars in management, human resources, and positive psychology have recently focused significantly on employee engagement (Sun & Bunchapattanasakda, 2019). The definition of employee involvement varies among different scholars, organisations, and countries. Coined by Kahn (1990), it denotes the comprehensive engagement of individuals in their professional roles, encompassing physical, mental, and emotional involvement. Since that time, other scholars have presented their individual views of employee involvement, each embodying their distinct viewpoint. Based on the needs-satisfaction paradigm, which underpins Kahn's (1990) definition, employees exhibit increased engagement in their job when three essential psychological needs are fulfilled. Meaningfulness refers to the perception of value and purpose derived from one's work, stemming from the rewards associated with dedicating time and effort to job performance. Safety – The liberty to articulate oneself without concern about its impact on one's standing, career, or self-perception and Availability – possessing the requisite physical, emotional, and psychological resources to execute tasks efficiently. When organisations neglect to fulfil these needs, employees may become disengaged. Job tasks and relationships influence meaningfulness, social environment and management affect safety, and personal resources, such as energy and work-life balance, determine availability (Kahn, 1990). In distant work settings, the lack of human and physical encounters might hinder the development of relationships and team cohesion. To mitigate this issue, firms such as HP, Lenovo, TCS, and Cisco deploy digital platforms like Zoom, Google Hangouts, and MS Teams to conduct virtual meetings, hence maintaining successful employee engagement in the absence of physical interaction (Majumder & Kunte, 2022).

### 2.2. Role and Adoption of Virtual Tools

Employees have become increasingly adept at utilising digital tools for work, resulting in the

establishment of new habits and routines. These tools are inherently adaptable, accommodating diverse work styles without necessitating specialised modifications (Richter & Riemer, 2013). Remote work may induce emotions of isolation; yet, robust ties with coworkers might mitigate this (Hickman, 2018). Richter (2020) asserts that numerous employees associate digital work with the lack of in-person interactions with colleagues. It is important to remember that the COVID-19 pandemic, rather than digital labour, precipitated physical isolation. Research demonstrates that remote employees place significant importance on substantive connections with both their supervisors and colleagues (White, 2017). Quality time spent with peers is associated with employee engagement for both remote and in-office workers, with a greater correlation observed among remote employees (White, 2018). Therefore, arranging an annual or biannual in-person assembly for remote teams can substantially improve employee engagement (Patel, 2017). Kim & Gatling (2018) assert that rather than modifying in-office engagement strategies for remote teams, one should concentrate on engaging employees within their remote environments, such as through Virtual Employee Engagement Platforms (VEEPs). These platforms facilitate effortless communication, cooperation, and contact between employees and the organisation. Nevertheless, for success, VEEPs must exhibit user-friendliness.

### 2.3. Impact of Virtual Team Collaboration Tools

**Bolstad and Endsley (2003) delineate four major facets of collaboration:**

1. Timing: whether it occurs immediately or with a delay.
2. Predictability – whether it adheres to a predetermined timetable or occurs as required.
3. Location – whether team members are co-located or working remotely.
4. Level of interaction. Collaboration in remote teams can occur via in-person meetings, telephone conversations, or digital platforms like as email, chat, and online forums.

These technologies facilitate the dissemination of knowledge and resources; but, in-person encounters remain crucial for effective collaboration (Watson-Manheim & Belanger, 2002). Email serves as a prevalent asynchronous medium for communication and document management; yet, its absence of instant feedback may impede trust and the exchange of knowledge (Godar & Ferris, 2004). Project management tools monitor tasks and progress (Xu et

al., 2008), and document-sharing systems facilitate real-time collaboration (Lomas et al., 2008). AI-driven functionalities such as meeting summaries and transcripts significantly improve productivity across different time zones. These tools facilitate uninterrupted information exchange, maintaining team awareness, involvement, and coherence while securely revising contracts, proposals, and project updates (Dennison, 2024). The practices inside an organization's environment influence digital work. Throughout the lockdown, the majority of organisations functioned under crisis conditions, affecting the nature of the required work. This frequently necessitated extensive coordination, resulting in a heightened demand for virtual meetings. This scenario led to what was historically termed technostress (Ayyagari et al., 2011) and is presently recognised as "Zoom fatigue" (Fosslien & Duffy, 2020). A greater number of employees now perceive that digital work entails an increased frequency of meetings compared to the period prior to the lockdown. Nonetheless, online meetings are not the sole method of conducting digital work. Experienced digital professionals, including digital nomads (Richter & Richter, 2020; Schlagwein, 2018), have developed strategies to minimise the need for synchronous communication while enhancing productivity across time zones. Research conducted by Mazmanian et al. (2013) has demonstrated that whereas autonomy, akin to mobile work, may appear empowering, it can also yield unintended consequences such as excessive email monitoring and diminished capacity to disengage. Feldman and Mazmanian (2020) indicate that employees who

