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Does remote work adoption boost firm innovation? A cross-cultural study

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ABSTRACT

The unprecedented large-scale remote work practices during the COVID-19 pandemic have demonstrated the effectiveness of this new way of working. However, previous findings regarding the influence of remote work adoption on firm innovation have been inconsistent. Building upon the culture fit perspective, the current study aims to examine the vital role of national culture in shaping the relationship between remote work adoption and firm innovation. Specifically, we propose that the adoption of remote work will foster firm innovation, particularly when the cultural characteristics are congruent with the nature of remote work. Based on multi-wave data collected from 8,053 firms across 21 countries, research findings from our multilevel analysis suggest that the positive effect of remote work adoption on firm innovation was stronger in nations with low power distance, high indulgence, and short-term orientation. The current study sheds light on the cultural factors in remote work practices and also has practical implications for organizations transitioning to remote or hybrid work in the post-COVID-19 era.

KEYWORDS

Remote work; innovation; national culture; cultural fit; COVID-19

Introduction

To become the absolute best place to work, communication and collaboration will be important, so we need to be working side-by-side.

Jackie Reses, human resources chief at Swisher (2013)

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The idea you can only be collaborative face-to-face is a bias. And I'd ask, how much creativity and innovation have been driven out of the office because you weren't in the insider group?

Dan Spaulding, chief people officer at Miller (2021)

Remote working is defined as 'a flexible work arrangement whereby workers work in locations, remote from their central offices or production facilities, the worker has no personal contact with co-workers there, but is able to communicate with them using technology'(Di Martino & Wirth, 1990, p. 530). Remote work arrangement has long been framed as a benefit and a privilege in the workplace, and its adoption has been slow until the recent outbreak of COVID-19. In the current post-pandemic world, remote work has become an increasingly common practice and constitutes an important dimension in the future of work (Wang & Parker, 2023). This shift prompts an essential inquiry: Does remote work adoption enhance a firm's performance, especially in domains like product innovation and contingencies underpinning this relationship?

While the significance of this question is undeniable, the academic exploration into the nexus between remote work adoption and firm performance remains scant. A few pioneering studies have ventured into this domain (Bloom et al., 2015; Martin & MacDonnell, 2012). As Gohoungodji et al. (2023) identified in their recent review, most existing studies have only examined the effects of remote work on 'collective productivity' (i.e. organizational performance), but scholars need to investigate whether this 'collective productivity' considers the innovative capacity.

Innovation performance is a function of a firm's ability to create, manage, maintain, and utilize knowledge (Krammer, 2022a). Building upon the Resource-Based View (RBV) (Barney, 1991), firms that excel in adopting innovative human resource management (HRM) practices, can leverage these practices as a valuable resource to enhance their innovation capacity (Andreeva et al., 2017; Loon et al., 2020). Remote work arrangement, as a specific HRM practice, is often anticipated to enhance firm innovation by effectively leveraging the firm's human capital. By creating a work environment that supports employee psychological well-being and intrinsic motivation, these arrangements can activate latent human capital resources within the firm (Allen et al., 2015). This enhanced human capital, in turn, can lead to increased creativity and innovation at an organizational level. Additionally, firms that successfully implement remote work practices can foster a culture of knowledge-sharing and collaboration, thereby enhancing their innovation capacity. Martínez-Sánchez et al. (2007, 2008) provide empirical support for this, suggesting that when employees are more motivated and satisfied, they contribute more actively to collective knowledge-sharing activities. This strategic activation and utilization of human capital ultimately position the firm to capitalize on new ideas and innovative processes.

Nevertheless, recent studies have identified potential barriers to innovation stemming from remote work practices. Ongoing innovation often relies on close collaboration and teamwork, and remote work can sometimes hinder spontaneous intra-firm communication and collaboration (Raghuram et al., 2019). During the COVID-19 pandemic, firm-wide remote work led to more static and siloed collaboration networks, with fewer bridges between disparate departments (Yang et al., 2022). In light of these mixed findings on the relationship between remote work adoption and firm innovation, we introduce a culture-fit perspective, positing that the alignment between remote work arrangements and national cultural contexts plays a crucial role in shaping firm innovation outcomes.

Based on a culture fit perspective (Aycan et al., 2000), we argue that the omission of cross-cultural variations may have led to inconsistent findings in previous studies. Culture refers to 'common patterns of beliefs, assumptions, values, and norms of behavior of human groups' (Aycan et al., 2000), and it may differentiate people's understanding of remote work practices and their responses. The term 'culture fit' refers to the alignment between organizational HRM practices and the prevailing cultural norms and values of a country (Aycan et al., 1999). Specifically, alignment captures the degree to which HRM practices align with the broader cultural values. For instance, in low power distance cultures, where employees expect bottom-up communication and the freedom to express their opinions openly, HRM practices that emphasize flexibility and autonomy are more culturally aligned (Dastmalchian et al., 2020). According to the cross-cultural literature, cultural characteristics influence the attitudes and perceptions of managers and employees about the adoption of a particular HRM practice by osmosis, and ultimately affect the effectiveness of conducting that practice (Lee et al., 2007). HRM practices that are consistent with and rooted in the values and norms of culture are considered successful and enduring. In this research, the impact of remote work adoption on firm innovation is also contingent on national culture. In other words, while we concur with the first stream of literature suggesting that remote work adoption can boost firm innovation (Martínez-Sánchez et al., 2007, 2008), we recognize the advantages of such HRM practice might be limited in some countries (Peters et al., 2016).

Building upon a culture fit perspective (Aycan et al., 2000), the current study aims to propose and examine the moderating role of national culture in the relationship between remote work adoption and firm

innovation, thereby reconciling mixed findings in the existing literature. Namely, we argue that in countries where the remote work arrangement is better aligned with national cultures, remote work is more likely to boost firm innovation (see Figure 1 for our conceptual model). Our study contributes to the literature in several ways. First, our study contributes to the literature by exploring the largely overlooked relationship between remote work adoption and firm innovation, extending the understanding of how remote work, as a strategic HRM practice, can influence a firm's innovative capacity. Second, by introducing a culture-fit perspective, the current study sheds light on the importance of cultural alignment in the success of remote work arrangement and provides insights into the impact of cultural contingencies on the efficacy of remote work practices, addressing potential contradictions in this research field. Specifically, the study suggests that the positive effect of remote work adoption on firm innovation is more pronounced in nations with low power distance, high indulgence, and short-term orientation. Additionally, this study enriches the remote work literature by examining the relationship between remote work adoption and firm innovation with rigorous methodologies, using data from 8,053 firms across 21 countries and multilevel regressions to enhance generalizability.

