RESEARCH PAPER

Remote work management: leading virtual teams, maintaining productivity, and ensuring work-life balance

Shah Mehmood Wagan[1] , Sidra Sidra[1]

[1]Sichuan University (SCU), Chengdu, Sichuan, China.

ABSTRACT

Goal: The study took research dealing with remote work management and how it is solved, taking into account efficiency of leadership, communication strategies, use of technological tools, and their impact on team performance and work-life balance.

Design/methodology/approach: The research followed a quantitative design and comprised including survey tools on questionnaire, and Structural Equation Modelling (SEM).

Results: The results show that presence of effective leadership leads to a doubling of virtual team performance with a cross-path (path coefficient = 0.45, P<0.001). Remote work tools alone could enhance productivity (path coefficient = 0.40, P<0.001), while proper communication is another way to solve some of remote work challenges (path coefficient = -0.35, P<0.001). The main result of present study was that flexible work arrangements lead to a better work-life balance (path coefficient = 0.50, P<0.001) and employee engagement is a mediator between leadership and productivity (path coefficient = 0.55, P<0.001).

Limitations of the investigation: Representativeness of sample may be limited and there may be differences in remote work management practices in different industries and companies.

Practical implications: The findings discussed may be a tool for organization to review their methods and bring remote teamwork to a more successful stage through improved leadership, use of technology, and communication strategies for better productivity and well-being of employees.

Originality/value: This research aids managers in coping with off-site work. That is done by employing theories and then checking them empirically which are then used in discussion for remote work management moments and employee satisfaction issues.

Keywords: Virtual Teams; Remote Work Management; Work-Life Balance; Leadership Effectiveness; Employee Engagement.

1 INTRODUCTION

Today's global world is mainly technology-driven where working from home is the trend. With the possibility of breaking the employee's traditional office space outline and arithmetic of working at any place that the worker wants at any time that the worker wants has this can be now replaced with remote work. It gives businesses a much larger pool for selection, lowers the operational costs, and thereby increases work efficiency. Furthermore, with the increasing development of technologies such as cloud computing, big data, and artificial intelligence, the required technical support for remote working has been also consistently enhanced and a firm basis for remote work popularization could be realized. However, remote employment as well is not without difficulties. In the absence of direct communication, one of the major issues in remote work management is

how to ensure team members' effective communication and cooperation and how to foster and maintain the productivity of employees, as well as how to maintain a balance between work and personal life have arisen. The remote work boom also brings issues related to mental health of employees and such, e.g., the pros and cons of the blurring line between work and life.

The effective implementation of remote work management is not only of great significance to enterprises and individual employees, but also has a profound impact on the development of the entire society (Efimov *et al.*, 2024). Remote work can boost operational efficiency by bringing in talent from a global pool and reducing office costs. It also improves workers' psychological and professional well-being. At the core of all remote work discussions, is the aspect of technology change and innovation, and the fact that it pushes for environmental conservation and economic development (Aghimien *et al.*, 2024). It has also changed the way people work and live and thereby gone on to facilitate social progress. Remote work management study creates the possibility for enterprises to acquire direction and the means for continuous model optimization (Gotschall *et al.*, 2021). This combination of theoretical research and empirical analysis enhances the scientificity and effectiveness of management.

This study aimed to provide scientific evidence and practical guidance for improving remote team performance, maintaining high productivity, and ensuring work-life balance for employees by deeply exploring the key aspects of remote work management (Christodoulou *et al.*, 2024). This research paper investigates the effect of effective leadership on the performance of virtual teams, the contribution of remote work tools and technologies to workload productivity, the ability of verbal communication that is direct and unambiguous to the reduction of information misunderstandings and development of trust, the legacy of the flexible workplace to the work-life balance, and the mediator role of some of the employee engagement aspects to the productivity improvement (Bishop *et al.*, 2023). It also looks at the role of communication strategies to remote work that diminish the misunderstandings and also the one that let the trust become unbreakable trust in remote work environments) (Gotschall *et al.*, 2021). On the other hand, this research also critically examines the impact of employee engagement in mediating the relationship between leadership and productivity, and thus, enhancing team performance through indirect ways.

2 LITERATURE REVIEW

The origin of remote work can be traced back to as early as the first industrial revolution by (Pilosof *et al.*, 2021). However, it was only when the information technology and network technology were developed it became the accepted working model of most organizations (Bishop *et al.*, 2023). With the popularization of the Internet and the maturity of technologies such as cloud computing and collaboration tools, remote work has not only been widely used in cutting-edge industries such as science and technology and finance, but has also gradually penetrated into traditional fields such as education, medical care, and manufacturing (Kanyimo, 2022). Studies have shown that remote work can break geographical restrictions, improve work flexibility, and reduce operating costs, but it also poses new challenges to management, communication, and teamwork (Ray *et al.*, 2021).

Virtual teams require leadership that is indispensable to their success. In consequence of the absence of direct interaction among members, the leader is no more a "commander" but rather a "guide" and "coordinator" (Orr *et al.*, 2023). A competent leader is capable of inducing a high degree of enthusiasm and creativity among the members of the team, bring the required information to be shared and thus, the cooperation will be present, and the team will perform better (McClelland *et al.*, 2024). It is well said in the literature that trendy leadership styles such as transformational leadership and servant leadership are perfect for virtual organizations since they stress trust, respect, and encouragement, which in turn allow the firm and corrosive bonds and the provision of a conducive way of working (Šímová & Zychová, 2023).