perceived diminished visibility during the lockdown endeavoured to exhibit their engagement by increasing their responsiveness and working more hours. This perpetual online engagement, however, resulted in diminished time allocated to genuine productive endeavours, complicating employees' ability to address their own needs and situations. In conclusion, although productivity did not decline, the lack of established social norms drove employees to overcompensate for their diminished visibility by enhancing communication (Hafermalz, 2021). Yang et al. (2022) examined the impact of the COVID-19 pandemic on information workers transitioning to full-time remote employment. The results indicated that distant work led to less team interactions and more fragmented and disjointed collaborative networks. Furthermore, asynchronous communication, including emails and messages, increased, whereas synchronous communication, such as in-person meetings and phone conversations, diminished. Employees encountered increased challenges in exchanging and acquiring new information within the organisation due to these changes. Conversely, research demonstrates that it enables employees to participate in novel kinds of engagement, affording them greater autonomy in their job and fostering innovative concepts for workplace independence and leadership (Dittes et al., 2019; Richter et al., 2020). Although ICT tools enhance communication and information dissemination, effective collaboration is contingent upon interpersonal interactions and the organisational context. Goodwin, 2017.

**Table 1: Summary of the Role, Adoption and Impact of Virtual Team Collaboration Tools.**

S. No	Factors	Studies	Findings
1	Role and Adoption of Virtual Tools	Richter & Riemer, 2013	Employees' proficiency in use of digital tools has increased the flexible nature of employees.
		Hickman, 2018	Feelings of isolation due to remote work can be overcome by strong connections with colleagues.
		Richter, 2020	The reason for physical distancing with colleagues is covid 19 and not digital work.
		White, 2017	States that remote workers highly value meaningful interactions, both with their managers and peers.
		White, 2018	Remote employees show a stronger correlation with employee engagement
		Patel, 2017	Suggests in-person gathering for remote teams once or twice annually to enhance employee engagement
		Kim & Gatling, 2018	Suggests Virtual Employee Engagement Platforms (VEEPs) to enhance employee engagement.
2	Impact of Virtual Team Collaboration Tools	Bolstad & Endsley 2003	
		Watson-Manheim & Belanger, 2002	These technologies help share information and resources, but meetings in physical setup are still important for effective teamwork.
		Godar & Ferris, 2004	Email is a widely used asynchronous tool for communication and document management but lacks immediate feedback, which can hinder trust and knowledge sharing.
		Xu et al., 2008	Project management tools track tasks and progress.
		Lomas et al., 2008	Document-sharing platforms enable real-time collaboration
		Dennison, 2024	Virtual tools ensure seamless information-sharing, keeping teams informed, engaged, and aligned while securely updating contracts, proposals, and project updates
		Ayyagari et al., 2011	Technostress (Ayyagari et al., 2011)
		Mazmanian et al., 2013	over checking of mails
		Goodwin, 2017	While virtual tools improve communication and information sharing, successful collaboration still depends on social relationships and the workplace environment.
		Hafermalz, 2021	Increased communication to overcompensate for their reduced visibility.
		Richter & Richter,	Digital workers portrayed as digital nomads.

		2020; Schlagwein, 2018	
		Fosslien & Duffy, 2020	Zoom fatigue
		Yang et al., 2022	Studied how the COVID-19 pandemic affected workers who switched to full-time remote work. The findings demonstrated that working remotely resulted in fewer team interactions and more dispersed and disconnected collaborative networks.
		Dittes et al., 2019; Richter et al., 2020	In contrast, indicates that it also allows workers to engage in new forms of interaction, providing them with more freedom in their work and encouraging fresh ideas for workplace autonomy and leadership.

In summary, the reviewed literature highlights the growing integration of technology in the workplace, which employees appreciate for the freedom and autonomy it provides (Richter & Riemer, 2013; Hickman, 2018; Richter, 2020; White, 2017; White, 2018; Patel, 2017; Kim & Gatling, 2018). However, this integration has diminished interpersonal communication among employees, leading to an increase in technostress (Ayyagari et al., 2011), "Zoom fatigue" (Fosslien & Duffy, 2020), excessive email checking (Mazmanian et al., 2013), heightened communication efforts to compensate for reduced visibility (Hafermalz, 2021), and the portrayal of digital workers as digital nomads (Richter & Richter, 2020; Schlagwein, 2018).

This study aims to examine Remote Work Dynamics by analysing the impact of Virtual Team Collaboration Tools on Employee Engagement, with the intention of providing recommendations based on the findings.

### 3. METHODOLOGY

The methodology employs a mixed-method approach, incorporating qualitative analysis through a comprehensive examination of prior studies and quantitative analysis via data collection through online means. The demographic inquiry examined four factors: Age, Gender, Job Role, and duration of engagement in Remote Work. The quantitative data was gathered using a scale created by Sowmya K.R. (2024), which underwent pre-testing and yielded a reliability score of 0.78.

The questionnaire was created based on existing literature regarding remote work and associated characteristics (Smith, 2021). It comprised 12 items related to Meaningfulness, Safety, and Availability.

The sample statements included: "My work provides a sense of accomplishment," "My team values my perspectives and contributions," and "I believe my current workload is manageable with the available resources." The questionnaire gathered four significant personal and organisational enquiries in section 1. Part 2 gathered data concerning significance, security, and accessibility. The research tool was distributed to personnel engaged in a remote working approach.