Remote work adoption and firm innovation

According to RBV (Barney, 1991), HRM practices, such as remote work arrangement, go beyond mere operational aspects and act as strategic tools that offer a competitive edge to firms. Extensive research has supported the idea that HRM practices constitute a complex system that is valuable, unique, and inimitable (Stavrou et al., 2010). In the current study, we conceptualize remote work arrangement as a competitive tool for firms that positively impact firm innovation.



Figure 1. Research Framework.

First and foremost, the adoption of remote work can significantly enhance a firm's human capital. Human capital is defined as individuals' knowledge, skills, and abilities used to produce a given set of outcomes, which plays a pivotal role in fostering firm innovation capability (Barba-Aragón & Jiménez-Jiménez, 2020; Harris et al., 2019). By embracing remote work, organizations can tap into a broader pool of potential employees, transcending the constraints of time and space (Coenen & Kok, 2014). As Mohammadi et al. (2017) identified, firm innovation performance will benefit from workforce heterogeneity. Additionally, remote work arrangement can amplify the value of human capital. On the one hand, remote work offers a more relaxed environment by distancing employees from direct leadership monitoring (Dimitrova, 2003). The reduced monitoring inherent in remote work environments allows employees to experiment more freely and express creative ideas without the immediate pressure of oversight, thereby enhancing their ability to innovate (Zhou, 2003). On the other hand, remote work often grants employees more control over their work life, including the flexibility to set their own schedules and work in environments that they find most comfortable and inspiring (Coenen & Kok, 2014). This autonomy can increase job satisfaction and motivation, which are closely linked to higher levels of creativity and innovation (Martínez-Sánchez et al., 2007).

Moreover, enabled by information and communication technology (ICT) (Wang et al., 2021), remote work plays a vital role in the acquiring and accumulating the valuable information resources essential for innovation (Park et al., 2024). The remote work setting facilitates ICT-mediated interactions beyond the limitations of physical proximity, making cross-functional collaboration among teams across various departments more feasible (Coenen & Kok, 2014). This, in turn, enhances the flow of intra-organizational knowledge, a crucial driver of product and firm innovation (Mei et al., 2023). Additionally, the virtual nature of remote work also promotes inter-organizational collaborations by expanding the boundaries of an organization's network (Yang et al., 2022). The resulting increase in knowledge diversity from this extended network will further foster firm innovation (Oke, 2013). Accordingly, we propose:

Hypothesis 1: Remote work adoption is positively associated with firm innovation.

Moderating role of national culture

Culture at the national level refers to the widely shared ideas of a group about what is good, right, and desirable, which guides the actions and evaluations of individuals in this nation (Hofstede, 2001). According to the culture fit perspective, national culture can influence the effectiveness of HRM practices, implying that HRM practices that align and resonate with external cultural values can lead to better organizational performance (Newman & Nollen, 1996). The current study posits that national culture plays a moderating role in the relationship between remote work adoption and firm innovation. Specifically, when remote work arrangements align well with the embedded national culture, firms are more likely to exhibit better innovation performance.

To investigate cross-cultural variations in the relationship between remote work adoption and firm innovation, we introduce Hofstede's cultural dimensions. Hofstede proposed six dimensions to understand cultural differences across nations, namely, individualism, power distance, uncertainty avoidance, masculinity, long-term orientation, and indulgence (Minkov & Hofstede, 2012). These dimensions have been extensively used in cross-cultural research and have been supported by a substantial body of empirical studies (Beugelsdijk et al., 2015). Scholars have advocated examining cultural dimensions most relevant for remote work practices, such as individualism (e.g. Kniffin et al., 2021; Schlaegel et al., 2023). However, particularly in the wake of the COVID-19 pandemic, remote work practices are no longer confined to isolated contexts but are becoming a pervasive phenomenon. As such, focusing exclusively on a single or a limited number of cultural dimensions (e.g. individualism or power distance) risks oversimplifying the intricate interplay between culture and organizational adaptation. As Peretz et al. (2018) research shows, it is necessary to consider the comprehensive dimension of cultural values rather than the isolated individual dimension, in order to avoid the possible negligence of selecting only the most obvious dimension. Therefore, this study will systematically analyze the impact of all cultural dimensions on the relationship between remote work adoption and firm innovation, thereby contributing a more comprehensive understanding. In what follows, we will detail the moderating effects of each cultural dimension.

Power distance

Power distance (PD) represents 'the extent to which a society accepts the fact that power in institutions and organizations is distributed unequally' (Hofstede, 1980, p. 45). In high PD countries, there is a greater acceptance of a strong concentration of power and strict hierarchical order. Conversely, in low PD countries, power is more evenly distributed, and there is less tolerance for class distinctions, which encourages democratic participation (Nakata & Sivakumar, 1996).

This study posits that low PD cultures amplify the innovation benefits of remote work by allowing more autonomy and encouraging participative management, thus attracting and retaining innovative talent. In low PD countries, remote work context offers more autonomy to virtual workers, enabling them to independently determine task completion (Ollo-López et al., 2011), which effectively activates human capital by creating more opportunities for innovation. Additionally, virtual work is more accepted and legitimate in low PD cultures, making it easier to attract and retain talented individuals (Eversole et al., 2012). However, in high PD cultures, where directive management prevails (Tang et al., 2020), the distributed nature of remote work may prompt firms to enforce stricter controls (Rhymer, 2023), possibly undermining the innovation benefits remote work could offer (Peters et al., 2016). Therefore, we propose that the effectiveness of remote work in spurring innovation varies significantly with the cultural acceptance of power hierarchies:

Hypothesis 2: The positive relationship between remote work adoption and firm innovation is stronger in countries with lower levels of PD than in countries with higher levels of PD.