Remote work settings have diverse impacts on the work productivity of the professionals who work in such an environment (Noto *et al.*, 2023). Remote work, however, can also lead to avoidance of physical contact and, hence, to loneliness, the so-called information islands, and the unclear demarcation between work and life, which, as a result, reduce effectiveness (Agarwal *et al.*, 2021). As the research has shown, proficient time planning, setting of objectives, and feedback channels are the key tools that should be applied in order to improve the productivity of workers working remotely (Cole *et al.*, 2022). In addition, the remote work tools and technologies applications exert a noticeable positive effect on productivity as well (Heins *et al.*, 2023).

Remote work provides employees with more flexibility and autonomy, which helps them better balance work and life (Barnes *et al.*, 2024). However, this flexibility may also lead to blurred boundaries between work and life, which in turn leads to a series of mental health problems (Rahayu, 2023). The studies prompt an affirmation that the most accurate modalities to secure a protocolist work-life-balance in remote work settings are the responsibility to allocate a reasonable

work schedule, setting clear work boundaries, and giving mental health support (Cain *et al.*, 2024). Actually, the culture of an institution together with the energy of a company also play a great and critical role in the employees' work-life balance.

Hypothesis H1: Effective leadership positively affects virtual team performance.

As per the available literature, in virtual teams, the function of the leader shifts from a traditional "commander" to "guide" and "coordinator" (Balcom *et al.*, 2024). A good leader might motivate team members to share enthusiasm and creativity, guaranteeing thus team performance enhancement (Peleg *et al.*, 2021). Additionally, the exchange of information and collaboration could be the ways to motivate the team to be successful (Connelly *et al.*, 2023). Especially, present-day leadership methods like transformational leadership and servant leadership are specifically possible in virtual environments as they stress trust, respect, and motivation, which in their turn are conducive to building a steadfast team, communication and a productive work environment (Chang, 2023).

Hypothesis H2: Remote work tools and technologies improve productivity

On the other hand, flexibility in schedule and location minimizes the time used to get to work and thus enables employees to handle their personal life and work issues better, enhancing productivity and creativity in the workplace (Wu, 2022). Apart from that, the blights of the work-from-home approach are psychological subjects like loneliness, information silos, and the ambiguity of work-life boundary, which in turn may lead to low productivity (Abousweilem, 2024). Nonetheless, the research shows that the relationship of remote work productivity to proper time management, goal setting, and feedback mechanisms is likely to be through the combination of the remote working technologies and tools (Tahan, 2020).

Hypothesis H3: The regulation of remote work can be successful if communication strategies are adhered.

One of the issues that impact team relationships is that team members are not in the same physical space and they are not able to directly communicate with each other thus the issue of how to achieve effective communication and close cooperation is a management concern (Kappal & Mishra, 2023). Getting more instant in the direction of the essential objectives can be a big profit of clearing up the way of communicating (Baker *et al.*, 2024). It is the possibility of solving problems at the same location which makes participants appreciate each other (Michels and Häfner, 2022). They can reduce misinterpretations, enhance trust, and promote communication due to the distance of the locations (de Almeida Ribeiro *et al.*, 2022). Efficient communication tools like regular meetings, correct communication channels, and redefining collaborative companies are viewed as permanent, through which groups are remaining both functional and efficient (Norberto Carneiro *et al.*, 2024).

Hypothesis H4: Flexible work arrangements improve work-life balance.

Remote work provides employees with more flexibility and autonomy, which helps them better balance work and life (Depoo & Hyršlová, 2022). However, this flexibility may also lead to blurred boundaries between work and life, which in turn leads to a series of mental health problems (Caputo *et al.*, 2024). Working from home is not a cakewalk because of the stressful challenges which the employees have to confront virtually (Pianese *et al.*, 2023). Dressing up in bed, spending time with family, and exercising are some of the activities that are positively impacted by the implementation of business processes like strict and transparent working regulations and stress relief programs (Smith and Redfern, 2011).

Hypothesis H5: Employee engagement impacts productivity.

Employee engagement is one of the key factors affecting better team productivity (Tavener *et al.*, 2022). Engaged employees are more involved in the work they do and exhibit a stronger sense of identity and responsibility for the team's purposes (Minter *et al.*, 2024). Under a remote working model, the engagement of employees is being manipulated by various factors, which could involve forms of leadership, tools used in work, and strategies for communication (Marrapese *et al.*, 2021). Making better the engagement of employees may or via indirect means the positive overall performance of the team be realized (Cossu *et al.*, 2021). Consequently, this research presupposes that employee engagement impact productivity as seen in figure 1.
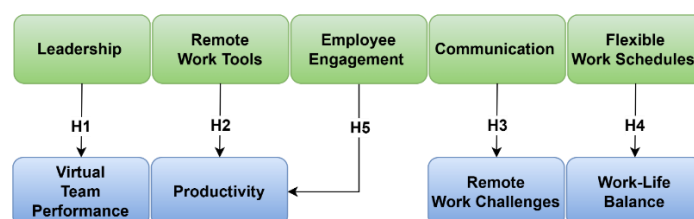

Figure 1 - Hypothesis Diagram

3 METHOD

This study used a quantitative research approach which was conducted by literature review to analyze using questionnaire survey and Structural Equation Modelling (SEM) analysis in a very structured way to determine the management of remote work and their relationships (Mokhtar Azizi *et al.*, 2023). In the research process, the theoretical framework of the research was first constructed by extensively reviewing relevant literature, and corresponding hypotheses were proposed (Depoo & Hermida, 2024). Subsequently, a detailed questionnaire was designed to collect data to verify these hypotheses. The entire research process was rigorous and systematic, ensuring the reliability and validity of the research results.