A non-probability sampling technique employing

the snowball approach was utilised to gather replies. The questionnaire was distributed to remote employees, who were subsequently instructed to share it with their contacts, and so on. A total of 332 responses were obtained from the disseminated surveys. Of the 332 replies, 300 were deemed usable for the study. The sample is heterogeneous, encompassing participants from various genders, age demographics, and roles. Participants were required to be current remote workers and to complete the entire questionnaire.

This guaranteed that the sample comprised persons with direct experience with remote work dynamics.

SPSS IBM 20 was utilised to examine the gathered data for this study. SPSS was chosen for its intuitive design, rendering it accessible to researchers with less technical proficiency (Arkkelin, 2014). Its user-friendliness obviates the necessity for programming expertise, facilitating effective data management and analysis (Wagner, 2019).

In this study, descriptive statistics are essential for elucidating the principal characteristics of the data. This strategy successfully summarises and represents data using visual tools such as pie charts. This improves the clarity of the study's results, facilitating a more accessible interpretation of the data.

This study employs inferential statistics to derive findings and make inferences on the larger population from which the sample is extracted. The principal objective is to extrapolate the results from the sample to the overall population. Utilising methods like correlation and regression analysis, a P-value is produced and juxtaposed with a predetermined significance threshold, commonly established at 0.05 (alpha,  $\alpha$ ). A P-value under 0.05 often signifies that the results are statistically significant (Hill, 2006).

### 4. ANALYSIS AND DISCUSSION

#### 4.1. Demographic Data

In this section the personal data was interpreted to understand the demographics of the respondents. It included Age, Gender, Level, and years in remote working.

#### 4.1.1. Age

The demographic data illustrates the age distribution of the 300 participants ( $N = 300$ ) in the study. The predominant segment, comprising 97 respondents (32.3%), is within the 25-34 age bracket, closely succeeded by 87 respondents (29.0%) aged 25 or younger. Individuals aged 35-44 constitute 22.7% of the sample (68 respondents), whilst the smallest group comprises 48 respondents (16.0%) aged 45-54. This distribution reveals that most participants are young professionals.

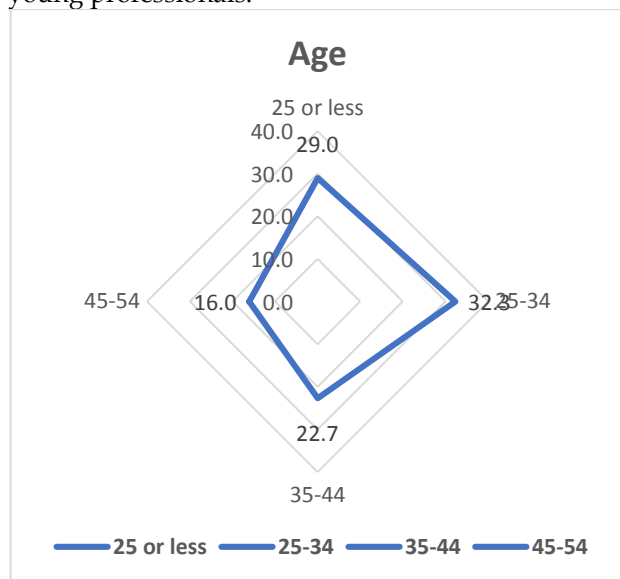


Figure 1: Age of the Respondents.

#### 4.1.2. Gender

The gender distribution of the 300 respondents ( $N = 300$ ) reveals that a majority are female, totalling 169 persons (56.3%), while the remaining 131 respondents (43.7%) are male.

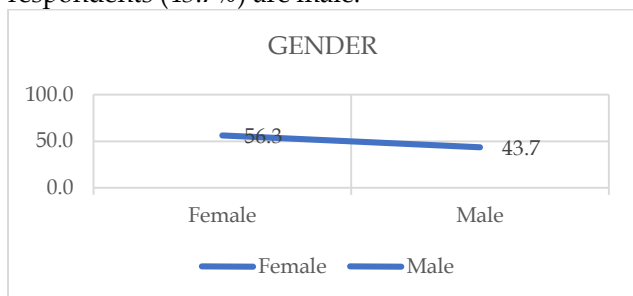


Figure 2: Gender of the Respondents.

#### 4.1.3. Role

The role distribution among the 300 respondents ( $N = 300$ ) reveals that the predominant group comprises mid-level workers, including 104 respondents (34.7%). Junior workers are the second-largest group, totalling 79 respondents (26.3%).

Senior workers comprise 71 respondents (23.7%), whereas managers constitute the lowest cohort, with 46 respondents (15.3%). This distribution indicates that most individuals occupy mid-level or junior roles.