Individualism/collectivism

Individualism (or collectivism) refers to 'the relationship between the individual and the collectivity that prevails in a given society' (Geert Hofstede, 2001). In individualistic societies, people are expected to be highly self-directed, prioritizing their individual goals and self-interests. Conversely, in collectivist nations, people place a strong emphasis on building tight and strong social ties, believing these social bonds can provide valuable resources and protection.

This study suggests that remote work adoption can lead to greater firm innovation in individualistic cultures, where free and independent links between individuals allow for a greater focus on self (Nakata & Sivakumar, 1996). In such contexts, remote work provides the high degree of autonomy needed for employees to work independently, which is conducive for deep thought and the generation novel ideas (Shalley & Gilson, 2004). Conversely, collectivist cultures value onsite work for coordination and cooperation (Strese et al., 2016), as it strengthens interpersonal bonds that are critical for trust and knowledge exchange (Yang et al., 2022). In these cultures, remote work may hinder communication and collaboration by reducing face-to-face interactions (Zahra & George, 2002), potentially diminishing innovation within firms. Altogether, we posit that:

Hypothesis 3: The positive relationship between remote work adoption and firm innovation is stronger in countries with higher levels of individualism than in countries with lower levels of individualism.

Masculinity/femininity

The dimension of masculinity is defined as the degree to which a society is characterized by assertiveness (masculinity) versus nurturance (femininity) (Hofstede, 2001). Masculine cultures are characterized by competition, dominance, personal achievement, performance, materialistic items, etc. Femininity indicates the importance attached to equality, nurturing relationships with others, and a focus on the quality of life.

This study posits that remote work aligns well with masculine cultures, where assertiveness and a focus on achievement are predominant values. In remote work settings, reduced frequency of face-to-face interactions can increase job autonomy (Dimitrova, 2003), which in turn fosters the emergence of product champions who drive innovation through independent advocacy and risk-taking (Howell et al., 2005). In contrast, feminine cultures value interpersonal relationships and quality of working life. Reduced social support and interaction in remote work context could hinder innovation by impacting team dynamics and trust, both of which are essential for incubating and implementing innovative ideas (Wong et al., 2022). Altogether, we propose that:

Hypothesis 4: The positive relationship between remote work adoption and firm innovation is stronger in countries with higher levels of masculinity than in countries with lower levels of masculinity.

Uncertainty avoidance

Uncertainty avoidance (UA) refers to 'the extent to which the members of a culture feel threatened by ambiguous or unknown situations' (Hofstede, 1980). In countries with high UA, people are averse to risks and ambiguity, preferring formal and well-structured rules, procedures, and tasks. Thus, they emphasize control and stability. Conversely, in countries with low UA, people are more tolerant of risks and ambiguity, displaying greater flexibility and openness to change.

This study argues that high UA cultures hamper the innovation benefits of remote work adoption. Remote work often introduces a higher level of uncertainty (Groen et al., 2018). Organizations prioritizing stability and disciplines, therefore, respond by increasing managerial controls, such as frequent online meetings and progress reports to ensure teleworkers' performance aligns with organizational goals (Felstead et al., 2003). However, these measures may stifle employee creativity and dampen intrinsic motivation to share novel ideas or take initiative in driving changes (Zhou, 2003). Ultimately, the suppression of creative and open thinking within an organization may hinder the acquisition and assimilation of novel knowledge necessary for innovation. Conversely, low UA cultures are more tolerant of risks (Strese et al., 2016), more likely to empower employees, and tend to view ambiguities as an opportunity for innovation (O'Connor et al., 2022). These cultures encourage experimentation and flexible responses to remote work challenges, thereby enhancing firm innovation (Lauriola et al., 2016; Lee et al., 2020). Thus, we hypothesize:

Hypothesis 5: The positive relationship between remote work adoption and firm innovation is stronger in countries with lower levels of UA than in countries with higher levels of UA.

Long-term orientation/Short-term orientation

Long-term orientation (LTO) refers to 'the choice of focus for people's efforts: the future or the present and past' (Hofstede, 2011). In long-term oriented societies, people prepare for the future with persistence and effort, adapting traditions to fit changing circumstances. In contrast, in short-term oriented societies, people tend to value and respect traditions, and they may view social changes with suspicion.

This study posits that remote work adoption may have a limited positive influence on firm innovation in short-term oriented cultures, as organizations may be reluctant to adjust to new working methods and may prioritize the maintenance of the status quo (Nakata & Sivakumar, 1996). This adherence to traditional practices and aversion to rapid organizational shifts might hinder the effective implementation of remote consequently affecting ability foster work, its to innovation (MartÃnez-SÃ;nchez et al., 2009). However, long-term oriented cultures, with their future-focused mindset, are more likely to embrace and adapt to remote work. This adaptability can foster sustainable innovation by exploring the benefits of remote work and adjusting human resource systems accordingly. Thus, we hypothesize:

Hypothesis 6: The positive relationship between remote work adoption and firm innovation is stronger in countries with higher levels of LTO than in countries with lower levels LTO.

Indulgence/restraint

Indulgence refers to 'the gratification versus control of basic human desires related to enjoying life' (Hofstede, 2011, p. 8). Societies with

higher indulgence scores allow free gratification of basic and natural human drives. Individuals in such cultures typically place higher importance on personal life control, freedom, and hedonic well-being. Conversely, restraint stands for 'a society that controls gratification of needs and regulates it by means of strict social norms' (Hofstede, 2011, p. 15). Individuals in these societies are governed by norms and rules, and are less likely to pursue leisure activities.

This study argues that remote work can enhance firm innovation in indulgent cultures, where there is a greater appreciation for freedom, life control, and pleasure. The remote work context provides employees with control over their work schedules, enhancing work-life balance and job satisfaction (Gajendran & Harrison, 2007), which could further activate innovative human capital and lead to improved firm innovation. Conversely, restraint cultures value discipline and consistency; the reduced visibility in remote settings could breed mistrust (Felstead et al., 2003). Increased monitoring and limited worker autonomy in such cultures might inhibit knowledge sharing and experimentation, thereby restricting innovation potential (Zheng et al., 2023). Altogether, we hypothesize:

Hypothesis 7: The positive relationship between remote work adoption and firm innovation is stronger in countries with higher levels of indulgence than in countries with lower levels of indulgence.