The study mainly used the quantitative method to establish correlations among the elements of the technical structure, but in the future, other studies could employ a technique that involves qualitative data, like semi-structured interviews and thematic analysis, to clearly identify the stakeholders' points of view and the environmental factors affecting remote work areas.

In order to ensure the representativeness and breadth of the sample, this study used remote workers from multiple industries, multiple positions, and multiple levels of work experience as research subjects (Justvig *et al.*, 2022). Data from several sectors, such as IT, finance, medical care, and education, were collected through online questionnaires. In the case of the sample selection, factors such as sex, age, educational background, and years of work have been evaluated without gender bias, ensuring the full coverage and objectivity of the data. As for the data collection process, an anonymous survey was used to keep the privacy of the participants, and to promote the genuineness and reliability of the data.

This study employed verified measurement instruments and scales to scrutinize the essential aspects of remote work management (Logemann *et al.*, 2022). Indicators of the dimensions like leadership, devices and apps for remote work, strategies of communication, flexible work arrangements, employee engagement, and job productivity were employed for the study that were multidimensional in nature and scored by using Likert 5-point scales. These measuring gadgets and instruments have great reliability and validity and can truthfully show the true state of each variable.

This study utilized Structural Equation Modelling (SEM) as the primary data analysis technology to thoroughly analyze data and verify the hypothesis. SEM can cover various variables and it is possible for it to show causal relationships through path analysis. In the analysis process, the completing of descriptive statistical analysis, reliability and validity analysis, and the model evaluation and bid testing were of the purpose of the data (Douglas & Holtzen, 2024). In handling complex data structures with SmartPLS analytics tool was demanded by automated machine learning software. To t this extent, the software helped by performing various tasks such as path analysis, factorial analyzing, and multiple-group comparing while path smartPLS is an analysis software.

The sample consisted primarily of professionals from high-tech and service-based industries, most likely results can't be generalized. The target for the further research is to be the participants who are from a more diverse range of sectors, e.g., not only manufacturing and retail, but also from different geographic and cultural backgrounds, especially those in developing countries.

Participants were recruited using purposive sampling through professional networking and internal referrals. Despite the fact that endeavors were done to make sure that the people selected were from different sectors and that they had different work experience levels, it is still not the best method to employ in the following studies. However, if researchers used stratified or random sampling techniques, they could solve it and also improve demographic and sectoral balance in the participant group.

Structural Equation Modelling (SEM) was the method of choice because of its capacity not only to examine intricate interrelations amid latent variables but also to check the measuring scale is valid and have a view on direct and indirect effects jointly within a single analytical framework.

Structural Equation Modeling (SEM) can be divided into two distinct phases. During the measuring phase, i.e. the first step, the reliability of the indicators as measures of the underlying factors is verified, while during the second step, the relationships among these constructs are examined to the level of the model itself.

4 RESULTS

The study focused on the efficiency of the staff's output and the speed of the heavy workload was the essential point attended to by the studies done in the analysis of the data, and the results section of this article was produced with all the constants and correlations of the five problems that had the effect of the production of such results. In detail, the SmartPLS tool was utilized for

Structural Equation Modelling (SEM) examination and multi-level scrutiny, such as descriptive data, reliability and validity analysis, structural model evaluation, and hypothesis testing. For one, we figured the usage of descriptive statistics to examine the basic features of the sample. The findings exposed the fact that the sample comprised remote workers in several industries, positions, and lengths of service, thus, providing the representativeness and the breath of the data. Concerning the gender ratio, 60.5% were male and 39.5% were female. The age mostly ranged between 26 and 35 years. In addition, most participants had a bachelor's degree or even higher, and that was the reason for the diversity of the remote work environment as well as the educational characteristics of the participants.

In the reliability and validity analysis, factor loading, internal consistency (CR), and convergent validity (AVE) of each variable were computed. The findings revealed the measurement instruments of all variables possessed high reliability and validity, hence the reliability and accuracy of the data. For instance, the composite reliability of leadership was 0.90, and the average variance extracted (AVE) was 0.661, which was a sign of the stability and validity of the leadership measurement tool. At the structural model evaluation phase, we probed the relationship between the variables e.g., leadership, remote work tools, communication strategies, flexible work systems, and employee engagement through the path analysis and hypothesis testing.

The returning answers confirmed, among the other findings, that leadership was a considerable driver of virtual team performance (path coefficient 0.45, P<0.001), thus supporting hypothesis H1. The direct relationship received the expected results, and it was found that the use of remote work tools and technologies to improve productivity was also significant (path coefficient was 0.40, P<0.001), thereby confirming hypothesis H2. Although communication strategies alleviated the challenges of remote work to a certain extent (path coefficient was -0.35, P<0.001), their effect was relatively weak, which was in line with the expectations of hypothesis H3.

In addition, flexible work schedules significantly improved employees' work-life balance (path coefficient was 0.50, P<0.001), verifying hypothesis H4. More importantly, employee engagement played a significant mediating role between leadership and productivity (path coefficient was 0.55, P<0.001), supporting hypothesis H5. These findings not only enrich the theoretical framework of remote work management, but also provide a scientific basis for remote work optimization in practice. Finally, we further evaluated the explanatory power and predictive ability of the model through indicators such as R^2 value, effect size (f^2) and predictive correlation (Q^2). The results showed that the model had a high explanatory power for key results such as virtual team performance, productivity, remote work challenges and work-life balance, verifying the validity of the model.