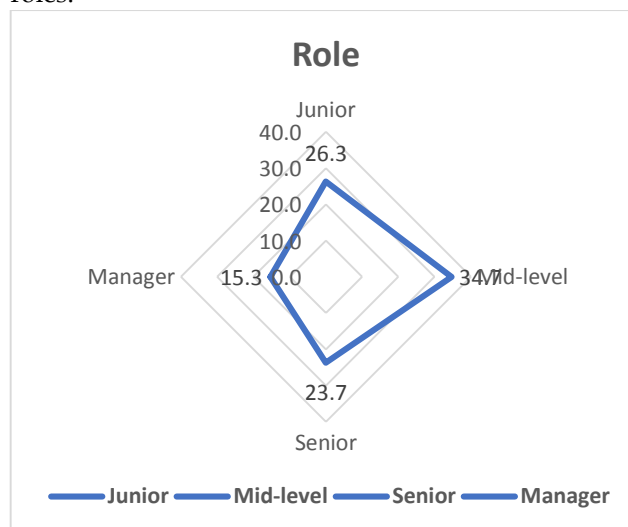


Figure 3: Role of the Respondents.

#### 4.1.4. Remote Working Duration

The remote work experience distribution of the 300 respondents ( $N = 300$ ) shows that the largest group has been working remotely for 6-12 months, comprising 134 respondents (44.7%). This is followed by those with 1-2 years of remote work experience, accounting for 71 respondents (23.7%). A smaller portion, 51 respondents (17.0%), have been working remotely for two years or more, while the least experienced group, with less than six months of remote work, consists of 44 respondents (14.7%). This distribution indicates that most participants have a moderate level of remote work experience.

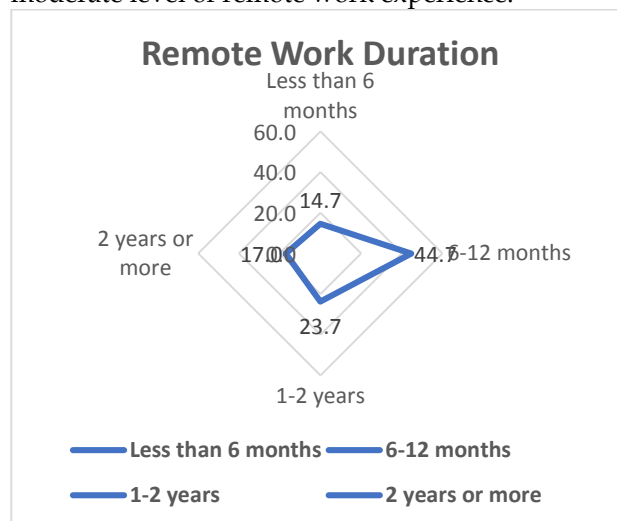


Figure 4: Remote Working Duration.

## 4.2. Influence of Virtual Team Collaboration Tools on Employee Engagement

### 4.2.1. Meaningfulness

**Table 2: Correlation between Virtual Usage and Meaningfulness.**

Correlations			
		Virtual Tool Usage	Meaningfulness
Virtual Tool Usage	Pearson Correlation	1	.868**
	Sig. (2-tailed)		.000
	N	300	300
Meaningfulness	Pearson Correlation	.868**	1
	Sig. (2-tailed)	.000	
	N	300	300

\*\* . Correlation is significant at the 0.01 level (2-tailed).

The results of the analysis in table 4.2.1 indicates a strong positive relationship between virtual tool usage and meaningfulness in the work of employees, with a Pearson correlation of 0.868, which is statistically significant at the 0.01 level ( $p$ -value = 0.000). This suggests that the more employees use virtual collaboration tools, the more they feel that their work has value and purpose.

**Table 3: Model Summary.**

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.868 <sup>a</sup>	.753	.752	2.82276

a. Predictors: (Constant), Virtual Tool Usage

The regression analysis reveals a robust and statistically significant correlation between the use of virtual collaboration tools and employees' perception of Meaningfulness in their work.

The R-value of 0.868 indicates that Virtual Tool Usage accounts for a significant portion of the variance in Meaningfulness, evidenced by a  $R^2$  of 0.753, signifying that 75.3% of the variability in employees' perception of Meaningfulness is attributable to the frequency or intensity of their utilisation of virtual collaboration tools such as Slack, Zoom, or Microsoft Teams. This serves as a robust predictor, as a significant amount of employee engagement with their work is correlated with the frequency and efficacy of their use of these technologies.

The ANOVA table in Annexure 1 validates the statistical significance of this link. The F-statistic of 908.118 and the  $p$ -value of 0.000 demonstrate that the model is very significant overall. The fluctuation in Meaningfulness is not attributable to random chance but may be consistently ascribed to the utilisation of virtual tools.

The regression coefficient ( $B = 0.293$ ) in

Annexure 1 indicates that for each 1-unit increase in Virtual Tool Usage, there is a corresponding 0.293-unit rise in Meaningfulness. Employees that utilise virtual tools more regularly or effectively experience a heightened sense of value and purpose in their work. The standardised coefficient ( $Beta = 0.868$ ) signifies a robust link, indicating that the utilisation of virtual tools is a pivotal component affecting employees' perceptions of the significance of their activities and overall job duties.

Consequently, these findings underscore that organisations that invest in and promote the regular use of virtual collaboration tools can markedly improve employees' feeling of Meaningfulness, thus cultivating more engagement and job happiness.