Methods

We used a longitudinal approach to build our database, two key data sources were merged: the World Bank's Enterprise Surveys (WBES) which was collected pre-COVID, and the COVID-19 Follow-up Surveys (COV-FS) collected after the COVID-19 outbreak. WBES is a nationally representative establishment-level survey of formally registered private businesses operating in the manufacturing and service sectors of the national economy. A standardized sampling procedure based on the stratification of within-country locations, sectors, and firm size ensures representativeness at the national and sectoral levels, whereas the use of a common questionnaire and uniform methodology allows for comparisons of estimates across countries (Krammer, 2022b). The 2019-18 WBES included in this study served as the baseline prior to the onset of the COVID-19 pandemic. WBES comprise face-to-face interviews with top managers and business owners with help of structured questionnaires. Each questionnaire was then translated into the native language in each country and covered different business topics. Perceptual measures are widely employed and regarded as truly reflecting the theme of interest (Grichnik et al., 2014). This survey data is widely used in a range of research contexts (e.g. Bahl et al., 2021; Jensen et al., 2010). The World Bank Group team failed to detect any content and face validity issues relating to questions on the questionnaires (Jensen et al., 2010).

After the declaration of COVID-19 outbreak, firms initially surveyed in the baseline WBES were re-contacted to gauge the pandemic's impact. Through telephone interviews executed in three waves from May 2020 to July 2021, these subsequent surveys procured data on firms' adaptations in areas spanning production, operations, sales, financial accessibility, and governmental policy responses. The initial follow-up, denoted as Wave 1, examined the immediate repercussions of COVID-19 on firms and the consequent firm level adjustments. Firms engaged in Wave 1 were subsequently contacted in 2021 for Wave 2 and Wave 3, using questionnaires consistent in thematic scope with the initial wave. Notably, Wave 3 uniquely incorporated our study's pivotal dependent variable: firm innovation, marking its sole inclusion in the COV-FS (see Appendix Table A1).

The final database enabled the generation of a longitudinal base relating to eight thousand firms located in 21 countries (see Appendix Table A2 for the list of the countries included in the analysis).

Measures

Dependent variable

Following prior studies, we measured firm innovation with a binary outcome (Fritsch & Görg, 2015). We measure firm propensity to innovate using single item question during the pandemic (specifically in wave 3 of the COV-FS) 'Has this establishment introduced new or improved products or services in response to the COVID-19 outbreak?'.

The pandemic has significantly influenced consumer buying behavior, leading to decreased spending on most products and services, thereby creating a demand shock (Charm et al., 2020). In response, firms have had to adapt by adjusting their production processes and temporarily halting production in some cases. Innovation during this period has been essential for firms to adapt to the rapidly changing business environment (Chesbrough, 2020). Innovations have included launching new products and services to maintain productivity and survival, to recover sales during and after the pandemic. Hence, we have computed a binary dependent variable where firms responding affirmatively to having introduced such innovations are coded as '1' (yes), and those that did not are coded as '0' (no). This binary coding captures the presence or absence of innovation activities triggered by the pandemic's impact on market conditions and consumer behavior. Appendix Table A3 provides the definition and measures of all variables included in the analyses.

Independent variable

The current study employed 'remote work adoption' as an umbrella term, for firms that allow employees to spend time away from the traditional office was captured during the wave 1 survey when COVID started to disrupt the economies. In line with prior studies, our main explanatory variable measure is a binary variable (Gajendran & Harrison, 2007). Gajendran and Harrison (2007) conducted a test comparing different types of remote work arrangements, specifically the binary nature versus the intensity of remote work (ranging from 0% to 100%), and found no statistical difference between them.

Moderating variables

We analyzed national culture, represented by the six national cultural dimensions (Minkov & Hofstede, 2012). We used national culture as a second-level collective construct in our research. We obtained cultural values dimension scores (range of 1 to 100) from Hofstede's website (https://www.hofstede-insights). All the six cultural dimension scores were Z-standardized ensuring a collective metric and calmer interpretation of the coefficients.

Controls

We employed a wide range of individual-level, firm-level, and country-level controls to ensure that firms' innovation is correctly identified. In terms of individual-level control, female lead firm has been important when it comes to firm innovation and growth (Foss et al., 2022; Sieweke et al., 2023). We therefore included a dummy variable that takes value 1 if top manager is female and whether there are any females among the firm's owners and 0 when it is not. Whereas in terms of firm-level control variables we considered firm sector, size, and age. In addition to accounting for historical trajectory of innovation and the possible organizational learning effects from such experiences we considered both pre-COVID innovative endeavors, spanning input-side dynamics like R&D investments and outcome-centric measures such as product innovations. Lastly, to gauge firms' predisposition towards digital platforms, a control variable was introduced to denote whether a firm had established its digital presence via a website before the onset of the COVID-19 pandemic (Haller & Siedschlag, 2011). This thorough approach in incorporating controls ensures a nuanced and robust interpretation of firms' innovative behaviors in the contemporary landscape.

Finally, we included three country-level controls. GDP and population taken from World Development Indicator (WDI). Previous research has identified a link between macroeconomic indicators and firm innovation (Estrin et al., 2022). Pandemic regulations have played a critical role during the pandemic period on firms outcomes (Ashraf, 2020; Jensen et al., 2010). COVID stringency is a 'government response stringency index' that measures the stringency of government responses (such as school closures, workplace closures, and travel bans) to COVID-19 (Hale et al., 2021). The value of the index lies between 0 and 100, where higher means more stringent measures. We take an average stringency score for the months in which the COVID-19 surveys are conducted.

Common-method bias

It is worth noting that common-method bias (CMB) can be a concern when working with survey data. However, the Enterprise Survey has built-in procedural safeguards against CMB. These include anonymizing all respondents and firms, as well as placing questions about firm-specific aspects in different sections of the survey. Additionally, the questions about remote work adoption and firm innovation have been asked in two separate follow-up surveys (wave 1 and wave 3, respectively), which further reduces the risk of bias. In addition, our empirical analysis by conducting Harman's one-factor test has confirmed that CMB is not a major issue in this case as multiple factors are responsible for the variance. Therefore, we can conclude that CMB is not a major issue in this case.

