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Digital Disruptive Innovation and Firm Performance Nexus: Role of Dynamic Managerial Competence, Innovative Work Practices and COVID-19

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Abstract

This study investigates, with a particular focus on understanding how digital change shapes firm performance in an emerging economy context, first, the impact of digital disruptive innovation, conceptualized as an external condition characterized by technological, market, and competitive turbulence on firm performance within tech-intensive service sector companies, and second, the mediating influence of management skills, proxied by dynamic core managerial competence, and the moderating influence of modern management practices, proxied by innovative work practices, on this relationship. It also examines the moderating effect of innovative work practices on the relationship between digital disruptive innovation and dynamic core management competence, and the impact of COVID-19 on the link between dynamic core management competence and firm performance. This study applies structural equation modelling (SEM) (AMOS 26.0 software) to explore several hypotheses testing for target relationships. The sample was collected via a Qualtrics online survey from 730 senior executives working in digital telecom and banking firms in Pakistan. The study findings show that digital disruptive innovation has a negative effect on service sector performance, and this negative impact is also mediated by dynamic core management competence, as heightened digital disruption tends to weaken managerial competence, which subsequently affects firm performance. While innovative work practices exhibit a positive association with performance, they also positively moderate the negative effect of digital disruptive innovation on performance and mitigate the negative impact of dynamic core management competence on performance. The analysis also reveals that the COVID-19 pandemic positively moderates the effect of dynamic core management competence on performance, indicating that managerial adaptability becomes particularly important when firms operate under crisis conditions. Overall, this study highlights the significance of these phenomena on firm performance in an emerging economy context and provides practical insights for managers and policymakers operating in digitally disrupted service sectors.



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1. Introduction

Rapid technological advancement in the digital age poses unprecedented challenges to companies. In this competitive environment, companies must not only innovate technologically but also maintain a strong, skilled workforce with effective practices for sustained performance. Digital disruptive innovation (DDI) refers to radical technological changes

(i.e., technological turbulence) that simultaneously create new processes, disrupt markets (i.e., market turbulence), and displace leaders (i.e., competitive turbulence) (Niaz et al., 2021; Schuelke-Leech, 2021; Tait & Wield, 2021). In this study, digital disruptive innovation is treated as an external environmental condition reflecting technological, market, and competitive turbulence faced by incumbent firms, rather than firms' own innovation outputs. While DDI is essential (Tukina et al., 2020), it can also create risks and unintended consequences (Bains, 2022). It often poses challenges and can challenge the stability of incumbent companies (Dorothy et al., 2020; Raffaelli et al., 2019; Weile et al., 2018). Such disruption occurs when an innovation creates disturbances, displaces or renders existing technologies less effective, and offers improved performance (Brownsword, 2022). Complementing this, Chen (2021) asserts that disruptive technologies, influenced by relentless innovations, drive companies and economies.

A skilled workforce and effective workplace practices are essential for companies to maintain a competitive edge against threats driven by DDI. The literature documents that managers require industry-specific skills and competencies that directly influence firm performance (Al-Subaie et al., 2021). However, existing managerial competencies can quickly become ineffective, resulting in a competence gap that impedes innovation (Bondarenko et al., 2021; Busulwa et al., 2022). Moreover, continuously improving competencies for innovation and performance is becoming highly challenging (Cui et al., 2022). While competence deficiencies hinder firm performance (FP) and organizational efficiency, dynamic core management competence (DCC) enhances collaborative competence and organizational resilience (Chen, 2022; Elia et al., 2020; Lan et al., 2020; Ma et al., 2022). Dynamic competence requires managers to develop new competencies for achieving a competitive advantage (Pechlaner et al., 2019). This suggests that companies can develop core management competencies (e.g., marketing, technological, social) to enhance their competitive advantage and market responsiveness (Lan et al., 2020). These core competencies facilitate the efficient use of company resources, leading to better performance (Nurfauzi & Firmansyah, 2018).

Relatedly, developing DCC requires modern workplace practices in a disruptive environment, combining individual and team efforts for improved ways of working (Totterdill & Exton, 2014). Specifically, these practices include creative ideas and innovative practices that enable managers to implement changes necessitated by disruptions. In the literature, innovative work practices (IWPs) generate innovative products and services, thereby enhancing firm performance (Ko & Ma, 2019). Hence, IWPs achieve this by improving employee skills, motivation, and overall firm performance (Wattoo et al., 2020). This suggests that IWPs provide a productive and challenging work environment for employees by increasing favourable interactions between them and the organization (Wattoo et al., 2020). Nevertheless, while IWPs develop a competent workforce (Moussa & El Arbi, 2020), maintaining DCC requires structured, creative work, continuous learning, and robust HR support. Critically, no industry is immune to DDI, especially tech-intensive service sectors in developed and emerging economies, due to their reliance on innovation and intense competition. Lubkova et al. (2019) argue that this effect is particularly evident in the telecom and banking sectors that have been evolving rapidly through the use of the latest technologies. Increasing DDI poses severe threats to incumbent firms, requiring tailored market responses (Dorothy et al., 2020). To mitigate the profound impact disruptive technology has on business operations and firm performance, the roles played by both DCC and IWPs are paramount in effectively managing the structural relationship between DDI and sustained firm performance. Thus, both telecom and banking sectors, which have gone through massive digital disruption, are required to execute new types of strategies to ensure the competence of managers in effectively avoiding future disruptions. Understanding the dynamics of individual-level

DCC and firm-level IWPs for identifying the skills that are essential in a disruptive environment to bring clarity and allow firms to invest in the right direction and develop strategies (Li et al., 2020). Thus, a detailed empirical investigation of DCC is required to draw a meaningful conclusion. Despite this need, there is currently little understanding of the influence of managers' competence acquisition on incumbent firms' strategic reactions to DDI. Moreover, Diener (2020) noted that the employee competence gap is expected to increase due to changes in the current market direction and competitive dynamics within the service sector, caused by DDI. This relationship remains insufficiently explored in the literature, stressing the need for further empirical research.

Our motivation derives from C. Wang et al. (2021), highlighting that the research on DDI and its impact on firm performance remains scarce and ambiguous. In an intense market competition environment, increasing dependency on technology by service sector companies, such as banking and telecommunications, causes disruption that can jeopardize performance. This study complements the ongoing academic debate by addressing a significant void in the literature in the context of an emerging economy. Moreover, the interplay between managerial competence deficiency and innovative practices has not been explored in depth and thus requires further empirical attention. We address the pertinent gap in the literature by examining the unique interrelationships among DDI, DCC, IWPs, and FP within the telecom and banking service sectors. More precisely, we examine the impact of DDI on tech-intensive service sector performance, mediated through DCC, and also the moderating effect of IWPs on the nexus between DDI and firm performance, as well as on the relationship between DDI and DCC. In addition, we explore the moderating role of COVID-19 on DCC and firm performance relationships. We contribute to extant literature in several ways:

First, unlike prior DDI research, this study examines the impact of DDI on firm performance within Pakistan's service sectors, a developing economy with limited research in this area. It specifically analyses three dimensions of DDI (technological, market, and competitive turbulences) as direct determinants of performance, rather than as moderators used in the extant literature (C. Wang et al., 2022). Second, our study introduces a new idea of exploring the mediating role of dynamic core competence (DCC) in the DDI and firm performance (FP) relationship, recognizing the role of DCC in enhancing firm performance under conditions of digital disruption. We contend that DCC is a critical driver and has utmost importance in influencing FP. By investigating the under-explored mediation effect, this study clarifies the nature of DCC to address practical gaps in the literature.

Third, our study examines both the direct and moderating effects of innovative work practices (IWPs) on FP. While some research exists on the link between IWPs and FP, the moderating influence of IWPs between the DDI and FP relationship, as well as the DDI and DCC relationship, represents a significant gap in the literature that this study addresses. Finally, this study investigates the moderating impact of the COVID-19 pandemic on the DCC–FP nexus by treating the pandemic as an external shock that enhances the value of dynamic managerial capabilities. Given the profound economic impact of the pandemic and uncertainty across Pakistani service sector firms' responses (Xu et al., 2022), this study fills a critical empirical void. Taken together, we uncover a comprehensive investigation for the (i) direct relationship of DI, DCC, and IWPs to FP, (ii) mediating relationship of DCC between DI and FP, (iii) moderating relationship of IWPs between DI and DCC, and between DI and FP, and (iv) moderating impact of COVID-19 between DCC and FP. Until now, there have been no frameworks for these three types of moderating relationships in the extant literature. Overall, this study provides a comprehensive investigation of DDI, DCC, and FP, including the moderating roles of IWPs and COVID-19, offering valuable insights for policymakers in emerging economies.

The rest of the paper is organized as follows: Section 2 presents the review of the literature and develops the study's theoretical underpinning and hypotheses for empirical investigation. Section 3 reports on the data and methodology used. Section 4 presents the empirical results. Section 5 provides the discussion of findings, followed by Section 6, which concludes this study, with theoretical and practical contributions, policy implications, limitations, and directions for future research.