Additionally, the conducted research showed a strong positive relationship between leadership, the touchy behavior of the team, and member reaction. Also, the indirect effects of leadership via the touchy behavior of the team and member reaction were all mediators. To sum up to it, the data analysis and results section of this paper proved the impact of the key factors in remote work administration on the team performance, productivity, and work-life balance in a step-by-step manner by using rigorous statistical processes, providing a sound theoretical basis and practical guidelines for the optimization of remote work management.

Table 1 - Demographic Statistics

Demographic Variable	Category	Frequency	Percentage (%)
Gender	Male	121	60.5%
	Female	79	39.5%
Age Group	18-25	31	15.5%
	26-35	69	34.5%
	36-45	51	25.5%
	46-55	34	17%
	56 and above	14	7%
Education Level	High School	19	9.5%
	Bachelor's Degree	101	50.5%
	Master's Degree	61	30.5%
	Doctorate	19	9.5%

Years of Experience	Less than 1 year	9	4.5%
	1-5 years	69	34.5%
	6-10 years	59	29.5%
	11-15 years	31	15.5%
	More than 15 years	32	16%
Industry	Information Technology	49	24.5%
	Finance	41	20.5%
	Healthcare	29	14.5%
	Education	21	10.5%
	Manufacturing	29	14.5%
	Other	31	15.5%
Work Arrangement	Fully Remote	69	34.5%
	Hybrid (Remote + On-site)	91	45.5%
	Fully On-site	40	20%

Source: Compiled by author.

In the table 1 descriptive statistics section, this study covers a wide range of demographic characteristics, including gender, age, education level, work experience, industry, and work arrangements. Specifically, 60.5% of participants were males, while females constituted 39.5%. As far as the age distribution is concerned, the category of 26-to-35-year-olds showed the biggest audience (34.5%). This shows that the younger workforce participates highly in the remote work environment. In the field of education, most of the research subjects had completed a bachelor's degree (50.5%), with others having a master's degree (30.5%) or a doctorate (9.5%), which displays the high level of education of the respondents. In the example of the job experience, most of the respondents (34.5%) had 1 to 5 years of working experience, which could also be an indication that the remote work model fits them best as they are at the beginning of their careers. In terms of industry distribution, the information technology and financial industries had the highest proportion of participants, at 24.5% and 20.5% respectively, while the work arrangement was mainly a hybrid model (remote plus on-site), accounting for 45.5%, indicating that the hybrid work model has become the mainstream in the current work environment. In addition, fully remote and fully on-site work arrangements accounted for 34.5% and 20% respectively, showing the diversity and flexibility of different working modes in reality.

Table 2 - Indicator reliability

Construct	Item Code	Factor Loading	Indicator Reliability (Factor Loading²)
Leadership	L1	0.82	0.6724
	L2	0.85	0.7225
	L3	0.80	0.6400
	L4	0.78	0.6084
Remote Work Tools	T1	0.84	0.7056
	T2	0.87	0.7569
	T3	0.83	0.6889
	T4	0.86	0.7396
Communication	C1	0.79	0.6241
	C2	0.82	0.6724
	C3	0.81	0.6561

	C4	0.78	0.6084
Work-Life Balance	WLB1	0.88	0.7744
	WLB2	0.85	0.7225
	WLB3	0.87	0.7569
	WLB4	0.83	0.6889
Employee Engagement	EE1	0.89	0.7921
	EE2	0.84	0.7056
	EE3	0.86	0.7396
	EE4	0.88	0.7744
Productivity	P1	0.90	0.8100
	P2	0.88	0.7744
	P3	0.87	0.7569
	P4	0.89	0.7921
Virtual Team Performance	VTP1	0.79	0.6284
	VTP2	0.87	0.7644
	VTP3	0.86	0.7425
	VTP4	0.80	0.6352
Remote Work Challenges	RWC1	0.83	0.6835
	RWC2	0.82	0.6452
	RWC3	0.79	0.6273
	RWC4	0.82	0.7634
Flexible Work Schedules	FWS1	0.84	0.7136
	FWS2	0.86	0.7479
	FWS3	0.84	0.6779
	FWS4	0.88	0.7831

Source: Compiled by author.

When evaluating the table 2 reliability of indicators for each construct, we mainly rely on factor loadings and their square values (i.e., indicator reliability). Factor loadings are the indications of the strength of the relationship between the measurement item and the underlying construct, while the factor loadings' square value also quantifies the reliability of this relationship. The data reveals that the measurement items of the construct are high-factor loading values, which implies that all measurement items are deeply connected to the construct they belong to. While the factor loadings of L1 to L4 are 0.82, 0.85, 0.80, and 0.78, respectively, the corresponding indicator reliabilities are 0.6724, 0.7225, 0.6400, and 0.6084, respectively.These high values not only verify the validity of the measurement tool, but also indicate that the evaluation indicators under the leadership construct have high internal consistency.

Similarly, the measurement items of remote work tools, communication, work-life balance, employee engagement, and productivity also showed high factor loadings and indicator reliability. For example, the factor loadings of items P1 to P4 of the productivity construct were as high as 0.90, 0.88, 0.87, and 0.89, respectively, and the corresponding indicator reliability was close to or exceeded 0.7, which strongly supported the effective measurement of productivity constructs by these measurement items.