Model estimation

Our data were based on individual-level 8,169 observations grouped into 21 countries ensuing in a clustered dataset. Thus, to examine the firm-level remote work adoption effect and country-level cultural factors on firm innovation, we emphasized (random-effect) multi-level logistic regression modeling (Raudenbush & Bryk, 2002). In multi-level analysis, random effects are denoted to group-specific elements (countries) that are supposed to affect the study dependent variable in our case. The likelihood ratio test (Hox, 2010) was significant for our dataset, explaining that the single level estimating technique would produce inaccurate outcomes. Additionally intra-class correlation coefficient is 0.13, concluding that cross-country differences account for 13% of the variance in firm innovation suggesting that multilevel modelling is appropriate (Peterson et al., 2012).

Because the dependent variable is a dummy, a logit model was used to estimate it. A multilevel mixed-effects method was utilized to model binary dependent variables in which the log odds of the outcome variable are modeled as a linear combination of the independent variables. We employed multilevel modeling (Raudenbush & Bryk, 2002) with restricted maximum likelihood estimates to test our cross-level hypotheses.

All individual-level variables used in regression in their natural form. The national-level predictors and control variables used in this research are z-standardized because all were taken from different data sources and they have a different scale of measure and interpretations, this process ensuring a collective metric (M=0, SD = 1) and allowing calmer interpretation of the outcomes.

Results

Appendix Table A4 provide correlations among study variables. As shown in Appendix Table A5, the variance inflation scores were under 6.0, suggesting that multicollinearity is not a problem (Wooldridge, 2010). Overall remote work adoption and firm innovation were positively and significantly associated (r=0.114, p<0.05).

In Model 1 (as shown in Table 1), we estimated the null model to measure the variance between the dependent variable and the group (countries) and added no control or predictor variables in a mixed-effect regression model. We found that group-level variance was significant, signifying that group-level elements were responsible for the variance in firm innovation. These findings indicate that multi-level analyses are required; suggesting that applying a single-level estimating technique in a selective sample that contains significant group-level variance would produce inaccurate outcomes. We ran several model-fit tests: the $\chi 2$ test, which confirms a low and highly significant *p*value; Akaike's information criterion (AIC), which indicates an improvement in model fit when the main effect and the national culture variables are added; and a pairwise likelihood ratio test to compare the interaction models with the nested model 3, which suggests that the introduction of the national culture moderators offers a partial improvement in model fit.

The main effect of remote work adoption was introduced in Model 2. The regression coefficient ($\beta = 0.51$, p < 0.001) indicates that increased remote work adoption by a firm led to increased innovation, hence providing full support to our Hypothesis 1. Hypothesis 2–6 predicted that the relationship between remote work adoption and firm innovation would be moderated by national cultures. Models 3–8 include interaction terms. The multilevel modelling results related to Hypothesis 2 (in Model 3) show, there was a negative relationship between the interaction terms

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Female lead firm	.00	.00*	.00*	.00*	.00*	.00*	.00*	.00*
	(.00)	(.00)	(.00)	(.00)	(.00)	(.00)	(.00)	(.00)
Manufacturing	-0.18***	-0.18***	-0.18***	-0.18***	-0.18***	-0.18***	-0.18***	-0.18***
	(.07)	(.07)	(.07)	(.07)	(.07)	(.07)	(.07)	(.07)
Firm age	-0.12	-0.14	-0.14	-0.14	-0.14	-0.14	-0.14	-0.14
	(.09)	(.09)	(.09)	(.09)	(.09)	(.09)	(.09)	(.09)
Firm size (large = 1)	.32***	.20***	.20**	.20***	.20***	.21***	.21***	.20**
	(.08)	(.08)	(.08)	(.08)	(.08)	(.08)	(.08)	*(.08)
Product Innovation	.29***	.26***	.26***	.26***	.26***	.26***	.26***	.26***
(pre-COVID)	(.07)	(.07)	(.07)	(.07)	(.07)	(.07)	(.07)	(.07)
(pro COVID)	.54	.29	.29	.29	.29	.29	.50	.29
(pre-COVID) Wobsite (Vec - 1)	(.09)	(.09)	(.09)	(.09)	(.09)	0.09)	0.09)	(.09)
website (les – l)	.03	.00	.00	.00	.00	-0.00	-0.00	.00
GDP	-0.38	(.07) _0 37	(.07) _0.38	(.07) _0.37	(.07) _0 37	(.07) _0.37	-0.36	_0.37
	(27)	(27)	(27)	(27)	(27)	(27)	(27)	(27)
Population	.07	.06	.06	.06	.06	.06	.06	.05
ropulation	(.17)	(.17)	(.17)	(.17)	(.17)	(.17)	(.17)	(.17)
COVID stringency	.03	.02	.02	.02	.02	.02	.04	.03
J	(.23)	(.23)	(.23)	(.23)	(.23)	(.23)	(.23)	(.23)
Power distance	.10	.09	.17	.09	.09	.09	.09	.09
	(.27)	(.27)	(.26)	(.27)	(.26)	(.26)	(.26)	(.26)
Individualism	.44	.40	.39	.41	.40	.40	.40	.40
	(.30)	(.30)	(.29)	(.29)	(.29)	(.29)	(.29)	(.29)
Masculinity	-0.36	-0.33	-0.31	-0.33	-0.33	-0.32	-0.34	-0.33
	(.24)	(.23)	(.23)	(.23)	(.24)	(.23)	(.23)	(.23)
Uncertainty	.17	.17	.18	.17	.17	.21	.15	.16
avoidance	(.17)	(.17)	(.17)	(.17)	(.17)	(.17)	(.17)	(.17)
Long term	-0.20	-0.22	-0.22	-0.22	-0.22	-0.23	-0.11	-0.21
orientation	(.22)	(.22)	(.22)	(.22)	(.22)	(.22)	(.22)	(.22)
Indulgence	-0.07	-0.10	-0.10	-0.10	-0.10	-0.10	-0.10	-0.17
Dama ata wanik	(.19)	(.19) r1***	(.19)	(.19) r1***	(.19) 51***	(.19) 52***	(.19)	(.19) F1***
Remote Work		.51"""	.49"""	.51"""	.51"""	.52"""	.43"""	.51"""
		(.07)	(.07)	(.07)	(.07)	(.07)	(.07)	(.07)
			(08)					
			(.00)	_0.03				
				(06)				
RW X MAS				(.00)	01			
					(.07)			
RW X UA					()	-0.07		
						(.06)		
RW X LTO							-0.21***	
							(.07)	
RW X INDUL								.20***
								(.07)
Random part								
estimates								
Variance of random	.33***	.32***	.31***	.32***	.32***	.32***	.32***	.32***
intercept	(.12)	(.11)	(.11)	(.11)	(.11)	(.12)	(.12)	(.11)
Observations	8053	8053	8053	8053	8053	8053	8053	8053
Number of groups	21	21	21	21	21	21	21	21
(countries)								
IVIDUCEI TIT STATISTICS	***	***	***	***	***	***	***	***
	7220 41	7720 1 /	7166 44	7162 76	7160 40	7160 47	7167 20	7150 57
Log likelihood	2530 517	7230.14 _3400 72	7 100.44 _3/07 00	_3400 65	7100.40 _3400 72	7100.42 _3400.14	_3/05 10	-2408 34
Log internition	157 41	-5+29.75 150 47	147 64	-3-99.05 149.72	-5+29.72 149.87	-J+29.10 151 70	-5495.10 151 71	-5 490.30 1 <u>4</u> 9 71
rearession ^b	137.71	130,72	117.04	1 12112	1 1 2.07	131.27	1.5 1.7 1	