2. Theory, Literature and Hypotheses

In the areas of organizational dynamics in an environment of digital disruptive innovation and its link to financial performance, multiple theories have been explored, with the disruptive innovation theory (DIT) being the most commonly applied. In line with this study's perspective, these theories are applied to explain digital disruptive innovation as an external environmental condition that alters market, technological, and competitive dynamics faced by firms, rather than as firms' own innovation activities. This theory is widely used across various organizational aspects. Prior studies have shown that goods and services using innovative technology are more cost-effective, leading to a competitive market environment and ensuring a firm's targeted performance (Almulla & Aljughaiman, 2021). DIT is directly tied to both internal and external changes in organizations, which are indispensable in ensuring organizational performance in the service industry business in response to disruption from innovations (Zubizarreta et al., 2021). Complementing this, dynamic capability theory (DCT) explains how firms develop, deploy, and reconfigure managerial and organizational competencies to cope with disruptive conditions and sustain performance. Within this theoretical lens, DCC represents a firm's managerial capability to sense, integrate, and respond to environmental disruption. This theory posits that an organization must have the capability to incorporate, build, and reconfigure its internal and external capabilities to function in disruptive environments (Rotjanakorn et al., 2020). DCT enables firms to manage change in dynamic environments by leveraging core competencies and adapting to market conditions (Shan et al., 2019). DCT describes dynamic capabilities that enable organizations to meet the needs of a growing business environment when digital disruptive innovation affects firm performance (Saunila et al., 2019; Mehta & Ali, 2021; Lee et al., 2021). Contingency theory also helps to understand organizational dynamics during disruptive change, which is often unpredictable and inevitable due to market volatility and technological progress (Aubry & Lavoie-Tremblay, 2018; Ramiel, 2021). Therefore, managing disruptive change requires a deliberate and context-specific approach, as such disruptions can have meaningful implications for firm performance (Dikova & Veselova, 2021). Drawing on contingency theory, firm strategies and performance outcomes are contingent on how organizations align their managerial competencies and work practices with changing environmental conditions (Nekhili et al., 2018). Accordingly, the effects of digital disruptive innovation on firm performance are expected to vary depending on firms' dynamic managerial competence and innovative work practices. It suggests that during technological disturbances, adopting new organizational structures can be an effective response to external shifts and is also a valuable way to improve firm performance (Adawiyah, 2021). Firms may deal with digital disruptive innovation turbulence by using creative and new strategies to gain market share. Taken together, these theoretical perspectives suggest that digital disruptive innovation shapes firm performance through its influence on managerial competence, while the effectiveness of this relationship depends on organizational work practices and broader environmental conditions.

2.1. Digital Disruptive Innovation (DDI) and Firm Performance (FP)

DDI is regarded as an external technological and market condition that disturbs market activity and affects the growth of incumbent firms (Coccia, 2018; Lima et al., 2019). As DDI accelerates and creates new disturbances, many organizations, including multinationals, struggle to adapt (Anindita, 2021). Thus, DDI disrupts incumbents' business models, forcing them to deploy competent resources to maintain their competitive edge in the face of market change. In the digital era, DDI generates significant shifts in markets. Therefore, to remain competitive, companies must adapt to changing consumer needs, market rivalry, technological improvements, and the operational environment (Koay & Muthuveloo, 2021). Furthermore, firms' perception of disruption significantly influences their businesses, and rapid increases in innovative technologies may disrupt business activities and, in some cases, lead to performance losses (Arifin, 2022). Companies may flourish by improving their competencies in all business areas to gain a competitive edge and improve performance (Kornelius et al., 2021).

The existing literature suggests that in today's unstable technological environment, practical innovations are crucial for organizational survival and sustainability (Abbas et al., 2020). Research on the relationship between firm performance and innovation yields mixed results, ranging from positive to negative and mixed results (Rajapathirana & Hui, 2018). In highly turbulent service-sector contexts, the disruptive effects of DDI may outweigh its potential benefits in the short to medium term. DDI has a significant impact on financial performance, which is not always negative and can even advance an industry (Arifin, 2022; Ritch & McColl, 2021). While Bughin and Zeebroeck (2017) show DDI's significant effect on the company performance, Hunter (2003) highlights its negative impact on market value. In addition, Wicaksono et al. (2020) report the negative influence of external technological disruption on the performance of weakly and moderately reactive banking sector companies. Ramdani et al. (2018) argue that escalating DDI and the need for technology replacement have negatively affected the telecom sector's performance. Despite some research (Roy & Viswanathan, 2018), the effects of DDI on service sector firm performance remain poorly understood (Liu et al., 2020; Radukić & Kostić, 2019). Drawing on prior empirical evidence suggesting adverse performance effects of digital disruption (Feder, 2018; Wicaksono et al., 2020), we propose the following hypothesis:

H1: *Digital disruptive innovation (DDI) has a negative impact on firm performance (FP).*

2.2. Dynamic Core Management Competence (DCC), Digital Disruptive Innovation (DDI) and Firm Performance (FP)

Extant literature endorses that competence and industry-specific skills strongly influence DDI and directly affect firm performance (Al-Subaie et al., 2021). In the service sector, employee dynamic competence is a significant driver of performance and organizational success by developing new competencies to maintain competitive advantage (Pillai et al., 2019; Raffaelli et al., 2019; Pechlaner et al., 2019). Successful companies invest in the development of business strategies that would help them perform effectively in the face of stiff competition to improve firm performance (Chowdhury & Quaddus, 2021; Do et al., 2022). Moreover, companies must continually adapt to changing internal and external situations to ensure long-term survival. This suggests that businesses may develop core management competences for a competitive advantage and quick, cost-effective market response (Lan et al., 2020). Thus, a firm's capabilities and resources lead to a competitive advantage, depending on its dynamic business potential.

Having the DCC to respond quickly and recognize a DDI appears to be key to assisting organizations in determining the best method of competing (Rakic, 2020). DCC is

required to maintain firm performance in changing environments (Rotjanakorn et al., 2020). Moreover, DDI, organizational skills and people all have a major impact on organizational success (Koay & Muthuveloo, 2021). So, the acquisition of dynamic capabilities can assist incumbents in surviving in the market (Rakic, 2020). In this sense, DCC functions as a mechanism through which firms interpret, absorb, and respond to digital disruption, thereby shaping subsequent performance outcomes. Consequently, a positive effect of DCC on performance is expected. Furthermore, the development of advanced professional and managerial competences becomes a priority for executing an innovation-based corporate digitalization strategy (Vovchenko et al., 2018). However, when a business disruption occurs, firms often experience operational strain, and employees may be unprepared or lack the relevant expertise to respond effectively (J. Wang & Habibulla, 2021). As a consequence, a negative relationship is expected between DDI and DCC. However, their survival depends on their ability to predict and handle potentially disruptive risks successfully (Blume et al., 2020). So, firms must be prepared with strong and patient dynamic skills, as well as ongoing innovation to benefit from these prospects (Trivellato et al., 2021). Through such managerial abilities and dynamic skills (i.e., DCC), firms can, to some extent, minimize the negative effect of DDI on financial performance (FP). In other words, DCC mediates the negative effect of DDI on FP by attenuating the effect and improving firm performance. However, the negative mediation effect reflects transitional inefficiencies and short-term erosion of dynamic core management competence, rather than a permanent loss of managerial capabilities. Under conditions of heightened digital disruptive innovation, existing managerial competencies may become temporarily misaligned with rapidly changing technological and market demands, resulting in reduced effectiveness until firms adapt and rebuild competence.

In a study of digital disruption in the fashion industry, Langley and Rieple (2021) show that higher-performing incumbents tend to acquire new skills and upgrade existing ones to remain competitive. Huang et al. (2019) discovered that DCC strongly supports the efficacy of the innovation-based research project in China. Service sectors face increasing pressure to provide innovative services, demanding greater competencies due to dynamic changes. Such core competencies and technology skills of employees form the basis for ensuring high firm performance. However, most incumbent businesses lack the skills to address critical and novel challenges effectively. Therefore, further empirical research on DCCs is needed, which has been an important part of strategic management (Zhou et al., 2019). Nevertheless, neither has a serious effort been made to measure the disruptive threat of DDI on firms' DCCs, nor has there been any detailed and robust empirical research investigating DCC's role as a mediator between DDI and FP. We aim to investigate the role of DCC in ensuring firm performance amid the peculiar business environment of the telecom and banking sectors when DDI emerges. Based on the above discussion, we propose the following hypothesis:

H2: *Dynamic core management competence (DCC) mediates the negative relationship between digital disruptive innovation (DDI) and firm performance (FP).*

2.3. Innovative Work Practices (IWP) and Firm Performance (FP)

Innovative work practices refer to individual and team-based activities that involve generating creative and useful ideas and responding to problems arising from technological disruption, often leading to new and improved ways of working (Loo & Sutton, 2020; McMurray et al., 2023). IWPs occur in complex, dynamic, and stressful environments where plans can go awry (Super, 2020). As a result, IWPs can improve employee skills, knowledge, motivation, and performance (Wattoo et al., 2020). Innovative practices positively influence employee performance, firm productivity, and work-related perceptions (Garg, 2019; Jain,

2020). Nowadays, innovative practices are becoming a mainstream demand for service sectors (Lu et al., 2020). Research shows that coherent IWP are associated with improved firm performance (Diaz-Fernandez et al., 2015). Prior studies also assert that organizations resort to IWP to accomplish positive outcomes (Pam, 2011). Jungblut and Storrie (2011) observe that IWP are positively related to firm performance. Macky and Boxall (2007) reveal that IWP can produce win-win results for both employees and companies. We assert that IWP align primarily with HRM-oriented behavioural innovation practices, encompassing training, teamwork, knowledge sharing, innovative attitudes, and task design. Such IWP are distinct from mere technological innovation outputs, as organizational and human-centred practices shape employee behaviour and capability development in disruptive environments. Based on the above discussion, innovative work practices are expected to play a direct positive role in shaping firm performance, leading to the following hypothesis:

H3: *Innovative work practices (IWP) have a positive impact on firm performance (FP).*