Within Kahn's (1990) engagement framework, meaningfulness denotes the value and purpose that employees extract from their job. Employees feel heightened engagement when their work are rewarding, challenging, and congruent with their personal values. The results indicate that regular utilisation of virtual collaboration technologies correlates with an enhanced sense of meaningfulness. This may result from several circumstances. Tools such as Slack, Microsoft colleagues, and Zoom enable employees to maintain connectivity with their colleagues, enhance communication efficiency, and optimise job management. These technologies facilitate enhanced collaboration among employees and foster contributions to organisational objectives, so rendering their work more significant and congruent with their personal values and aspirations (Dennison, 2024).

Kahn's paradigm posits that meaningfulness is influenced by job responsibilities and employee interactions inside the organisation. Virtual technologies provide employees increased opportunities for connection, collaboration, and job alignment, thereby augmenting their impression of meaningfulness in their roles. Employees that regularly utilise these tools may experience heightened involvement in decision-making and project management, hence enhancing their perception of contribution to the organization's success.

Moreover, virtual collaboration technologies facilitate staff organisation and enhance communication efficiency, so fostering a more productive and goal-focused work environment, which contributes to the intrinsic benefits of their positions. Consequently, these technologies appear to be essential in promoting meaningful work by



improving task alignment and social connections among teams.

#### 4.2.2. Safety

**Table 4: Correlation between Virtual Usage and Safety.**

Virtual Tool Usage		Safety	
Virtual Tool Usage	Pearson Correlation	1	.877**
	Sig. (2-tailed)		.000
	N	300	300
Safety	Pearson Correlation	.877**	1
	Sig. (2-tailed)	.000	
	N	300	300

\*\* . Correlation is significant at the 0.01 level (2-tailed).

The analysis in Table 4.2.2. Reveals a strong positive relationship between virtual tool usage and safety with a Pearson correlation of 0.877, which is statistically significant at the 0.01 level ( $p$ -value = 0.000). This indicates that as employees' use of virtual collaboration tools increases, their perception of safety in the workplace also increases. The relationship is robust, suggesting that virtual tool usage has a substantial impact on creating a safe environment where employees feel secure in expressing themselves.

**Table 5: Model Summary.**

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.877 <sup>a</sup>	.770	.769	2.80770

a. Predictors: (Constant), Virtual Tool Usage

The regression analysis results indicate a robust and statistically significant correlation between the utilisation of virtual collaboration tools and employees' perceived safety in the workplace. An R-value of 0.877 indicates a robust association, while a  $R^2$  of 0.770 signifies that 77% of the variance in perceived Safety is attributable to Virtual Tool Usage. The manner in which employees interact with virtual tools profoundly influences their sense of safety, defined here as their comfort in self-expression, idea sharing, and risk-taking without apprehension of adverse repercussions.

The ANOVA table in Annexure 1 further substantiates the significance of this model. The F-statistic of 996.938, along by a  $p$ -value of 0.000, signifies that the model is very significant, demonstrating that the correlation between virtual tool usage and safety is not attributable to random chance.

The regression coefficient ( $B = 0.306$ ) in Annexure 1 indicates that for each 1-unit increase in Virtual Tool Usage, there is a corresponding 0.306-

unit rise in perceived Safety. This indicates that increased or effective usage of virtual collaboration technologies by employees correlates with an enhanced sense of psychological safety. The standardised coefficient ( $Beta = 0.877$ ) indicates that this is a robust predictor of safety, with the utilisation of virtual tools significantly impacting the safety perceived by employees in their work environment.

In conclusion, these findings indicate that organisations promoting the regular and efficient utilisation of virtual collaboration tools can improve employees' sense of safety, fostering a more open and trusting workplace where individuals feel secure in articulating their thoughts, sharing ideas, and participating in team discussions without apprehension of judgement or adverse repercussions.

Within Kahn's (1990) engagement paradigm, safety denotes the establishment of a work environment in which employees feel at ease to articulate their ideas, provide feedback, and undertake risks without apprehension of adverse repercussions, including mockery, punishment, or marginalisation. It is intricately linked to an employee's perception of psychological and social security within the job. The findings indicate that virtual collaboration platforms, including Slack, Microsoft Teams, and Zoom, are crucial in cultivating a sense of safety by promoting open communication and transparency among teams. For instance, when employees consistently utilise virtual platforms for communication and collaboration, they may experience a heightened sense of connection with their colleagues, fostering a more open and inclusive atmosphere. These solutions facilitate employees in sharing ideas, posing enquiries, and offering feedback without the constraints of physical distance, which is especially crucial in remote work environments. Moreover, the facilitation of communication provided by these tools may empower employees to articulate their viewpoints with greater confidence, free from concerns of judgement or retribution. A sense of safety, wherein employees perceive their voices as acknowledged and valued, is crucial for cultivating trust and collaboration within teams. Safety is significantly affected by organisational culture, leadership approach, and interpersonal relationships. Virtual collaboration technologies can improve safety by fostering openness and inclusivity. When leadership promotes open dialogue and feedback through these techniques, employees are more inclined to experience psychological safety. Conversely, a toxic or excessively hierarchical environment, even in

virtual settings, where employees fear retaliation for voicing concerns, can compromise safety and inhibit innovation and participation. In conclusion, the robust association between the use of virtual tools and safety underscores the critical role these tools play in fostering a psychologically secure workplace. By facilitating more accessible and open communication, virtual tools can enhance employees' sense of being heard and respected, thereby cultivating trust, collaboration, and deeper engagement in their work. This corroborates Kahn's argument that safety, essential to employee engagement, is predominantly influenced by the cultural and interpersonal dynamics of the workplace, and virtual tools can positively enhance these dynamics.