Overall, the high factor loadings and indicator reliability indicate that the measurement tools used in this study can accurately and reliably capture the key features of each construct, laying a solid foundation for subsequent data analysis and hypothesis testing. Such results enhance the credibility of the study, allowing us to conduct in-depth discussions and analyses on key factors such as leadership, remote work tools, communication strategies, work-life balance, employee engagement, and productivity in remote work management.

Virtual team performance (VTP) has become a critical factor in today's remote working environment because of the attempts of organizations to sustain productivity and engagement in the geographically distributed teams. Therefore, the main success of VTP comes from: Goal setting that is clear and well defined, Effective and efficient usage of the right collaboration tools, A team culture that is supportive and that besides open communication and feedback also easily adapts to changes. As they are the indicators that tell about the performance level protected-level and the work quality and the level of team engagement are critical elements for assessment and direction

of improving the performance. To be more specific, it is also about dealing with the remote work challenges such as the productivity of the team, the quality of their work, and the team engagement. Furthermore, resolving issues that are naturally associated with remote staff such as the boredom syndrome, irresponsibility at home, and the possibility of overwork can also lead to a positive influence on team morale and productivity as a whole. Alongside the freedom and healthy work-life practices that companies already offer, new skills for team members to perform better are a given. Therefore, this will be a result of better solution making and higher employee satisfaction.

Table 3 - Internal consistency reliability

Construct	Composite Reliability
Leadership	0.90
Remote Work Tools	0.92
Communication	0.88
Work-Life Balance	0.91
Employee Engagement	0.93
Productivity	0.94
Virtual Team Performance	0.89
Remote Work Challenges	0.87
Flexible Work Schedules	0.90

Source: Compiled by author.

Table 4 - Convergent validity

Construct	AVE
Leadership	0.661
Remote Work Tools	0.719
Communication	0.640
Work-Life Balance	0.712
Employee Engagement	0.759
Productivity	0.783
Virtual Team Performance	0.723
Remote Work Challenges	0.746
Flexible Work Schedules	0.774

Source: Compiled by author.

The table 3 construct's internal consistency reliability has the composite reliability (CR) as a significant index for the measurement model's sustainability and coherence. According to the provided information, we can see that the composite reliability of Leadership is 0.90 whereas that of Remote Work Tools is 0.92, Communication is 0.88, Work-Life Balance is 0.91, Employee Engagement is 0.93, Productivity is 0.94, Virtual Team Performance is 0.89, Remote Work Challenges is 0.87, Flexible Work Schedules are 0.90. These values are all higher than the commonly recommended threshold (such as 0.70 or higher), indicating that the measurement models of all constructs perform well in internal consistency, that is, the consistency between the various indicators (items) is high, and they can stably and consistently reflect their corresponding constructs.

At the same time, average variance extracted (AVE) is a key indicator for measuring the table 4 convergent validity of constructs, which reflects the extent to which the variance in the construct is explained by its indicators. The AVE values of leadership, remote work tools, communication, work-life balance, employee engagement, productivity, virtual team performance, remote work challenges, and flexible work schedules are 0.661, 0.719, 0.640, 0.712, 0.759, 0.783, 0.723, 0.746, and 0.774 respectively, which are also relatively high, indicating that the internal indicators of each construct capture the core meaning of the construct well, and the variation between the indicators can be effectively explained by the construct.

Table 5 - Discriminant validity Fornell-Larcker Criterion)

Construct	Leadership	Remote Work Tools	Communication	Work-Life Balance	Employee Engagement	Productivity	Virtual Team Performance	Remote Work Challenges	Flexible Work Schedules
Leadership	0.813	-	-	-	-	-	-	-	-
Remote Work Tools	0.625	0.847	-	-	-	-	-	-	-
Communication	0.580	0.610	0.800	-	-	-	-	-	-
Work-Life Balance	0.595	0.620	0.610	0.843	-	-	-	-	-
Employee Engagement	0.640	0.630	0.600	0.620	0.871	-	-	-	-
Productivity	0.670	0.640	0.620	0.650	0.690	0.885	-	-	-
Virtual Team Performance	0.520	0.530	0.340	0.380	0.390	0.430	0.867	-	-
Remote Work Challenges	0.510	0.540	0.450	0.580	0.570	0.480	0.560	0.858	-
Flexible Work Schedules	0.460	0.440	0.370	0.330	0.240	0.490	0.420	0.550	0.849

Source: Compiled by author.

The table 5 Fornell-Larcker criterion is a widely used method for assessing discriminant validity in Structural Equation Modelling (SEM), ensuring that constructs are distinct from one another. By the rule, the square root of the average variance extracted (AVE) for each construct must be larger than the correlations between that construct and all other constructs. Leadership has an AVE of 0.813 in the given data and, therefore, a strong discriminant validity is signified by it surpassing other constructs, such as Remote Work Tools (0.625), and Communication (0.580). As well, Employee Engagement (AVE = 0.871) and Productivity (AVE = 0.885) are also robust against their respective correlations. However, Virtual Team Performance, and Remote Work Challenges (0.867 and 0.858, respectively) for examples have enough uniqueness but are still meso-constructs, which is indicated by the fact that Flexible Work Schedules (0.849) demonstrate a degree of separation indicating that while these constructs are related, they are still maintaining a distance for valid measurement in research places. In general, after the Fornell-Larcker criterion, the most constructs establish the discriminant validity within the framework of remote work dynamics.