2.4. Digital Disruptive Innovation (DDI), Innovative Work Practices (IWP) and Firm Performance (FP)

DDI refers to an external technology-driven market condition that disrupts existing processes and brings transformational changes to industries and markets (Niaz et al., 2021). DDI may create opportunities for firms with strong adaptive capabilities, while posing significant challenges for those that struggle to respond effectively to technological change (Aeknarajindawat et al., 2020; Rizki & Saputra, 2021). In response to this volatile business environment, companies need IWP and innovative capabilities to thrive in volatile business environments (Tammam et al., 2019). In fact, technological disruption increases pressure on management to develop IWP for competitive advantage. Nasifoglu Elidemir et al. (2020) and Federici et al. (2021) find that effective IWP are essential for employee motivation and performance in service firms. Furthermore, Punia and Garg (2012) assert that IWP positively affect employee competence and organizational performance. So, IWP can counter the negative profit effects of disruptive changes by increasing productivity (Addison & Teixeira, 2020). In this way, IWP are expected to reduce the intensity of the negative performance effects associated with digital disruption, rather than fully offsetting them. In fact, the influence of IWP implies a vertical alignment between the employee's behaviours and the firm's outcome objectives. While IWP correlate with positive employee attitudes, new technologies can negatively impact their work (Agogo & Hess, 2018). Nevertheless, the above discussion suggests that higher levels of investment in IWP may help firms better manage the performance challenges associated with digital disruption. This is because IWP, in conjunction with innovative thinking and working capabilities, are able to influence such disruptions and attenuate the negative effects of DDI on FP. Accordingly, our fourth hypothesis is proposed as follows:

H4: *Innovative work practices (IWP) moderate the negative relationship between digital disruptive innovation (DDI) and firm performance (FP).*

2.5. Digital Disruptive Innovation (DDI), Innovative Work Practices (IWP) and Dynamic Core Management Competence (DCC)

In contemporary business environments, digital disruption represents a pervasive external condition that can challenge firms' existing competencies, particularly where internal capabilities are limited. To cope with that, DCC is required to maintain firm performance in changing environments (Rotjanakorn et al., 2020). Rapid DCC response to DDI is key for competitive strategy (Rakic, 2020). Moreover, IWP empower employee problem-

solving and enable innovation strategies. In disruptive environments, such practices help employees translate external digital pressures into learning and capability development, thereby strengthening firms' dynamic core management competence. In fact, IWPs promote modernization by developing employee competencies (Roch, 2018). It can advance their lifelong learning and enable them to have more active, productive and fulfilling working lives. IWPs foster employee commitment to company growth. IWPs predict employee competence and firm financial performance (van Esch et al., 2018). Hence, embracing digital disruptive innovation requires more dynamic and innovative approaches to IWPs (Khatri et al., 2010). Because IWPs, in conjunction with innovative thinking, employee competencies, and working capabilities, can influence such disruptions and attenuate the negative effects of DDI on DCC. Despite the importance of DDI, organizational skills, and people (Koay & Muthuveloo, 2021), few firms have sufficient innovative practices (Naranjo-Valencia et al., 2018), hindering their ability to respond to disruptions and achieve strategic success. Based on the above discussion, we propose the following hypothesis:

H5: *Innovative work practices (IWP) moderate the negative relationship between digital disruptive innovation (DDI) and dynamic core management competence (DCC).*

2.6. COVID-19 Pandemic, Dynamic Core Management Competence (DCC) and Firm Performance (FP)

The COVID-19 pandemic severely disrupted healthcare systems, economies, businesses, and financial markets worldwide. The COVID-19 pandemic caused significant economic, social, and political disruption globally (Shehzadi et al., 2020). It reduced financial resources and increased pressure on industries and GDP (Khurshid & Khan, 2021). Shen et al. (2020) found that the pandemic decreased firm performance across industries and regions. The pandemic placed significant strain on economies and workforce stability, largely due to widespread business disruptions and closures (Cukier et al., 2021). Even dynamic and innovative firms were affected (Apedo-Amah et al., 2020). This new reality created challenges for organizations to sustain vitality, ensure survival, and adapt performance and workforce management (Carnevale & Hatak, 2020). However, growing investment and income will mitigate the pandemic's detrimental impact. Moreover, firms need adequate collective competencies to manage situations like the COVID-19 pandemic (Yustian, 2021). Under such crisis conditions, the effectiveness of dynamic core management competence (DCC) in supporting firm performance is likely to vary depending on the severity and persistence of pandemic-related disruptions. A higher DCC can reduce the negative impact of COVID-19 on FP, and vice versa. But many companies lack resilience and recovery plans, hoping for a return to normalcy. In this new context, examining the pandemic's effects on corporate performance and employee competence management is worthwhile (Hu & Zhang, 2021; Guerrero et al., 2021). Based on the above discussion, we propose the following hypothesis:

H6: *COVID-19 moderates the positive relationship between dynamic core management competence (DCC) and firm performance (FP).*

2.7. Theoretical Frameworks

The relationships hypothesized in H1–H6 are represented in Figure 1 below. The primary theme of this research relates to the relationships between digital disruptive innovation, dynamic core management competence, and firm performance. As illustrated in Figure 1, the framework depicts the directional relationships among digital disruptive innovation (DDI), dynamic core management competence (DCC), innovative work practices (IWP), and firm performance (FP). Specifically, the framework examines the direct

relationship between DDI and FP, with dynamic core management competence (DCC) acting as a mediating mechanism, and innovative work practices (IWP) and the COVID-19 pandemic serving as moderating variables. In short, the framework below presents the direct relationship of DI, DCC, and IWPs to FP, and for the mediating relationship of DCC between DI and FP, finally, and for the first moderator relationship of IWPs between DI and DCC, the second moderator relationship between DI and FP, and the third moderator impact of COVID-19 between DCC and FP.

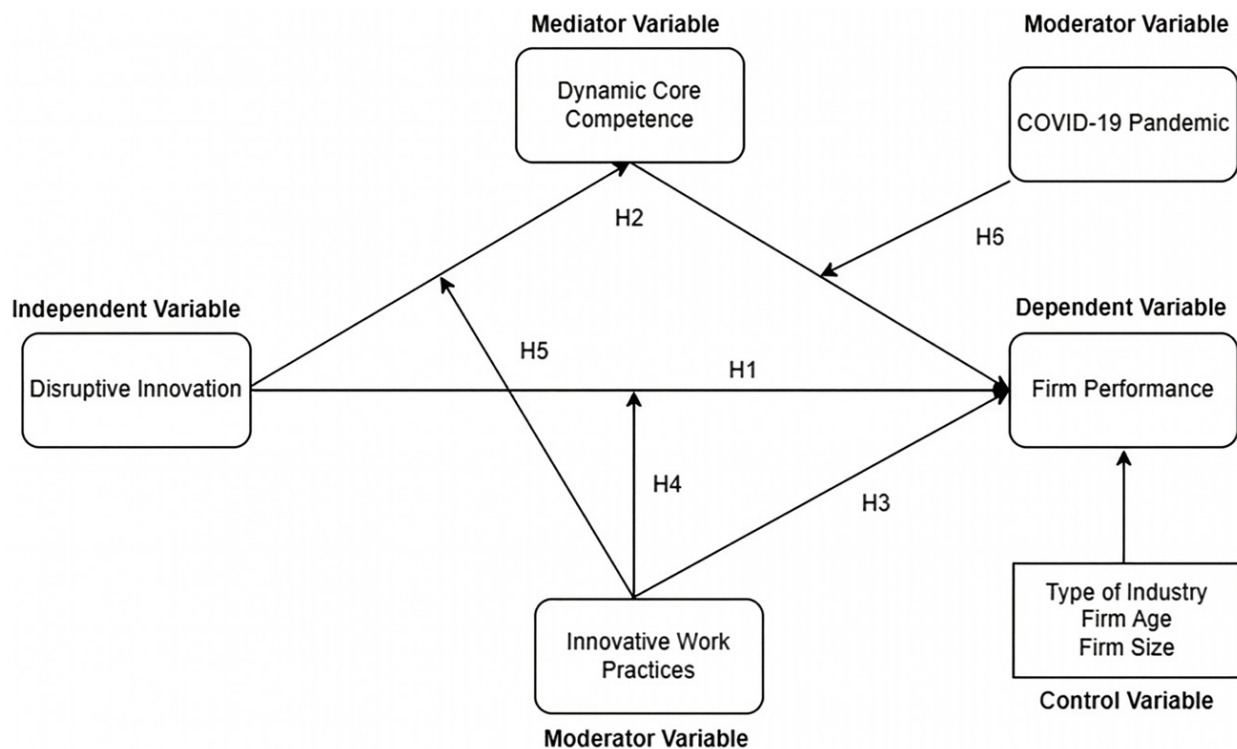


Figure 1. Theoretical Framework.

3. Research Method and Data

3.1. Sample Selection and Data Collection

With the assistance of *Qualtrics*, we collected data through an online survey. The research participants were the senior executives from Pakistan's two key service sector industries—telecom and banking. In the service industry, the telecom and banking sectors are rapidly evolving global business fields from one generation to the next and are more diverse than Pakistan's other key industries on the grounds of the prevailing rate of innovations. Hence, primary data were gathered from senior executives in the digital telecom sector (PTCL, Jazz, Ufone, Telenor, and Zong) and banking (HBL, NBP, MCB, UBL, and ABL) from Pakistan, using a cross-sectional design through an anonymous structured questionnaire. All the companies have their own registered company pages on LinkedIn, which are used by almost 80% of staff regularly for business purposes (Raheem & Khan, 2019). A link to an online survey was created in *Qualtrics*, which was later shared with the senior executives via *LinkedIn Messenger*. Before data collection, permission was obtained from the relevant companies to conduct the study in their organizations, and respondents were assured that their responses would remain completely anonymous and strictly confidential. A priori power analysis, with a moderate effect size, i.e., 0.15 (Cohen, 1988), $p < 0.05$, and observed power of 80%, revealed that a sample size of 68 respondents would be adequate for each organization (Faul et al., 2009). The final sample comprised

730 respondents from 10 organizations, and it exceeded the minimum sample size indicated by the a priori power analysis.