#### 4.2.3. Availability

**Table 6: Correlation between Virtual Tool Usage and Availability.**

Virtual Tool Usage		Availability	
Virtual Tool Usage	Pearson Correlation	1	-.818**
	Sig. (2-tailed)		.000
	N	300	300
Availability	Pearson Correlation	-.818**	1
	Sig. (2-tailed)	.000	
	N	300	300

\*\*. Correlation is significant at the 0.01 level (2-tailed).

The correlation analysis between virtual tool usage and availability reveals a strong negative relationship, with a Pearson correlation coefficient of -0.818, which is statistically significant at the 0.01 level ( $p$ -value = 0.000). This result indicates that as the use of virtual collaboration tools increases, the perceived availability of necessary resources (physical, emotional, and psychological) among employees decreases significantly.

**Table 7: Model Summary.**

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.818 <sup>a</sup>	.669	.668	3.43135

a. Predictors: (Constant), Virtual Tool Usage

An R-value of 0.818 signifies a robust link between the two variables, while a  $R^2$  value of 0.669 demonstrates that 67% of the variance in availability is attributable to the utilisation of virtual tools. This indicates that increased employee engagement with virtual tools may correlate with a diminished perception of the essential resources (physical, emotional, or psychological) needed for optimal performance.

The regression study indicates a robust and statistically significant adverse correlation between the utilisation of virtual collaboration technologies

and employee availability, encompassing the physical, emotional, and psychological resources essential for effective role performance.

The ANOVA table in Annexure 1 validates the significance of the regression model. The F-statistic of 602.335, along with a  $p$ -value of 0.000, signifies that the model is very significant, indicating that the correlation between virtual tool usage and availability is not attributable to random chance.

The regression coefficient ( $B = -0.290$ ) in Annexure 1 indicates that for each 1-unit increase in Virtual Tool Usage, there is a corresponding 0.290-unit decrease in Availability. This adverse correlation suggests that increased utilisation of virtual collaboration technologies may result in employees perceiving a depletion of their physical, emotional, and psychological resources, ultimately culminating in burnout or diminished engagement. The standardised coefficient ( $Beta = -0.818$ ) indicates that Virtual Tool Usage is a significant negative predictor of availability, implying it is a vital element affecting employees' perceived resource availability.

In conclusion, our findings suggest that although virtual collaboration tools facilitate communication and work management, they may also lead to employees feeling inadequately equipped to perform their duties successfully. Organisations must evaluate this trade-off and guarantee that they offer ample help to avoid employees from feeling overwhelmed or under-resourced, balancing tool utilisation with sufficient physical and emotional assistance. Furthermore, Hinds et al. (2003) indicate that employees experience overwhelm due to an excess of collaboration tools intended to enhance productivity. They recognise their stress and fatigue but feel powerless to mitigate the incessant stream of communication.

Within Kahn's (1990) engagement paradigm, availability denotes the essential resources required by employees to execute their responsibilities proficiently. These resources encompass physical (tools, equipment, workspaces), emotional (support, energy), and psychological (mental clarity, confidence) dimensions. Employees necessitate these resources to maintain engagement and execute their responsibilities effectively. Insufficient resources may induce emotions of overwhelm, stress, or tiredness, potentially culminating in burnout or disengagement. Remote employment poses obstacles to employees' well-being, including isolation, difficulty in delineating work from personal life, and indistinct boundaries (Tsipursky, 2022). To address these challenges, it is imperative to provide services

that promote both physical and mental well-being, cultivate relationships among colleagues, and assist employees in discovering meaning in their job. The lack of a physical workplace can adversely impact work-life balance and foster isolation, particularly for individuals engaged in complete remote work (Tsipursky, 2022). This can be resolved through virtual wellness programs, mental health resources, and team-building efforts.

The pronounced negative connection indicates that increased dependence on virtual tools correlates with a diminished perception of the availability of these vital resources. This may suggest that although virtual solutions such as Slack, Microsoft Teams, or Zoom enhance collaboration and task management, they might unintentionally lead to resource depletion. Frequent virtual meetings and incessant digital contact may result in emotional tiredness or digital fatigue, diminishing employees' emotional vitality and psychological clarity.

Furthermore, excessive reliance on virtual technologies may obscure work-life boundaries, resulting in extended work hours and diminished recovery time, which adversely affects emotional and psychological resources. Employees may experience a perpetual state of connectivity, devoid of the necessary mental respite to rejuvenate (Gillet et al., 2022). Furthermore, virtual tools may lack sufficient physical resources, such as ergonomic workspaces or necessary equipment, potentially detrimentally affecting performance and well-being. Employee engagement and well-being are essential for maintaining productivity and job satisfaction in remote work settings. The feelings of isolation and disconnection from business culture frequently associated with remote work might negatively impact employees' mental health and engagement levels (Yamijala et al., 2024).