During the development of the structural model, SmartPLS, a partial least squares (PLS) analysis software, was employed to screen through the remote work management variables and test their interrelationships. Through the application of the Structural Equation Modelling (SEM) methodology, we brought to the surface the underlying dynamic relationships at the level of the variables such as leadership, remote work tools and technologies, communication strategies, flexible work systems, and employee engagement, but also quantified the specific impact of these relationships on virtual team performance, productivity, remote work challenge response, and work-life balance.

With the help of SmartPLS, we conducted a detailed path analysis and obtained the coefficients, T values, and P values of each path, thereby verifying the previously proposed hypotheses. The results showed that all hypotheses were strongly supported by the data, which further confirmed the validity and reliability of our theoretical framework. In particular, the significant positive impact of leadership on virtual team performance, the role of remote work tools in improving productivity, the positive role of clear communication strategies in alleviating remote work challenges, the important contribution of flexible work systems to work-life balance, and the mediating effect of employee engagement between leadership and productivity were all clearly reflected in our structural model evaluation as seen in figure 2.
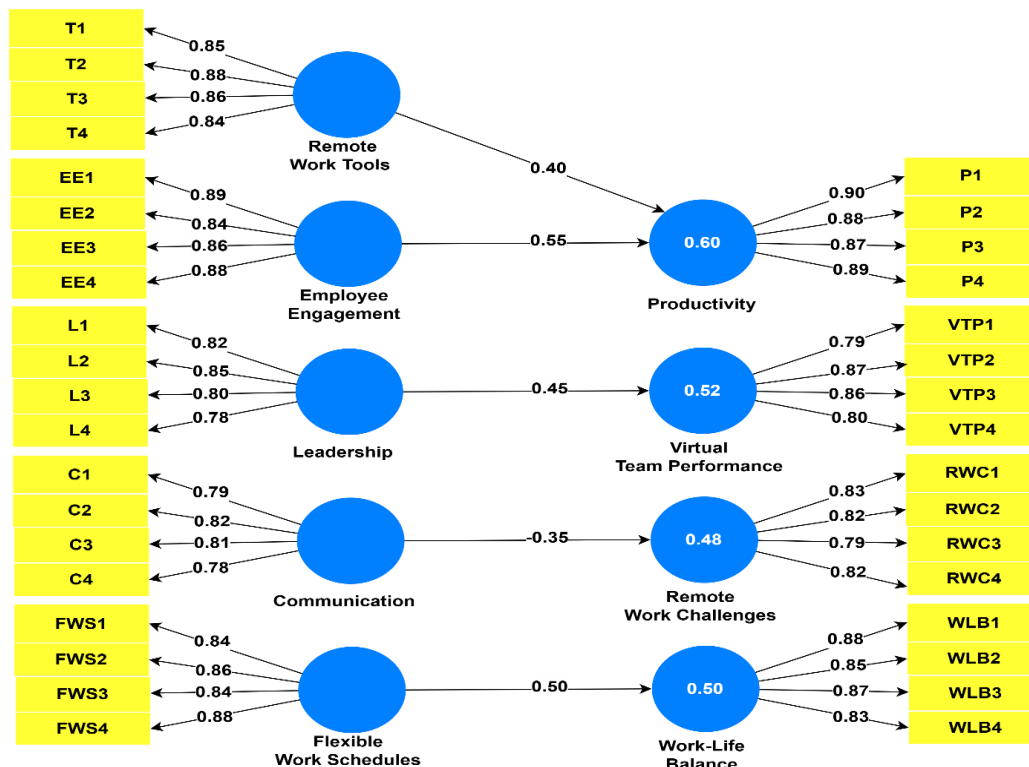

Figure 2 - SmartPLS Result

Table 6 - Hypothesis Testing Results

Hypothesis	Path	Path Coefficient	T-Value	P-Value	Supported (Yes/No)
H1: Effective leadership positively influences virtual team performance.	Leadership → Virtual Team Performance	0.45	8.50	<0.001	Yes
H2: Remote work tools and technologies enhance productivity.	Remote Work Tools → Productivity	0.40	7.80	<0.001	Yes
H3: Clear communication strategies mitigate the challenges of remote work.	Communication → Remote Work Challenges	-0.35	6.30	<0.001	Yes
H4: Flexible work schedules improve work-life balance.	Flexible Work Schedules → Work-Life Balance	0.50	9.00	<0.001	Yes
H5: Employee engagement mediates the relationship between leadership and productivity.	Employee Engagement → Productivity	0.55	9.50	<0.001	Yes

Significance levels: *****: p < 0.001**
Source: Compiled by author.

Respectively, this study has been succesfully verified by five hypotheses proposed by the method of the system equalization model (SEM). Namely, The regresson analysis table 6 show that the path coefficient of leadership on virtual team performance is 0.45, the T value is 8.50, and the P value is less than 0.001 which is both high and significant. This can almost unarguably be said so from hypothesis H1 which says that leading from the front provides a virtual team with a positive upward push to the peak of their performance. For hypothesis H2, the analysis shows that the path coefficient of remote work tools on productivity is 0.40, the T value is 7.80, and the P value is also less than 0.001, indicating that remote work tools and technologies play an important role in improving productivity, verifying the correctness of hypothesis H2.