A pilot study was conducted before the main survey to assess the clarity and suitability of the questionnaire. Following Cooper and Schindler (2008), a sample of 100 participants was selected from the telecom and banking sectors (i.e., 50 from each sector) to measure whether respondents were able to complete the questionnaire on diverse activities across their respective firms. Accordingly, the questionnaire was pilot tested with the subset of respondents drawn from both sectors to evaluate reliability and relevance, as well as to obtain feedback on item clarity and identify any necessary modifications. Cronbach's alpha was used to assess the items' relevance, reliability, and consistency. The results indicated strong internal consistency with no further revisions required. All the lower-order and higher-order scales had Cronbach alpha values > 0.7 , indicating a high standard of reliability as the literature has suggested (Hair et al., 2019). Thus, the measurement instruments demonstrated satisfactory internal consistency, and the questionnaire was deemed reliable and suitable to proceed to the full-scale data collection phase.

3.2. Measurement of Main Variables and Scales Used

All measurement scales were adapted from established literature and slightly refined to align with the study's context and objectives. The questionnaire had 98 items included in two sections: the first contained 8 items of demographic information about the participants, and the second 90 items that measured five constructs. These constructs, together with the relevant items used in our survey, are spelled out in the Appendix A.

All study variables were measured using established multi-item scales on a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree) (Likert, 1932). Following Y. Wang et al. (2006), digital disruptive innovation (DDI) was operationalized across three dimensions: *technological turbulence*, *market turbulence*, and *competitive intensity*. These dimensions were measured using a total of 15 items. Dynamic core management competence (DCC) was measured across five dimensions, and they were *marketing*, *technological*, *integrative*, *social*, and *service competence*, and used 25 items adapted from prior studies (Z. Wang & Xu, 2017; Yun & Lee, 2017). To understand the participants' views about IWPs, we used five dimensions (i.e., *innovative teamwork*, *innovative training*, *innovative attitude*, *innovative task*, and *innovative knowledge sharing*) with 25 items of IWPs developed by Puente-Palacios et al. (2016), and Yun and Lee (2017). Next, the 5 items that we adapted to measure COVID-19 were originally developed by Conway et al. (2020). Finally, the variable firm performance (FP) is classified as a firm's capacity to meet its *financial*, *customer and internal processes and learning and growth perspectives* (Abuzaid, 2018). To measure the past three years' FP of telecom and banking companies, a 20-item scale was adapted from the literature, and responses were collected from executives regarding their company's performance based on Kaplan and Norton's (1992).

3.3. Control Variables

This study also controls for firm-specific variables, which may influence firm performance. The control variables in this study were chosen based on the pertinent literature to ensure the strength of the results (e.g., Bodlaj & Čater, 2019). Accordingly, firm size, firm age, and industry type were included as control variables in the empirical model.

4. Empirical Results

4.1. Data Analysis

The data were analyzed using SPSS v26 for descriptive and inferential statistics, and AMOS v26 was employed to test the hypothesized causal relationships using structural equation modelling (SEM). Details on the demographics of this study are given in Table 1.

Table 1. Descriptive Statistics of the Demographic Profiles.

Characteristic	Frequency	Percentage
Gender		
Male	607	83.15
Female	123	16.85
Age		
20–29	120	16.44
30–39	466	63.84
40–49	130	17.81
50 years and above	14	1.92
Education		
Bachelor	221	30.27
Master	456	62.47
Other	53	7.26
Sector		
Telecom	360	49.32
Banking	370	50.68
Firm Size (Number of Employees)		
Below 5000	106	14.52
5000–10,000	243	33.29
10,000–15,000	94	12.88
Above 15,000	287	39.32
Organizational Age		
Less than 5 years	47	6.44
5–15 years	99	13.56
More than 15 years	584	80
Job Role		
Manager	198	27.12
IT Manager	110	15.07
Marketing Manager	98	13.42
Operations Manager	190	26.03
Customer Service Manager	134	18.36
Managerial Experience		
1–5 Years	306	41.92
5–10 Years	236	32.33
More than 10 Years	188	25.75
N = 730		

The self-administered online questionnaire was distributed to 800 targeted senior executives in the telecom and banking sectors. A total of 761 responses were completed and received (95.125%), of which 730 were usable, resulting in an effective response rate of 91.25%. The remaining 31 responses (3.875%) were excluded due to excessive neutral responses or limited variability in response patterns and straight-lining, which indicates a potential response bias. Our response rate exceeded 90%, and according to Kog (2019), the minimum response rate for a survey study should be 50%. Carley-Baxter et al. (2009) asserted that the non-response error is negligible, especially when the percentage of the non-response is very little (i.e., 20% or less). Therefore, it was not necessary to conduct the test of non-response bias. Nonetheless, following data cleaning and screening, non-response bias was assessed by comparing 25% of early and 25% of late respondents. No significant differences were observed, suggesting that non-response bias was not a concern

(Ali et al., 2022). Mahalanobis distance was employed to identify multivariate outliers using a significance threshold of $p < 0.001$, as recommended in prior studies (Hair et al., 2019). To declare any value an outlier, the p -value should be < 0.001 (Ghorbani, 2019); as such, no outliers were detected. To assess the potential presence of common method bias, Harman's (1960) single-factor test was conducted. Common Factor Analysis (CFA) examined the possibility of common method bias using Harman's single-factor test. Less than 50% of the variance was accounted for by the first factor or first-order (i.e., 28.64%), which suggests that the data is not afflicted by common method bias (Hair et al., 2019). Furthermore, our data was also found to be normal, as most of the skewness and kurtosis values were within ± 1 , a few within ± 2 (Hair et al., 2019; George & Mallery, 2021). Similarly, multicollinearity was not a concern, as variance inflation factor (VIF) values were below 3 and tolerance values exceeded 0.2 for all variables (Hair et al., 2019). The non-existence of multicollinearity is also another way to rule out common method bias. The linearity assumption was fulfilled with the help of positive and negative significant bivariate correlations (Table 2). In addition to this, the measures of central tendency and correlations are given in Table 2. Table 1 presents the demographic profile of the respondents and shows a balanced representation of the telecom and banking sectors and a predominance of senior managerial roles. In Table 2, the descriptive statistics indicate acceptable distributional properties, with skewness and kurtosis values within recommended thresholds, and no evidence of multicollinearity based on VIF and tolerance values.

Table 2. Descriptive and Correlational Statistics.

No	Scale	M	SD	1	2	3	4	5	Skew	Kurt	VIF	Tol
1	DDI	2.20	0.56	1					0.832	1.671	1.507	0.664
2	DCC	3.92	0.57	−0.488 **	1				−0.959	1.56	2.025	0.494
3	IWP	4.02	0.48	−0.547 **	0.695 **	1			−0.717	0.57	2.176	0.460
4	C19	2.43	0.91	0.212 **	−0.193 **	−0.130 **	1		0.747	0.063	1.062	0.942
5	FP	3.95	0.54	−0.557 **	0.695 **	0.738 **	−0.286 **	1	−0.658	0.059	n. a.	n. a.

N = 730, ** $p < 0.01$, skew = skewness, kurt = kurtosis, Tol = tolerance, n. a. = not applicable.

4.2. Measurement Model Validation

We conducted a confirmatory factor analysis (CFA) to test the reliability and validity of the pre-developed study measures. Hair et al. (2019) recommend checking the fitness of the CFA model by examining three fitness categories, namely, incremental fit, absolute fit, and parsimonious fit, with a minimum of one index from each category. Following Byrne (2016), the model was re-specified to allow theoretically justifiable correlated error terms with modification index (MI) values > 4 , in order to improve model fit. Subsequently, to identify the best-fitting model, we investigated various CFA models (Hair et al., 2019). As shown in Table 3, the five-factor model showed the best fit among the alternate CFA model options, $\chi^2 = 7789$, $df = 3813$, $\chi^2/df = 2.043$, CFI = 0.910, TLI = 0.905, RMR = 0.044, RMSEA = 0.038. The full five-factor model shows superior fit compared to alternative and more constrained models, supporting the distinctiveness of the study constructs. All reported fit indices meet or exceed commonly accepted thresholds, indicating an adequate overall fit of the measurement model.

Table 3. CFA Models Comparison.

Model	χ^2/df	RMR	TLI	CFI	RMSEA
Criteria	<3	<0.08	>0.9	>0.9	<0.08
Single Factor	3.29	0.060	0.790	0.800	0.056
All Predictors + FP	3.092	0.057	0.810	0.818	0.054
DDI–Mediator–Moderators–FP	2.917	0.056	0.826	0.833	0.051
DDI–DCC–Moderators–FP	2.819	0.129	0.835	0.842	0.050
DDI–DCC–IWP–COVID-19–FP	2.043	0.044	0.905	0.910	0.038

Our additional measures on the reliability and validity of the measurement model also showed compliance with the established criteria. Table 4 provides details on indicators' reliability or FL (>0.5), Cronbach alpha or CA (>0.7), composite reliability or CR (>0.7), convergent or AVE (>0.5), and discriminant validity or HTMT (<0.85). Acceptable values are given in parentheses (Hair et al., 2019). It is noted that no indicator reduction was applied. As shown in Table 4, all constructs determine satisfactory internal consistency and convergent validity, with factor loadings, CA, and CR values exceeding recommended thresholds. In addition, the HTMT ratios are below the critical value, confirming adequate discriminant validity among the study constructs. It is, however, noted that although the AVE of COVID-19 is marginally below the 0.50 threshold, we justify its acceptance based on its strong composite reliability. Also, the variation between 0.50 and 0.492 is not statistically significantly different.