Table 1. Multi level analysis of the relationship between informal institutions and firm innovation.

Note: Standard errors are in parentheses.

*****p* < 0.01, ***p* < 0.05, **p* < 0.1.

^aAkaike's information criterion; smaller values indicate better model fit.

^bA likelihood-ratio test tests whether the random-intercept model offers significant improvement over a linear regression model with fixed effects on.

of remote work adoption and PD and the firm innovation ($\beta = -0.17$, p < 0.05). Following Cohen's (2013) recommendations, we plotted this interaction at conditional values of the PD (1 SD above and below the means). As shown in Figure 2, the effect of remote work adoption on firm innovation was stronger when PD was at lower levels. Thus, Hypothesis 1 was supported.

The coefficients of interaction terms in Model 4-6 were not significant, which means Hypotheses 3–5 were not supported by our data. Model 7 indicates a negative moderating effect of LTO as opposed to our hypothesis on remote work adoption and firm innovation ($\beta = -0.21$, p < 0.001). As shown in Figure 3, the effect of remote work adoption on firm innovation was stronger when LTO was at lower levels. Thus, Hypothesis 6 was rejected.



Figure 2. The moderating role of power distance.



Figure 3. The moderating role of long-term orientation.



Figure 4. The moderating role of indulgence.

Model 8 indicates a positive moderating effect of indulgence on remote work adoption-firm innovation ($\beta = 0.20$, p < 0.001). We then plotted this interaction at conditional values of the indulgence (1 SD above and below the means). As shown in Figure 4, the effect of remote work adoption on firm innovation was stronger when indulgence was at higher levels. Thus, Hypothesis 7 was supported.

Additional analysis

As delineated in Appendix Table A6, we conducted multi-group analyses, taking cues from prior methodologies (Broderick et al., 2007) to substantiate our central hypotheses.

To facilitate this, the dataset was categorized into two distinctive groups—'low' and 'high'. This classification was anchored on the median split of the cultural dimension values. For example, while focusing on the metric of PD, this division yielded two groups: a low PD group comprising eleven countries and a high PD group encompassing ten countries. These divisions symbolically represent nations that either lean heavily towards PD or exhibit a more restrained orientation towards it.

Our multi-group analysis, subsequently, unveiled some compelling insights. The interplay between remote work adoption and firm innovation turned out to be more pronounced in countries with low PD (β =0.60, p<0.001) as opposed to their high PD counterparts (β =0.40, p<0.001). This discovery emphatically endorses our Hypothesis 2, accentuating the modulating role of PD in the relationship between remote work and innovation. Similarly, Hypothesis 7 was supported, with higher indulgence countries exhibiting a stronger relationship (β =0.624,

Hypotheses	Multilevel analysis (Table 1)	Multi-group analysis (segments the countries into low and high groups-Table A6)	Final thoughts
H2: Stronger positive relationship between remote work and innovation in countries with lower PD.	Supported	Countries with lower PD showed a stronger link between remote work adoption and firm innovation ($\beta = 0.598$, $p < 0.001$), compared to countries with higher PD ($\beta = 0.40$, $p < 0.001$)	Both multilevel and multi-group analysis support the hypothesis.
H3: Stronger positive relationship between remote work and innovation in countries with higher individualism.	Not supported (non-significant)	Countries with high individualism exhibited a stronger linkage between remote work adoption and firm innovation $(\beta = 0.542, p < 0.001),$ compared to low individualism $(\beta = 0.48, p < 0.001).$	Mixed results suggest caution in drawing conclusions. Multilevel analysis did not support; multi-group analysis did.
H4: Stronger positive relationship between remote work and innovation in countries with higher masculinity.	Not supported (non-significant)	Countries with high masculine orientations exhibited a stronger linkage between remote work adoption and firm innovation ($\beta = 0.553$, $p < 0.001$), compared to low masculine orientations ($\beta = 0.445$, $p < 0.001$).	Mixed results suggest caution in drawing conclusions. Multilevel analysis did not support; multi-group analysis did.
H5: Stronger positive relationship between remote work and innovation in countries with lower UA.	Not supported (non-significant)	Countries with lower levels of UA exhibited a stronger linkage between remote work adoption and firm innovation (β =0.643, p < 0.001), compared to high levels of UA (β =0.420, p < 0.001).	Mixed results suggest caution in drawing conclusions. Multilevel analysis did not support; multi-group analysis did.
H6: Stronger positive relationship between remote work and innovation in countries with higher LTO.	Not supported/ opposite direction	Countries with a lower emphasis on LTO exhibited a more potent association between remote work adoption and innovation (β =0.591, p < 0.001), compared to high levels of LTO (β =0.301, p < 0.001).	Results oppose hypothesis; stronger link in countries with shorter-term focus.
H7: Stronger positive relationship between remote work and innovation in countries with higher indulgence.	Supported	Countries with a heightened emphasis on indulgence exhibited a stronger linkage between remote work adoption and firm innovation ($\beta = 0.624$, $p < 0.001$), compared to low levels of indulgence ($\beta = 0.398$, $p < 0.001$).	Both multilevel and multi-group analysis support the hypothesis.