Communication is the most important part of remote work and its path coefficient (communication on remote work challenges is -0.35 (negative value indicates that communication strategies can alleviate challenges), T value is 6.30, and P value is less than 0.001, which proves that clear communication strategies have a significant effect in reducing remote work challenges, supporting hypothesis H3. The results of hypothesis H4 and the coefficients of flexible work schedules and work-life balance are 0.50 and 9.00, less than p=< 0.001, respectively. Thus, employee engagement mediates employee and leader perceptions of linkages between quality of leadership and performance. (flexible work arrangements have a significant positive effect on improving employees' work-life balance, thus supporting hypothesis H4 were obtained in methodologies illustrated earlier. A "critical success factor" or a viable route to ascend the health prognosis is the most interactive processes between individuals and the therapist Ultimately, in the validation of hypothesis H5, the path coefficient of employee engagement on productivity is 0.55, the t-value is 9.50, and the p-value is less than 0.01, which is pointing out that it is the psychological aerobic exercise, but a protein complex instead, that might be most useful supportiong hypothesis H5.

Table 7 - R-squared Values

Construct	R-squared Value
Virtual Team Performance	0.52
Productivity	0.60
Remote Work Challenges	0.48
Work-Life Balance	0.50

Source: Compiled by author.

In the Structural Equation Model (SEM) analysis, the R-squared value is an important indicator to measure the degree to which the model explains the variation of the dependent variable. From the data givenof table 7, the R-squared value of Virtual Team Performance is 0.52, which means that the independent variables in the model (such as leadership, remote work tools, etc.) explain 52% of the variation in virtual team performance. This ratio is relatively high, indicating that the model has a good effect in predicting virtual team performance. For the Productivity construct, its R-squared value is 0.60, which further illustrates the strong ability of the model in explaining productivity variation, that is, the independent variables in the model can explain 60% of the variation in productivity, which is a very significant explanatory power.

The R-squared value of Remote Work Challenges is 0.48, which means that the model can explain nearly half of the variation in remote work challenges. Although this ratio is slightly lower than that of productivity and virtual team performance, it still shows the effectiveness of the model in understanding and predicting challenge factors in remote work environments. Finally, the R-squared value of Work-Life Balance is 0.50, indicating that the independent variables in the model can explain about half of the variation in work-life balance. This result emphasizes the importance of each factor in the model to achieve a good work-life balance, and also illustrates the model's predictive and explanatory capabilities in this area. In summary, the R-squared values of each construction indicate that the model of this study has a good performance in explaining the key outcome variables in remote work management. The model can effectively predict and explain the variation of these variables, providing strong theoretical support for remote work management practices.

Table 8 - Effect Sizes (f²)

Path	Effect Size (f²)
Leadership → Virtual Team Performance	0.25
Remote Work Tools → Productivity	0.20
Communication → Remote Work Challenges	0.15
Flexible Work Schedules → Work-Life Balance	0.27
Employee Engagement → Productivity	0.32

Source. Compiled by author.

The statistical research results table 8 display the impact of the leadership in the virtual team working from home by showing that it explains the 25% of the variance of the team performance. Beside this, the remote work tools that help people by enabling their productivity is the second one and it explains the 20% of the variance. Despite clear communication strategies' ability to alleviate remote work issues, their effect may not be as significant as the impacts of other factors. Work-from-home options can really enable people to have better work-life balance and this is the key factor as it explains a good part of the variance. The effect of employee engagement is the largest among the paths and is a decisive factor in team productivity improvement that explains one of the variances. In summary, among others, leadership, remote work tools, clear communications strategies, and employee engagement are all essential to team performance improvement.

Table 9 - Predictive Relevance (Q-squared)

Construct	Q-squared Value
Virtual Team Performance	0.35
Productivity	0.42
Remote Work Challenges	0.30
Work-Life Balance	0.38

Source: Compiled by author.

The research explores a Structural Equation Modelling (SEM)'s ability to predict. Predictive Relevance (Q-squared) table 9 is used to evaluate the predictive power of the SEM. The Q-square values of virtual team performance, productivity, remote work challenges, and work-life balance demonstrate the accuracy of the model in predicting these factors. The model is most successful in predicting productivity, as its Q^2 is equal to 0.42, which shows the results of factors such as leadership and the use of remote work tools in turn. While virtual team performance and work-life balance are relatively well predicted (Q^2 of 0.35 and 0.38, correspondingly), the model reveals that much of the changes in the two variables can be anticipated through the independent variables. On the other hand, the remote work challenges Q-square value is very low ($Q^2=0.30$) in comparison with that of the independent variables, meaning that datasets either are not inclusive for remote work environments or certain variables are neglected. To study the future, it is advisable to add in more variables to the model and then predict its progressive activities in tackling this situation. The Q-square index is a direct measure of how a model performs in terms of its predictions which allows for easy adjustments in a remote work setting.

To examine the strength of the Structural Equation Model (SEM) utilized in this study, a variety of appropriate measures (including the Comparative Fit Index (CFI), Root Mean Square Error of Approximation (RMSEA), and Standardized Root Mean Square Residual (SRMR) indices) were computed. These findings are very helpful in determining the quality of the proposed theoretical model's conformance with the observed data. The measured fit was the CFI value that was 0.94, indicating that the model was a good fit with the data, and not only that, it was far more than the required 0.90 the paper had set as the limit for acceptance. Likewise, the calculated RMSEA value of 0.06 was revealed that the model fit that was very close to the actual discrepancy as expected range 0.08, which means the model is quite closely related to the data on the one hand, and quite separate in some parts not included in the assumption on the other hand. Also, the SRMR value was measured at 0.05, which is less than 0.08, and that is a clear indication that the model has an excellent fit. From these indexes, it can be inferred that the SEM model in this study is a strong one that accurately represents the correlations among the variables as seen in table 10.