Table 4. Reliability and Validity of Measurement Model.

Variable	FL	CA	CR	AVE	HTMT				
					DDI	DCC	IWP	COVID-19	FP
DDI	>0.50	0.894	0.846	0.631	-				
DCC	>0.50	0.948	0.911	0.649	0.532	-			
IWP	>0.50	0.910	0.817	0.672	0.612	0.760	-		
COVID-19	>0.50	0.895	0.894	0.492	0.232	0.210	0.140	-	
FP	>0.50	0.929	0.872	0.630	0.596	0.742	0.806	0.304	-

4.3. Structural Model Analysis

We tested the direct, indirect and total effects of the predictors (i.e., DDI, IWP, DCC) on firm performance (FP) to evaluate hypotheses using the bootstrapping method and 95% confidence intervals, including both the lower bound (LB) and the upper bound (UB), and the significance level set to $p < 0.05$ for accepting or rejecting respective hypotheses. The relationships were modelled and tested using AMOS v26. The results in Table 5 show a significantly negative relationship between DDI and FP ($B = -0.146$, $p = 0.012$, 95% CI $[-0.216, -0.091]$). Therefore, H1 is supported. IWP has a positive and significant influence on FP ($B = 0.387$, $p = 0.008$, 95% CI $[0.306, 0.478]$); thus, H3 is also supported. Next, we find that DDI has a significantly negative impact on FP via Dynamic Core Management Competence (DCC) ($B = -0.023$, $p = 0.005$, 95% CI $[-0.045, -0.010]$), hence, the mediation effect of DCC is documented. However, since DDI has a significant direct impact on FP ($B = -0.079$, $p = 0.006$, 95% CI $[-0.121, -0.051]$), this is a case of 'partial' mediation as per Baron and Kenny (1986). Therefore, these results confirm that H2 is partly supported. Our results also indicate that only 22.55% of the negative effect of DDI on FP is mediated by DCC. We performed Sobel's (1982) test to further support the noted mediation, which suggests a strong indirect influence of DDI on FP via DCC ($z = 5.23$, $p < 0.001$). Hence, H2 is supported with partial mediation. Again, aligned with the literature, we used Industry

Type, Firm Age, and Firm Size as controls, though none of the control factors significantly affected FP. Thus, these controls do not have a confounding influence on FP.

Table 5. Hypothesis Testing—Direct and Mediation Effects.

Path	Estimate	LB	UB	<i>p</i>
DDI → FP	−0.146	−0.216	−0.091	0.012
IWP → FP	0.387	0.306	0.478	0.008
Industry Type → FP	−0.009	−0.058	0.034	0.657
Firm Age → FP	0.009	−0.033	0.056	0.589
Firm Size → FP	0.026	−0.020	0.082	0.306
DDI → DCC → FP Mediation				
Indirect Effect: DDI → DCC → FP	−0.023	−0.045	−0.010	0.005
Total Effect: DDI → FP	−0.102	−0.146	−0.074	0.007
Direct Effect: DDI → FP	−0.079	−0.121	−0.051	0.006

Next, we test the interaction/moderation effect of IWP and COVID-19 on the relationship between DDI and FP. The results in Table 6 show a significant influence of IWP on the relationship between DDI and FP ($B = 0.074$, $p = 0.037$, 95% CI [0.005, 0.125], suggesting a positive moderation effect of IWP. Therefore, H4 is supported. To assess H4 further, the observed interaction impact is plotted (Cohen et al., 2003). Figure 2 demonstrates that the negative effects of DDI on FP are reduced with the increase in the IWP scores. As revealed in Table 6, the slanted slope has weaker effects or relationships at the low levels of the moderator/−1SD of IWP (gradient = −0.146, $t = 6.497$, $p < 0.001$) but stronger effects or relationships at higher levels of the moderator/+1SD of IWP (gradient = −0.072, $t = 2.426$, $p = 0.016$), which confirms that IWP significantly reduces the negative impact of DDI on FP; hence H4 is further supported.

Table 6. Hypothesis Testing—Moderation Effects of IWP and COVID-19.

Path	Estimate	LB	UB	<i>p</i>
DDI × IWP → FP	0.074	0.005	0.125	0.037
DDI × IWP → DCC	0.095	0.022	0.173	0.011
COVID-19 × DCC → FP	0.095	0.020	0.169	0.009
Level	Gradient	<i>t</i> -Value	<i>p</i>	
<i>Conditional Effects of DDI on FP</i>				
Low IWP	−0.146	6.497	<0.001	
High IWP	−0.072	2.426	0.016	
<i>Conditional Effects of DDI on DCC</i>				
Low IWP	−0.162	5.180	<0.001	
High IWP	−0.067	1.976	0.049	
<i>Conditional Effects of DCC on FP</i>				
Low COVID-19	0.265	11.887	<0.001	
High COVID-19	0.360	16.659	<0.001	

Similarly, Table 6 also demonstrates the interaction/moderation effect of IWP on the relationship between DDI and DCC, which is significant ($B = 0.095$, $p = 0.011$, 95% CI [0.022, 0.173]). This suggests that a positive moderation occurred, where IWP significantly reduced the negative impact of DDI on DCC. Thus, H5 is also supported. Following Cohen et al. (2003), we plotted the interaction impact of IWP on the DDI–DCC relationship to confirm H5 further. Figure 3 substantiates that the negative impact of DDI on DCC is reduced with the increase in the scores of IWP. As depicted in Table 6, the slanted slope has weaker effects or relationships at the low levels of the moderator/−1SD of IWP (gradient = −0.162,

$t = 5.180, p < 0.001$) but the slanted slope has stronger effects or relationships at higher levels of the moderator/+1SD of IWP (gradient = $-0.067, t = 1.976, p = 0.049$). This clearly establishes that IWP significantly reduces the negative impact of DDI on DCC. Thus, H5 is further supported.

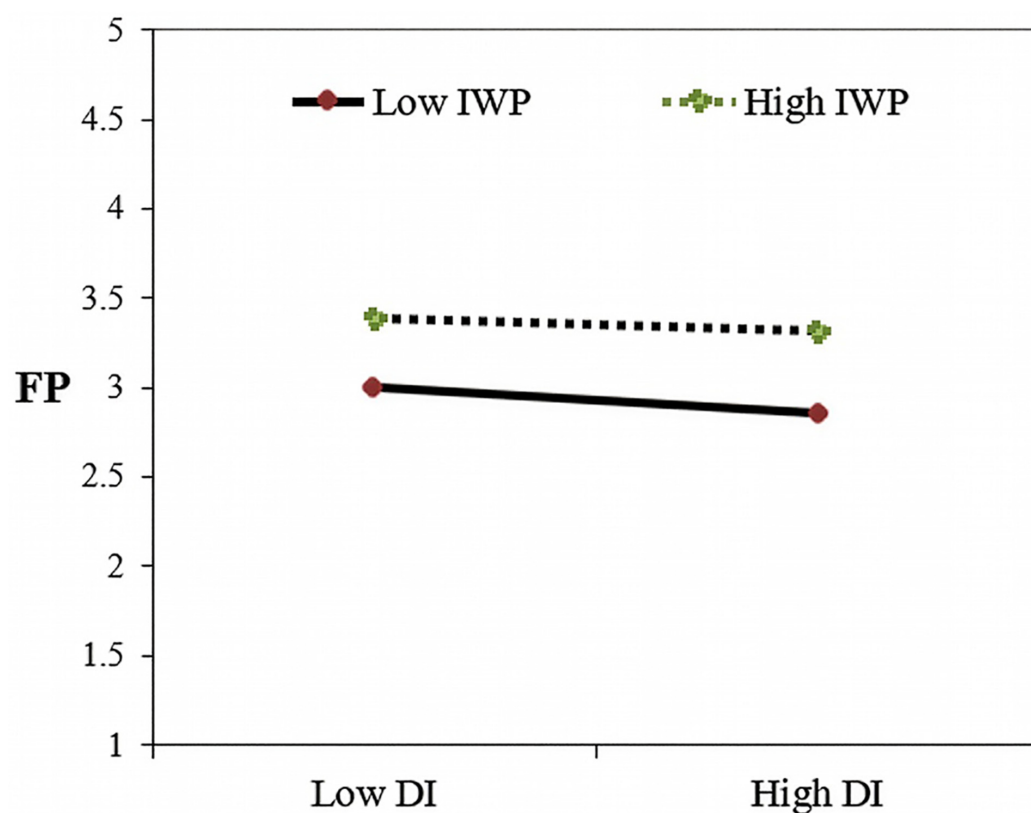


Figure 2. Slope Analysis—DDI-IWP-FP Moderation.