The inverse relationship between technology use and accessibility can be attributed to several factors, including role overload, Zoom fatigue, and digital burnout. Role overload occurs when an individual bears excessive responsibilities, leading to stress and diminished productivity. As remote work proliferates, technology has rendered employees perpetually accessible to their tasks, blurring the distinctions between professional and personal life. This constant connectedness may foster a "always-on" mentality, compelling employees to remain available around the clock, resulting in job overload.

Zoom fatigue, a factor contributing to the adverse correlation with availability, refers to the exhaustion caused by prolonged video conferences. Increased duration of virtual meetings leads to

greater exhaustion due to the lack of nonverbal communication, heightened self-awareness from being on camera, and the effort required to sustain a "virtual presence."

Digital burnout constitutes a significant concern. It is characterised as emotional, mental, and physical fatigue resulting from prolonged exposure to digital devices. The inundation of information and constant availability can lead to feelings of overwhelm and burnout. A Pew Research Centre research indicated that 55% of respondents felt overwhelmed by the amount of information they receive.

The pronounced negative link underscores a vital concern although virtual tools facilitate communication and workflow, overdependence on them may exhaust the physical, emotional, and psychological resources essential for optimal job performance. Organisations must maintain this equilibrium, ensuring that the utilisation of virtual technologies to augment productivity does not undermine the fundamental resources required for individuals to be motivated and productive in their positions.

While some study indicates a negative correlation between availability and technology use, other studies have shown contradictory findings. A study by Fialho (2022) indicates that remote work can enhance flexibility and work-life balance. A separate study found that remote employees exhibited increased productivity and elevated job satisfaction (Mautz, 2019). This suggests that the relationship between technology utilisation and availability is intricate and may depend on several aspects such as individual variations, work requirements, and organisational culture.

## 5. CONCLUSION

The investigation uncovers substantial insights concerning the influence of virtual collaboration technologies on employee engagement in remote work environments. The evidence repeatedly indicates that the utilisation of virtual platforms like Slack, Zoom, and Microsoft Teams enhances employees' perceptions of significance and security in their positions. The utilisation of virtual tools exhibits a robust positive link with meaningfulness ( $r = 0.868$ ) and safety ( $r = 0.877$ ), with both associations being statistically significant at the 0.01 level. This suggests that increased employee interaction with these tools enhances their connection to work, fosters a sense of purpose, and promotes a safer environment for expressing thoughts and ideas. Furthermore, the negative

connection with availability ( $r = -0.818$ ) indicates that increased tool usage may be linked to perceived difficulties in reconciling job availability with personal leisure.

The findings indicate that virtual collaboration technologies are vital for cultivating an engaging and psychologically secure work environment, which is crucial for sustaining employee motivation and productivity in remote contexts. The study's findings can be generalised among remote workers across many industries; however, their application across different areas requires additional investigation, as remote work practices vary by region. In 2025, the future of hybrid work will involve organisations enhancing their strategies, utilising technology and data, and emphasising employee requirements to establish flexible, productive, and engaging work environments that reconcile distant independence with the advantages of face-to-face interaction.

### 5.1. Implications

- **Employee Engagement:** Organizations that invest in and encourage the use of virtual collaboration tools can significantly enhance employees' sense of purpose and psychological safety, which are key components of engagement. A focus on these tools can lead to improved job satisfaction, higher productivity, and better overall performance, especially in remote and hybrid work settings.
- **Workplace Culture:** The findings emphasize the importance of fostering a culture of open communication and inclusivity, especially in virtual environments. Virtual tools can support transparency, help in breaking down communication barriers, and promote a sense of belonging among employees, leading to a more collaborative and supportive organizational culture.
- **Management Practices:** Managers should prioritize the integration of virtual collaboration tools in everyday operations to

facilitate better communication, task management, and employee interaction. By doing so, they can cultivate a work environment where employees feel both valued and secure.

- **Work-Life Balance:** While virtual tools can enhance engagement and safety, their influence on availability (inversely related to work-life balance) calls for managers to be mindful of the potential for overwork. Balancing tool usage with healthy boundaries is necessary to prevent burnout and support sustainable remote work practices.

### 5.2. Future Scope

- **Cultural and Contextual Differences:** The role of virtual collaboration tools in employee engagement may vary across different cultural or organizational contexts. Future studies could examine how factors such as industry, organizational size, and geographic location influence the effectiveness of these tools in fostering employee engagement.
- **Impact on Team Dynamics:** Future research could investigate the impact of virtual tool usage on team dynamics, specifically how these tools influence collaboration, decision-making, and creativity within teams.
- **Work-Life Balance and Productivity:** Further exploration into how virtual tool usage affects work-life balance and overall productivity would be valuable, especially considering the negative correlation with availability observed in this study. Understanding how to optimize tool usage to support both engagement and balance will be crucial for future organizational strategies.
- **Technology Adoption and Training:** Future studies could explore the effectiveness of training programs on virtual tool usage, especially in terms of enhancing engagement and safety. This would help organizations better equip their workforce to use these tools optimally.