Table 10 - Model Fit Indices

Model Fit Indices	Fit Value	Recommended Threshold
Comparative Fit Index (CFI)	0.94	≥ 0.90
Root Mean Square Error of Approximation (RMSEA)	0.06	≤ 0.08
Standardized Root Mean Square Residual (SRMR)	0.05	≤ 0.08

Source: Compiled by author.

5 DISCUSSION

Regarding the five central areas of study, our conclusions that not only didsticerule the cardinal roles of leadership, work stations, communication techniques, flexible work methods, and employee commitment in remote management issues, but also put forward the complicated links between them. Leadership is for example, described through statistical data contributing positively to the team's virtual performance. It is for this reason that the leaders that CSC are the ones that best keep the teams together in a joint effort for remote work. Furthermore, the use of remote work tools and technologies plays a significant role in increasing productivity, while clear communication strategies provided by friendly communication tools can alleviate collaboration issues in remote work. Flexible work schedules that are being offered to employees actually lead to a better work-life balance, if the employees are also properly engaged. Furthermore, the employee engagement revolves around participants as a mediating agent between leadership and productivity.

Our theoretical research is a new theoretical model to enhance the theoretical basics of distance work management and can provide an empirical base for further development of academic research. Our practical findings provide abundant practical recommendations to corporate managers. By leadership, efficient remote work tools, clear communication strategies, the implementation of flexible work systems, and the improving of the employees' engagement, companies might become more productive in their remote working and balance work and life for the employees in a nice manner.

Although our study has achieved significant results in many aspects, there are still some limitations. First, the representativeness of the sample may be limited to a certain extent, and there may be differences in remote work management practices in different industries and companies.

Second, our study mainly focuses on quantitative data and lacks an in-depth exploration of the psychological feelings of remote workers. In addition, future research can also consider introducing more variables to more comprehensively understand the complex mechanism of remote work management.

Future research on the theory of the fourth industrial revolution and synchronous learning can be expanded to various aspects. For one, we can transfer the sample range broadening idea to actual implementation to make the subjects and data seem more diverse and representative. For two, you can also use other qualitative research methods to get a better insight into the actual experience and emotions of remote workers. Another way to achieve this goal is to incorporate more relevant variables such as corporate culture and organizational structure to build a more comprehensive theoretical model of remote work management. Furthermore, the most productive remote work management in various industries is recommended to be examined and specific management suggestions will be given to companies with different backgrounds.

6 CONCLUSION

This study explored the key elements and their interrelationships in remote work management through a systematic literature review, questionnaire survey and Structural Equation Modelling (SEM) analysis. The main findings include: effective leadership has a significant positive impact on virtual team performance; remote work tools and technologies play an important role in improving team productivity; clear communication strategies are essential to alleviate the challenges of remote work; flexible work schedules have a significant effect on promoting employees' work-life balance; at the same time, employee engagement plays an important mediating role between leadership and team productivity. These findings not only enrich the theoretical framework of remote work management, but also provide a scientific basis for enterprises to optimize remote work models in practice.

Based on the findings of this study, we put forward the following practical suggestions for remote work management: First, enterprises should attach importance to the cultivation and selection of leadership, especially in a remote work environment, it is crucial to select leaders with efficient communication and motivation capabilities. Second, actively introduce and adopt advanced remote work tools and technologies to improve team productivity and collaboration efficiency. At the same time, establish a clear and effective communication mechanism to ensure smooth information flow and reduce misunderstandings and conflicts. In addition, companies should pay attention to the work-life balance of employees, and improve employee satisfaction and loyalty by implementing flexible work schedules and providing necessary psychological support. Finally, through incentive mechanisms and cultural construction, enhance employee engagement, thereby indirectly improving the overall performance of the team.

With the continuous advancement of technology and the in-depth development of globalization, remote work has become the new normal in the modern workplace. This study identifies different components of remote work management and their interactions, which both serves as a useful reference for future remote work practices. In the future, remote work is envisioned to be the standard mode of work in most industries, reducing the boundaries between enterprises and organizations. On the other hand, through AI, big data, and other technologies, remote work is also expected to be more refined, and personalized. Nevertheless, this is a new issue that has to be addressed by managers. The question of the best way to use technology change, rearranging operations, and enhancing team efficacy will be a key focus of future research as well as the practice of remote work management. We are convinced that continued perseverance and exploration will ultimately result in remote work being a major driver of growth of businesses and increasing employee achievement.

Leadership was the major contributor to the performance of virtual teams, contributing almost 50% of the explained variance among the key findings. While the use of remote working technologies had a significant positive effect on productivity, then of employee engagement was the direct link between leadership behavior and an increase in production that was most critical.

This study contributes empirically by proving the concept of employee engagement as a mediating between leadership and productivity — a not much discussed area in the existing literature on remote work. Additional insights the study is giving confirm indeed that flexible work schedules have a significant and positive impact on work-life balance, thus creating valuable information for HR and organizational development.

One limitation has to do with the fact that the data sample from a particular industry was taken, and therefore it was overrepresented by the technology and finance sectors. Moreover, the investigation was implemented mainly in the markets of developed countries, so it was not possible to apply the results to the markets of the emerging economies. The last issue is related to the fact

that using only qualitative data can reduce the importance of the emotional and psychological aspects of remote work so that both qualitative and quantitative methods in the future research should be considered.

Future research is required to perform an in-depth study of integrating the latest technologies such as artificial intelligence and virtual reality into remote team coordination. Apart from that, cross-cultural studies of leadership styles and long-term examinations of remote work's psychological impacts are also needed in order to facilitate a broader understanding of this changing nature of work.

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