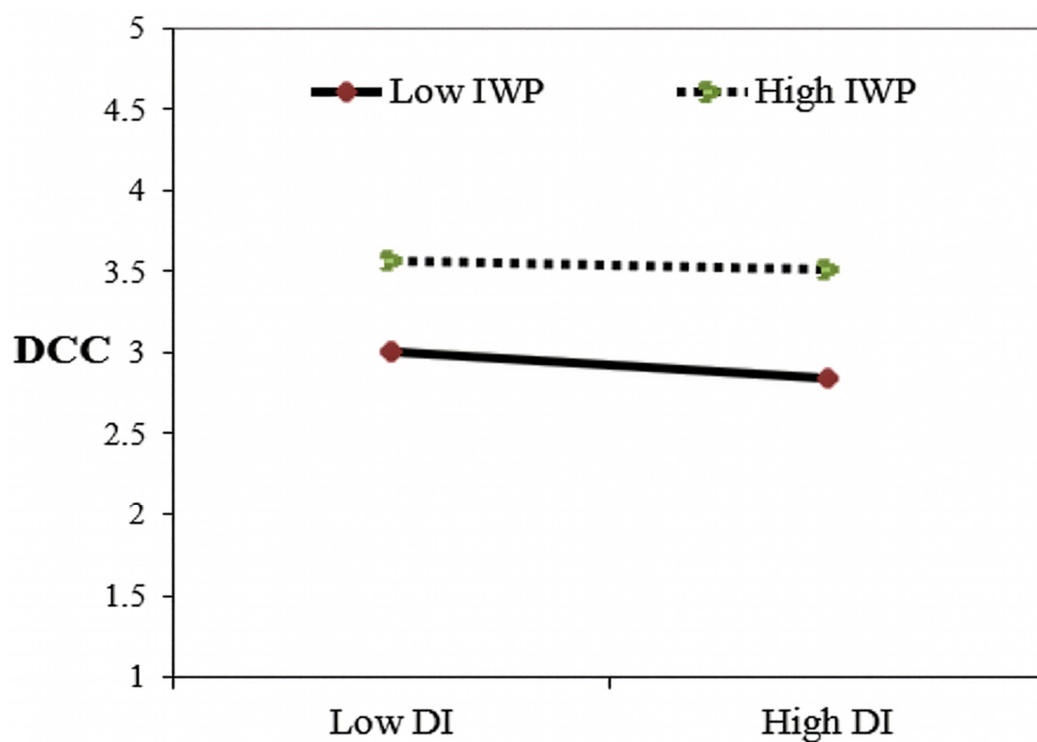


Figure 3. Slope Analysis—DDI-IWP-DCC Moderation.

Further, we check the interaction/moderation effect of COVID-19 on the positive relationship between DCC and FP. The results in Table 6 show that COVID-19 amplifies the positive effect of DCC on FP ($B = 0.095$, $p = 0.009$, 95% CI [0.020, 0.169]). Hence, the moderation of COVID-19 occurred in a positive direction, which supports H6, implying that higher DCC was able to maintain a positive relationship with FP, despite the presence of COVID-19 pandemic as an external shock. To further validate H6, following Cohen et al. (2003), we plotted the interaction impact of the COVID-19 on the relationship between DCC and FP. Figure 4 reveals that the positive effect of DCC on FP increased with the increase in the scores of COVID-19. As shown in Table 6, the slanted slope has weaker effects or relationships at the low levels of the moderator/ $-1SD$ of COVID-19 (gradient = 0.265, $t = 11.887$, $p < 0.001$) compared to the stronger effects or relationships at the higher levels of the moderator/ $+1SD$ of COVID-19 (gradient = 0.360, $t = 16.659$, $p < 0.001$), which indicates that COVID-19 significantly strengthened the positive impact of DCC on FP.

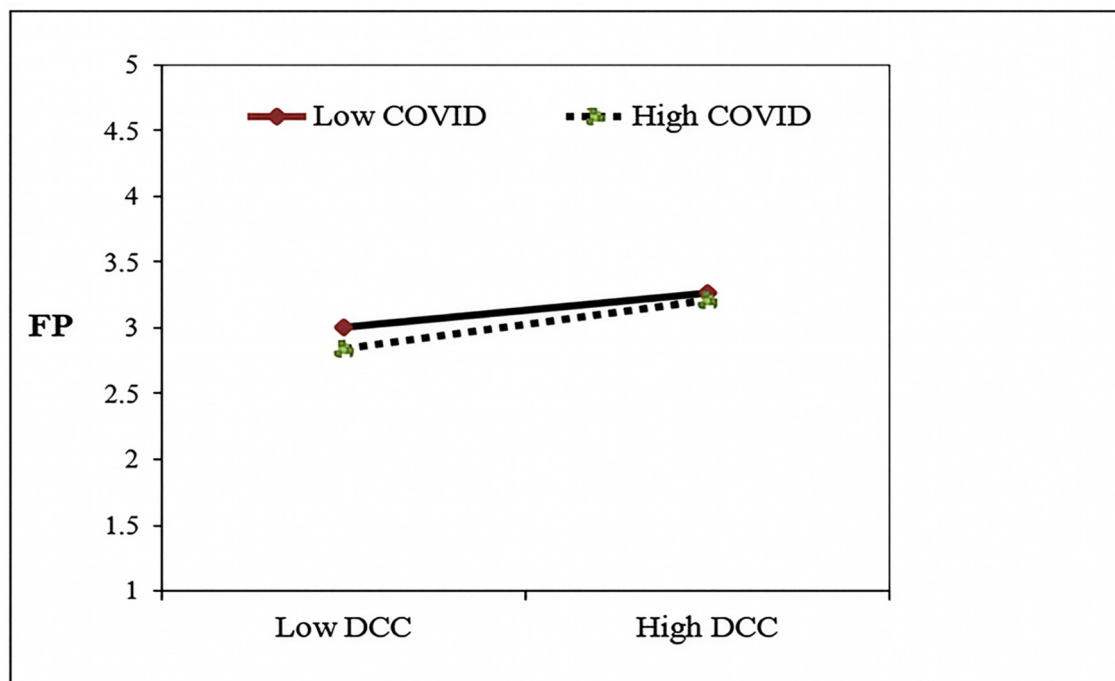


Figure 4. Slope Analysis—DCC–COVID-19–FP Moderation.

5. Discussion of Results

Table 5 provides the results of the SEM for the testing of H1 to H3, while Table 6 presents the results of relevance to H4 to H6. Figure 5 represents the quantified relationships that we found between the variables when considering the sample. As recommended by Hair et al. (2019), we examine the model indices of the SEM model and find fit with the data very well, $\chi^2 = 22.804$, $df = 5$, $\chi^2/df = 4.561$, CFI = 0.992, TLI = 0.925, RMR = 0.014, RMSEA = 0.070; the χ^2/df ratio exceeds 3, but is acceptable because the criterion is <5 , as set by Marsh and Hocevar (1985).

From the results of data analysis, our hypotheses from H1 to H6 are supported by the data. Concerning H1, the finding confirms a direct negative effect of DDI on firm performance, consistent with Arifin (2022), demonstrating that DDI could negatively affect business performance. A critical reflection for incumbents substantiates that DDI is effective and has the potential to continually cause disruption in the market (Tiilikainen et al., 2024; Yasser, 2021), as predicted by disruptive innovation theory. As such, incumbent firms need to accommodate customers' needs while also providing opportunities for innovation. As for Pakistan's telecom and banking sectors, high regulatory constraints, legacy systems,

and uneven digital infrastructure make rapid digital disruption particularly costly for incumbents, thereby amplifying the negative performance effects of DDI.

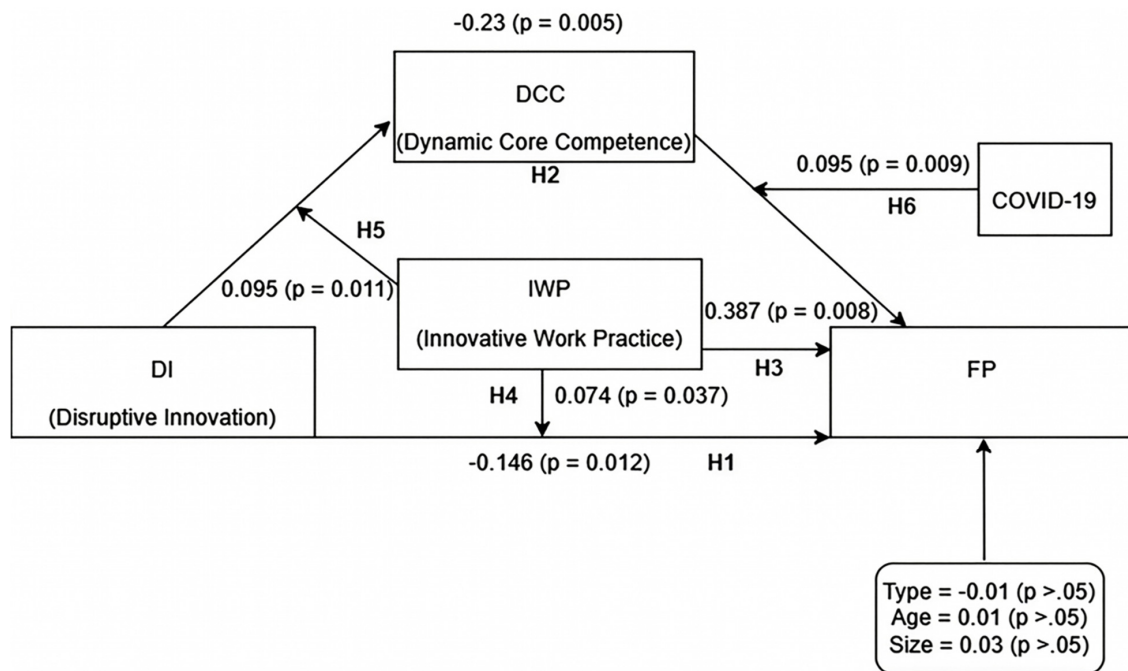


Figure 5. Structural Path Model.

Next, for H2, we find a partial mediation (inverse) effect of DCC contributing to minimizing the negative impact of DDI on FP. Given that DCC has a direct positive effect on performance and DDI has a direct negative effect on both DCC and performance, we document the ‘partial’ mediation effect of DCC in minimizing the negative effect of DDI on FP. Rather than fully offsetting the intensity of the negative nexus between performance and digital disruption, DCC is partially reducing the negative effect of DDI on FP. In other words, this implies that the indirect effect of DDI on performance through DCC is negative. However, the intensity of the negative performance effects associated with DDI depends on the strength of DCC compared to DDI in affecting FP, meaning that while DCC itself improves performance, it is eroded under conditions of high DDI, and vice versa. Although we report a negative indirect effect of DDI on FP via DCC, unlike prior studies, supporting a direct positive association between DCC and FP, extant literature has not focused on the mediator variable (Rotjanakorn et al., 2020). Nevertheless, our evidence shows that incumbent firms cannot control DDI or take precautions to prevent DDI due to a lack in core management competence, i.e., DCC (Roblek et al., 2021).