Table 2. Summary of the results.

p < 0.001) compared to lower indulgence countries ($\beta = 0.398$, p < 0.001). Both multilevel and multi-group analyses supported Hypotheses 2 and 7.

Multi-group analysis results highlight that for Hypothesis 3 countries with higher individualism demonstrated a stronger positive relationship between remote work and innovation. For Hypothesis 4, the relationship was more pronounced in countries with higher masculinity compared to lower masculinity. Lastly, for Hypothesis 5, countries with lower UA showed a stronger relationship compared to higher UA countries. While the multi-group analyses provided partial or full support for Hypotheses 3, 4, and 5, the multilevel analyses did not support these hypotheses, revealing some inconsistencies. In contrast, Hypothesis 6 was not supported; results showed an opposite direction, with countries emphasizing higher STO exhibiting a stronger association between remote work adoption and innovation compared to those with higher LTO.

Table 2 offers a concise summary and comparison of the results obtained from both the multilevel and multi-group analyses.

Discussion

Drawing upon the culture fit perspective; the current study aims to examine how the effect of remote work adoption on firm innovation is moderated by national cultures. Based on data collected from 8,053 firms across 21 countries, research findings reveal that remote work adoption had a positive impact on firm innovation and this positive relationship was stronger in low PD and high indulgent cultures. Contrary to our initial hypothesis, our results indicate that the effect of remote work adoption on firm innovation was more pronounced in short-term oriented cultures, which we will discuss in the following section.

Theoretical implications

This study contributes to the existing literature in several ways. First, the current study makes a theoretical contribution by specifically exploring the relationship between remote work adoption and firm innovation—a focus largely overlooked in existing literature. Previous research has primarily examined the efficacy of remote work at the firm level concerning overall company performance metrics (Martínez-Sánchez et al., 2007, 2008). By shifting the lens to innovation, our study extends the understanding of how HRM practices, particularly remote work, can impact a firm's innovative capacity. While it is well-documented that HRM practices influence corporate innovation (Lin et al., 2020; Yao et al., 2023), the specific role of remote work as a strategic HRM initiative in fostering innovation has not been adequately addressed. This gap is particularly

critical given the increasing prevalence of remote work arrangements and their potential to reconfigure traditional innovation processes within firms. Our research thus not only broadens the scope of HRM literature but also provides valuable insights into how leveraging remote work can strategically enhance a firm's innovation potential.

Second, by introducing a culture fit perspective, our research addresses the cross-cultural variations in the effectiveness of remote work adoption. While previous studies have acknowledged the influence of cultural factors on remote work adoption (Peters et al., 2016), the current study emphasizes that the effects of remote work adoption can also be influenced by embedded cultural contexts (Peretz et al., 2018). As Bélanger et al. (2013) argued, remote work involves a complex interrelationship among external contexts, organizational contexts, individual characteristics, management practices, and technologies. Thus, omitting cultural contingencies could lead to contradictory findings. Our study underscores the significance of cultural alignment in successful remote work adoption and sheds light on how cultural contingencies impact the effectiveness of remote work practices.

Specifically, our findings indicate that the positive impact of remote work adoption on firm innovation is more pronounced in cultures with lower PD. This result aligns with prior research conducted at the individual level. For example, studies have shown that the benefits of remote work for employees, such as increased motivation, satisfaction, and productivity, are more significant in low PD environments where employees experience greater autonomy and less hierarchical control (e.g. Gajendran & Harrison, 2007; Peretz et al., 2018). Our study extends beyond the existing literature by uncovering that these positive effects can aggregate to the firm level, ultimately contributing to enhanced firm innovation. This aggregation underscores the importance of cultural alignment in the successful implementation of remote work practices and highlights how such practices, when embedded in culturally conducive environments, can generate broader organizational benefits.

Besides, the current study also indicates a stronger positive relationship between remote work adoption and firm innovation in highly indulgent cultures. This finding may seem counterintuitive, considering Wang et al. (2021) recent study conducted during the pandemic, which showed that disciplined remote workers reported better task performance. However, a group of disciplined employees may not necessarily contribute to firm innovation. Excessive self-discipline can lead to a tendency towards over-organization, workaholism, and a lack of openness to novel experiences, all of which can potentially hinder innovation (George & Zhou, 2001). Particularly in the context of remote work, employees need to embrace novel and diverse experiences to generate creative ideas. By revealing the 'bright side' of indulgent cultures, the current study can inspire future research on innovation management in remote work settings.

Moreover, results from our multilevel analysis show that remote work adoption was positively related to firm innovation, regardless of the levels of individualism, masculinity, and UA. We speculate that these cultural factors may have exerted mixed effects in the unique pandemic context, observed non-significant the results. Specifically, while leading masculinity-oriented cultures usually align well with remote work due to their emphasis on achievement and performance, employees in these cultures are more likely to experience greater work-family conflict. This issue was particularly pronounced during the pandemic, when boundaries between work and family life became increasingly blurred (Gajendran et al., 2024). Similarly, although individualistic cultures generally support remote work adoption through greater autonomy and independence, the pandemic amplified challenges in communication and collaboration among employees. In-person meetings and activities-previously used to address these challenges—were no longer viable. Lastly, uncertainty-avoiding cultures are traditionally less suited to remote work due to a strong preference for stability. However, to cope with the uncertainty caused by the large-scale transition to remote work during the pandemic, organization in such cultures may rapidly implement formal or informal policies to adapt to the new norm. These policies likely helped mitigate the negative impacts of abrupt transitions and minimized their potential adverse effects on innovation. Taken together, we argue that individualism, masculinity, and UA may exerted double-edged sword effects on remote work practices during the pandemic, which ultimately may diminish the significance of the moderating roles of these cultural dimensions.