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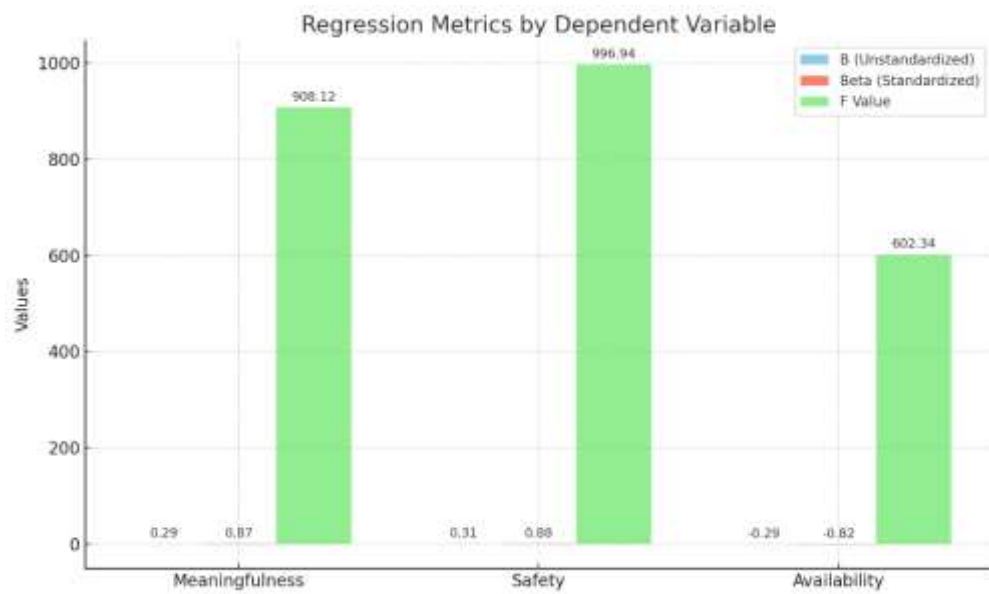
### **Appendix-1 ANOVA Table**

#### **ANOVA SUMMARY**

Dependant Variable	Regression SS	Residual SS	Total SS	F	Sig.
Meaningfulness	7235.882	2374.464	9610.347	908.118	.000
Safety	7859.057	2349.193	10208.25	996.938	.000
Availability	7091.976	3508.691	10600.667	602.335	.000

#### **Coefficients Summary**

Dependant Variable	B	Std.Error	Beta	t	Sig.
Meaningfulness	0.293	0.01	0.868	30.135	.000
Safety	0.306	0.01	0.877		.000
Availability	-0.290	0.012	-0.818		.000



## Appendix-2 Questionnaire

### Demographic Questions

1. Age:
  - ☐ Under 25
  - ☐ 25-34
  - ☐ 35-44
  - ☐ 45-54
  - ☐ 55+
2. Gender:
  - ☐ Male
  - ☐ Female
  - ☐ Other
  - ☐ Prefer not to say
3. Job Title/Role:
  - ☐ Junior Staff
  - ☐ Mid-level Staff
  - ☐ Senior Staff
  - ☐ Manager
  - ☐ Executive
4. How long have you been working remotely?
  - ☐ Less than 6 months
  - ☐ 6-12 months
  - ☐ 1-2 years
  - ☐ Over 2 years

### Section1: Virtual Tools Usage:

Statement	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
I use virtual collaboration tools (e.g., Slack, Microsoft Teams, Zoom) regularly for team communication.	[ ]	[ ]	[ ]	[ ]	[ ]
I prefer using virtual tools for communication over traditional methods (e.g., phone calls, emails).	[ ]	[ ]	[ ]	[ ]	[ ]
I rely on virtual collaboration tools to perform my daily tasks effectively.	[ ]	[ ]	[ ]	[ ]	[ ]

Statement	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
I frequently participate in video meetings using tools like Zoom or Microsoft Teams.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I find virtual collaboration tools helpful for team collaboration in remote work settings.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I use virtual collaboration tools to share files, documents, and updates with my team members.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I prefer using virtual tools (e.g., Slack, Microsoft Teams) to track my projects and tasks.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I feel that virtual collaboration tools make it easier to communicate with my colleagues, even in remote settings.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I feel confident using virtual collaboration tools to manage my work and collaborate with my team.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I actively use virtual collaboration tools to keep track of team meetings and schedules.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

### Section 2: Meaningfulness

Statement	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
I find value and purpose in my work.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
My work gives me a sense of accomplishment.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I believe the effort I put into my work is meaningful.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
My job allows me to contribute to the organization's goals.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

### Section 3: Safety

Statement	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
I feel safe to express my opinions without fear of judgment.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
My team respects my views and contributions.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I am confident that my work is valued without concerns about my status or career.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I am comfortable sharing challenges or mistakes in my work.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

### Section 4: Availability

Statement	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
I have the physical resources needed to perform my job effectively.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I have the emotional resources to manage work-related stress.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I have access to the psychological support necessary to succeed in my role.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>



Statement	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
I feel that my current workload is manageable with the available resources.	[ ]	[ ]	[ ]	[ ]	[ ]