Again, regarding H3, our results show a direct positive relationship between IWPs and FP, consistent with the finding of Baltrunaite et al. (2021), suggesting that competent senior executives can boost a firm’s productivity if they use IWPs. This is because of implementing a new set of practices in a workplace that combines individual and team-based activities, enabling managers to participate in institutional change, as necessitated by technological disruptions and renewals, either structurally or culturally, and hence improve work quality and FP. Also, IWPs provide employees with training and teamwork opportunities to generate positive work outcomes. Such a direct performance-enhancing effect of IWPs has become essential for employees to use more innovation at work and produce favourable organizational efficiency.

Next, for H4, the positive moderation effect of IWPs on the relationship between DDI and FP that supports H4 indicates critical needs for innovative work practices and the dynamic capability of employees. Such a moderation impact is in line with Alatailat

et al. (2019), denoting IWP to be an effective moderator of the link between timely thinking and success in business. In a similar vein, another finding of moderation of IWP exhibits that IWP positively moderates the negative relationship between DDI and DCC, thus supporting H5. This signifies the likelihood that the negative association between DDI and DCC is weaker when IWP is high. The result aligns with Adim et al. (2018), reporting the positive influence of innovative work strategies on the dynamic capability and efficiency of employees in the hospitality industry. Thus, businesses need to be aware of the risk and consequences of DDIs and prepared to respond successfully through dynamic management skills and innovative teamwork practices. DCC relates to businesses' ability to manage uncertain business environments and guarantees that FP is consistently maintained. Managerial capabilities foresee technological disruptions and their impact on firm performance, which can lead to carrying out organizational transformation so that they work through the development of a new organizational structure, culture, and internal communication strategies. Such a newly innovative set of practices (IWPs) marks a significant shift in the management to improve managerial competence and work quality (DCC), aiming at sustainable high performance (FP). In fact, IWPs emerge as predictors of employees' competencies and then firms' financial performance, which is reflected in their buffering role in reducing the negative impact of DDI on both DCC and FP. The interactive positive effects of IWPs cannot be overemphasized, particularly the results of the first and second moderating effects of IWPs on the inverse relationship between DDI and FP, and DDI and DCC, suggesting that service sector firms must have a thorough understanding of how to establish IWPs and the skills to cope with the challenges of disruptive technologies and achieve success.

Lastly, the moderation of COVID-19 between the DCC and FP relationship provides some unique findings in our study. Prior studies widely document that COVID-19 significantly impaired FP; as such, one would expect an inverse moderation of COVID-19 on the positive association between DCC and FP. However, the moderation effect of COVID-19 in reducing the positive impact of DCC on FP remains valid at the lower levels of DCC, rather than at the higher levels. In other words, with the increase in the COVID-19 pandemic, FP reduced at the lower DCC levels, while FP started to rise at the higher DCC levels. Thus, our H6 is verified, indicating that COVID-19 overruns DCC in affecting FP at lower levels of DCC than at higher levels of DCC. We contend that during COVID-19, both telecom and banking companies increased their DCC to better cope with COVID-19, so DCC proved effective in mitigating the negative effects of COVID-19 on FP. Such an effect of COVID-19, forcing companies to improve their DCC and face the challenge of the pandemic, appeared considerably significant for the sustainable profitability of companies, which is supported by Ndubuisi-Okolo and Igwebuike (2021).

As for Pakistan's telecom and banking sectors, we assert that COVID-19 amplifies the value of DCC primarily at higher competence levels, as firms with well-developed managerial capabilities are better positioned to reconfigure resources, manage uncertainty, and implement adaptive strategies during crisis conditions. In contrast, firms with lower DCC lack the capacity to translate disruption into strategic advantage, resulting in weaker performance outcomes. Further, by treating the pandemic as an external shock that increases the value of dynamic managerial capabilities, we argue that the pandemic enhanced learning activities among employees via online education platforms to improve knowledge of business challenges, on one hand, and contributed towards enhancing creativity during unexpected external environmental crises for better financial outcomes of the firms, on the other hand. As a result, DCC was able to offset the effect of COVID-19 on FP. Another reason could be the construction of the COVID-19 variable based on the most 'influential'

selected items, rather than taking a large range of items related to the pandemic, and the collection of data at a later part of the COVID-19 pandemic.

6. Conclusions and Implications

DDI poses significant challenges to firm performance in tech-intensive service firms due to their inherent nature of innovative products and services but also serves as a catalyzes revolutionary change. DDI drives challenging technological transformation requiring changes in work practices (Kane, 2019), products/services (Chanias et al., 2019), organizational structures (Berghaus & Back, 2017), and organizational identity (Wessel et al., 2020; Kuruppu & Lodhia, 2019). While technological advancement is crucial (Tukina et al., 2020), it has a profound impact on firms' sustainable performance. With this general background in mind, our study investigates the impact of DDI on the sustainable performance of Pakistani telecom and banking firms, and the mitigating role of executive skills and capabilities to overcome the impact of disruptive innovation. Analyzing survey data from 730 Pakistani telecom and banking executives through SEM in AMOS 26.0, we find that DDI negatively affects both FP and DCC, with DCC inversely mediating the DDI-FP nexus. Conversely, IWP positively moderates the DDI-FP and DCC-FP relationships. In addition, COVID-19 moderates the DCC-FP relationship, showing a more pronounced effect at higher DCC levels.

Our study validates that three major dimensions of DDI collectively influence FP in the negative direction. As noted earlier, DDI presents dual challenges for incumbent firms (i) creating barriers via disruptive technologies to hinder firm performance, and (ii) offering opportunities for mitigating the adverse effects of DDI through executive competence (DCC) and innovative work practices (IWPs). We also document that DCC and IWP significantly influence FP through direct and indirect pathways. Specifically, while DCC and IWP are positively affecting FP, DDI directly erodes DCC, resulting in an indirect (mediated) negative effect on FP. In contrast, IWP serves as a positive moderator, mitigating the adverse effects of DDI on both FP and DCC. IWP's moderating effects enhance competitiveness and sustain the performance of incumbent firms. Thus, the roles of DCC and IWP in the context of DDI have been empirically established. Thus, unlike prior studies, by empirically examining these roles within a single SEM, our study uniquely contributes to knowledge by documenting the causal nexus of DDI, DCC, IWP, and FP. It also contributes by showing how employees perceive and mitigate COVID-19's negative impact on performance by increasing DCC.

Again, theoretical implications are also substantiated from the findings of our study. Our results validate DIT (adverse DDI effects), DCT (employee capabilities coping with DDI), and contingency theory (managerial competence and strategies for technological disturbances and new environmental changes like COVID-19). Our findings align with these theories, highlighting that the rapid DDI transformation prompts firms to adapt managerial competencies for improved efficiency and performance, mirroring the work of Ranieri et al. (2024) in the context of COVID-19. Thus, our study contributes an integrated understanding of these theories, addressing a gap in the literature regarding incumbent firms in an emerging economy.

Furthermore, this study bridges the lack of knowledge and empirical evidence in understanding the importance of managerial competence and practical application. Our study addresses the dynamic competence gap (e.g., technological, service, social) created by DDI and offers insights into how incumbents can navigate and excel in disruptive environments (Nicolas-Agustin et al., 2022). The findings underscore the critical value of IWPs and DCC as drivers of performance of incumbent firms in disruptive settings. In order to survive and thrive in today's business world, managers must proactively foster

dynamic competence, a supportive work environment, and innovative practices. IWPs are crucial, especially in fast-paced service sectors like Pakistani telecom and banking, which are undergoing massive digital disruption and require new service strategies to ensure executive competence. Finally, we also emphasize the importance of understanding managers' perspectives during volatile situations like the pandemic and the role of DCC and IWPs in crisis management. Overall, these insights provide a roadmap for service firms to refine policies and enhance managerial competence, and IWPs in the face of DDI.

Despite limited research on causal relationships between DDI, DCC, IWP, COVID-19, and FP in Pakistan's telecom and banking sectors, our findings validate the structural model, offering a unique opportunity to observe the impact of DDI, DCC, IWPs, and COVID-19 (i.e., direct, indirect (mediated and moderated)) on FP. The application of a path model design in SEM is confirmed, adding to the accuracy of the empirical dynamics of this study. Nevertheless, our study has some limitations, such as a cross-sectional data design and non-proportional gender representation within the sample from executives in two Pakistani service sectors. Additional limitation arises from reliance on single-informant and self-reported data design, where all key constructs (DDI, DCC, IWPs, COVID-19 impact, firm performance) are measured via self-report from the same respondents, leading to common method variance and potential reverse causality concerns. Moreover, there may be a potential selection bias, as executives active on LinkedIn and willing to respond may differ from non-respondents. Another limitation could be the absence of objective performance indicators, as the variable firm performance (FP) is classified as a firm's capacity to meet its financial, customer, and internal processes and learning and growth perspectives, rather than accounting-based or market-based financial performance indicators. These limitations suggest future research based on longitudinal or multi-source designs, as well as replications in other sectors or emerging economies with different regulatory and digital trajectories. Therefore, more research is needed to address these limitations and further enrich the literature. While caution is warranted, these findings may be generalizable to similar service sectors across the globe, particularly in emerging markets with comparable institutional features. Thus, the empirical evidence of the study can inform managers, policymakers, investors, and stakeholders as they re-evaluate the impact of DDI on FP across sectors in many countries.