Our results also suggest a significant negative moderating effect of LTO on the relationship between remote work adoption and firm innovation, which is contrary to our initial prediction. One possible explanation is that the LTO dimension may not always promote the type of agility and rapid adaptability required for innovation in a remote work setting. Generally, people in long-term oriented cultures prioritize future plans and strategic goals, and are less affected by sudden, unplanned events (Hofstede, 2011). As our study was conducted during the pandemic, remote work may not have been a well-planned work arrangement for many organizations (Wang et al., 2021). In long-term oriented cultures, remote work might be perceived as a temporary adjustment, leading to lower commitment, adaptation, and consequently, reduced innovation performance. Given that remote work becomes the 'new normal' (Delany, 2022), we recommend more attention on the moderating role of long-term oriented culture in the post-pandemic world.

Finally, the current study enriches the remote work literature by examining the relationship between remote work adoption and firm innovation with rigorous methodologies. While previous research mostly focused on how remote work adoption impacts innovation at the individual level, such as idea generation or shared knowledge quality (Brucks & Levav, 2022), only a few studies delved into firm-level innovation influenced by remote work, often with limited samples and used cross-sectional designs (Martínez-Sánchez et al., 2007, 2008). To obtain more robust evidence, our study collected data in three waves from 8,053 firms across 21 countries. Utilizing multilevel regressions in our model helps to mitigate the effects of potential national-level factors, thereby enhancing the generalizability of our results.

Practical implications

The current study also has important practical implications. Our research findings highlight that the influence of remote work arrangement on firm innovation varies across nations. Specifically, remote work is found to be particularly conducive to fostering innovation in cultures characterized by low PD and high indulgence. This alignment can be attributed to the fact that employees in those cultures are more motivated to engage in innovative activities, and organizations can effectively manage online collaborations that catalyze the innovation process. Therefore, we recommend organizations to incorporate national cultures in their decisionmaking processes when devising and executing remote work strategies.

Additionally, our research has implications for multinational organizations and cross-cultural teams. Given the possible divergences in national cultures between the home and host countries, it is crucial for managers in multinational corporations or multicultural teams to accommodate national cultural nuances when implementing new HRM practices. Managers, in such scenarios, could opt for HRM practices that are culturally contextual, thereby endowing enterprises with competitive advantages (Raghuram et al., 2001). Moreover, the potential for mixed outcomes in multi-cultural coordination and cooperation underscores the need for enhancing managerial competencies. Managers need to provide additional support to employees whose cultural backgrounds might not resonate well with the new work practices, thereby minimizing the negative impact of the adoption of the new work practice.

Limitations and future research directions

While this study provides important insights into the relationship between remote work adoption and firm innovation, there are several avenues for future research to build upon our findings. First, we encourage scholars to explore theoretical frameworks beyond the RBV to deepen the understanding of this relationship, particularly within the unique context of the COVID-19 pandemic. For example, Boundary Theory (Hughes & Donnelly, 2024) could be applied to investigate how firms align remote work practices with rapidly changing environmental conditions, such as pandemic-induced disruptions. Additionally, the Dynamic Capabilities Perspective (Teece, 2014) offers a compelling lens to examine how firms adapt, integrate, and reconfigure resources to sustain innovation during periods of uncertainty.

Second, the current study operationalized remote work as a binary variable, while overlooking the nuanced ways in which remote work is implemented. Recent research has suggested that the design of remote work can significantly influence its effectiveness (Wang et al., 2021). For instance, poorly designed remote work arrangements, such as those characterized by excessive managerial control, are likely to undermine the desirable outcomes of remote work adoption. Conversely, well-designed remote work arrangements, such as those that provide social support to help remote workers cope with isolation, can maximize its benefit. Therefore, we encourage future research to probe deeper into the implementation of remote work policies, particularly to identify factors that influence firm innovation within the remote work context.

Besides, we acknowledge the inherent limitations associated with the use of single-item measures in the current study. While single-item measures offer simplicity and efficiency, they may not capture the full depth and breadth of complex constructs. In this study, some variables were assessed with single-item measures due to the constraints of the available data from the WBES. We recognize this as a limitation in our study and encourage future research to utilize multi-item scales, where possible, to measure constructs more comprehensively. Nonetheless, single-item measures can still provide valuable insights, especially when the construct is clear and unambiguous.

Another limitation is the potential influence of the COVID-19 pandemic as a contextual factor. While we accounted for pandemic-specific variables, such as COVID-19 stringency and industry type, in our regression models, the unique nature of the pandemic as a global crisis likely impacted both the adoption of remote work and firm adaptation in ways that are not fully captured by our analysis. Future research could explore whether the observed effects of remote work on innovation persist in non-crisis contexts or during other types of disruptions, such as economic downturns or natural disasters, to better generalize findings across various conditions. Additionally, longitudinal studies that incorporate pre-pandemic, pandemic, and post-pandemic data would provide a clearer understanding of how remote work practices evolve and their implications for innovation over time. Researchers could also investigate the role of other potential mediating or moderating variables, such as organizational resilience, leadership strategies, or employee adaptability, to further unpack the dynamics observed in this study. Finally, cross-contextual studies examining the interplay between remote work and innovation across regions less affected by the pandemic would contribute to a deeper understanding of the relationship in varying settings.

Finally, the effectiveness of remote work could be shaped by other aspects of the institutional environment, such as regulatory institutions. National legislation and government policy can exert coercive pressure that can either encourage or inhibit remote work. For example, a country's labor market regulations can significantly influence the effectiveness of the implementation of work practices within an organization (Ollo-López et al., 2011). Open and flexible labor markets encourage firms to adopt best new work practices, such as remote work. Conversely, rigid labor markets can restrict the scope of firms' internal managerial actions, cultivating a structured organization where employers are reluctant to adopt new work practices. Therefore, we suggest that future research consider the influence of other national institutional factors to further broaden and enhance our current understanding.

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Data availability statement

The data that support the findings of this study are available in The World Bank Enterprise Surveys (WBES) at http://www.enterprisesurveys.org.

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