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Institutional Review Board Statement: This study was conducted in accordance with the NHMRC National Statement on Ethical Conduct in Research in Australia and approved by the Human Research Ethics Committee of the University of New England, Australia (Approval No.: HE21-206 and date of approval: 22 September 2021).

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability Statement: The data presented in this study are available on request from the corresponding author due to privacy and ethical reasons.

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Conflicts of Interest: The authors declare no conflicts of interest.

Appendix A

Table A1. Coding sheet and items sources.

Construct	Dimension	Item	Code	Scale	Source
<i>Demographic Profile</i>	-----	Gender	-	1–2	-
		Age	-	1–4	-
		Education	-	1–3	-
		Working sector (Telecom)	-	1–5	-
		Working sector (Bank)	-	1–5	-
		Firm size	-	1–4	-
		Firm age	-	1–3	-
		Managerial experience	-	1–3	-
		Role	-	1–5	-
<i>Scale for Firm Performance (FP)</i>	Financial Perspective	Our company's market share of service increased over the last three years	FP11	1–5	Mafini and Poee (2013), Flynn et al. (2010)
		Our company's efficiency of generating net profit increased over the last three years	FP12	1–5	Mafini and Poee (2013), Flynn et al. (2010)
		Our company's technological efficiency improved over the last three years	FP13	1–5	Mafini and Poee (2013), Flynn et al. (2010)
		Our company's human expertise developed over the last three years	FP14	1–5	Mafini and Poee (2013), Flynn et al. (2010)
		Our company's sale of products and services increased over the last three years	FP15	1–5	Mafini and Poee (2013), Flynn et al. (2010)
	Customer Perspective	Our company experienced continuous growth in customers in the last three years	CP21	1–5	Mafini and Poee (2013)
		Our company provided high-quality services to customers over the last three years	CP22	1–5	Mafini and Poee (2013)
		Our company fulfill customer service demands on time	CP23	1–5	Mafini and Poee (2013)
		Our company supports corporate and social values such as sincerity, customer care, employee engagement, and governance	CP24	1–5	Mafini and Poee (2013)
		Our customers' feedback is good and satisfactory	CP25	1–5	Mafini and Poee (2013)
	Internal Process Perspective	Our employees possess necessary knowledge, expertise and technological skills to do their job well.	IPP31	1–5	Mafini and Poee (2013)
		Our company implements effective marketing strategies	IPP32	1–5	Mafini and Poee (2013)
		Our company promotes professional ethics and code of conduct for employees	IPP33	1–5	Mafini and Poee (2013)
		In our company, transparency and accountability is a key priority to improve governance.	IPP34	1–5	Mafini and Poee (2013)
		Our company is well equipped with handling IT related security threats and other associated risks	IPP35	1–5	Mafini and Poee (2013)
	Learning and Growth Perspective	Our company has qualified employees to maintain a prompt delivery of service to customers.	LGP41	1–5	Mafini and Poee (2013)
		Our company maintains a solid career progression system for skilled employees	LGP42	1–5	Mafini and Poee (2013)
		Our employees' turnover rate is less than other sectors	LGP43	1–5	Mafini and Poee (2013)
		Our company gives sufficient opportunity to employees to participate in training and professional development programs	LGP44	1–5	Mafini and Poee (2013)
		Our company adopts new technology on a regular basis	LGP45	1–5	Mafini and Poee (2013)

Table A1. Cont.

Construct	Dimension	Item	Code	Scale	Source
Scale for Disruptive Innovation (DI)	Technological Turbulence	The positive and negative impact of technological changes on our business is high	TT1	1–5	Song et al. (2005), Y. Wang et al. (2006)
		In our industry, technological changes provide many opportunities such as cryptocurrency, data analytics and artificial intelligence.	TT2	1–5	Y. Wang et al. (2006)
		It is challenging to manage technological developments in our sector.	TT3	1–5	Song et al. (2005), Jaworski and Kohli (1993)
		Our company needs more investment in R&D to compete well and stay in the market	TT4	1–5	Song et al. (2005), Jaworski and Kohli (1993)
		New technological developments can carry big risks if our company fails to response	TT5	1–5	Song et al. (2005), Jaworski and Kohli (1993)
	Market Turbulence	New developments in technology create market pressure in losing customers.	MT1	1–5	Y. Wang et al. (2006)
		It is difficult to predict changing demands and tastes of consumers	MT2	1–5	Y. Wang et al. (2006)
		Our competitors are highly unpredictable as the competition in the industry is very intense	MT2	1–5	Y. Wang et al. (2006)
		Customers' preferences of products or services change with time	MT2	1–5	Jaworski and Kohli (1993)
		Our customers look for new products or services all the time	MT2	1–5	Jaworski and Kohli (1993)
	Competitive Intensity	Service-based competition in our industry is rising	CI1	1–5	Jaworski and Kohli (1993)
		There are many marketing related "promotion wars" among our industry constituents	CI2	1–5	Jaworski and Kohli (1993)
		If our company adopts a new technology, other competitors also try to adopt that	CI3	1–5	Jaworski and Kohli (1993)
		Price-based competition is very common in our industry	CI4	1–5	Jaworski and Kohli (1993)
		Our competitors are targeting to develop new products/services	CI5	1–5	Jaworski and Kohli (1993)
Scale for Dynamic Core competence (DCC)	Marketing Competence	We are very competent in responding to customers' needs and services	MC1	1–5	Y. Wang et al. (2004)
		We are very competent in communicating with customers about their needs	MC2	1–5	Y. Wang et al. (2004)
		We are very competent in finding and judging our competitors' strengths and weakness	MC3	1–5	Y. Wang et al. (2004)
		We are very competent in making and maintaining long term customer relationship	MC4	1–5	Y. Wang et al. (2004)
		We are very competent in handling business threats in an intensely competitive market	MC5	1–5	Y. Wang et al. (2004)
	Technological Competence	We make high investments in R&D and product/service innovation	TC1	1–5	Y. Wang et al. (2004)
		We have strong skills to manage new technology and innovation	TC2	1–5	Y. Wang et al. (2004)
		Our employees get regular training to refresh and improve their skills	TC3	1–5	Y. Wang et al. (2004)
		We have the ability to predict future technological trends	TC4	1–5	Y. Wang et al. (2004)
		Our company leads in new technology adoption than our rival companies	TC5	1–5	Y. Wang et al. (2004)

Table A1. Cont.

Construct	Dimension	Item	Code	Scale	Source
Scale for Dynamic Core competence (DCC)	Integrative Competence	We have the necessary skills to share technical knowledge among different departments	IC1	1–5	Y. Wang et al. (2004)
		We have the necessary skills to add new technology to our products and services	IC2	1–5	Y. Wang et al. (2004)
		We welcome customers' ideas and feedback on our new products and services	IC3	1–5	Y. Wang et al. (2004)
		We have the necessary skills to increase value for customers by offering excellent products/services	IC4	1–5	Y. Wang et al. (2004)
		We adopt a team-based approach to complete projects successfully	IC5	1–5	Y. Wang et al. (2004)
	Social Competence	I feel comfortable around all types of people	SC1	1–5	Yun and Lee (2017)
		Our company protects employees from workplace violence and harassment	SC2	1–5	Yun and Lee (2017)
		I can adjust my behaviour in any situation	SC3	1–5	Yun and Lee (2017)
		I can communicate with others easily and effectively	SC4	1–5	Yun and Lee (2017)
		I can judge others by observing their behaviour	SC5	1–5	Yun and Lee (2017)
	Service Competence	I am confident and willing to provide quality services to customers proactively	SVC1	1–5	Z. Wang and Xu (2017)
		I know effective ways of providing customers with satisfactory services	SVC2	1–5	Z. Wang and Xu (2017)
		I am skilled and experienced at solving all customers' issues	SVC3	1–5	Z. Wang and Xu (2017)
		It is very easy for me to deliver satisfactory services to customers	SVC4	1–5	Z. Wang and Xu (2017)
		I am proactive in communicating when dealing with customer issues	SVC5	1–5	Z. Wang and Xu (2017)
Scale for Innovative work practices (IWPs)	Innovative Teamwork	Teamwork produces high-quality services for customers in my organization	ITE1	1–5	Puente-Palacios et al. (2016)
		My organization encourages teamwork for achieving high employee performance	ITE2	1–5	Puente-Palacios et al. (2016)
		Teamwork is highly productive in my organization	ITE3	1–5	Puente-Palacios et al. (2016)
		Employees meet targets more easily through teamwork	ITE4	1–5	Puente-Palacios et al. (2016)
		In my organization teamwork efficiently responds to customer requests	ITE5	1–5	Puente-Palacios et al. (2016)
	Innovative Training	My attitude and behaviour changes after attending several staff training session	ITR1	1–5	Ferraz and Gallardo-Vazquez (2016)
		In my organization employee training improves quality of work output	ITR2	1–5	Ferraz and Gallardo-Vazquez (2016)
		In my organization employee training improves my work efficiency	ITR3	1–5	Ferraz and Gallardo-Vazquez (2016)
		Employee training increases my satisfaction in the job	ITR4	1–5	Aziz (2015)
		My personal skills at work improve when I attend in-person staff training	ITR5	1–5	Mitki and Herstein (2007)

Table A1. Cont.

Construct	Dimension	Item	Code	Scale	Source
Scale for Innovative work practices (IWP)	Innovative Attitude	I openly discuss my career and promotion extension with my boss	IA1	1–5	Ettlie and O’Keefe (1982)
		I am efficient in supervising office employees	IA2	1–5	Ettlie and O’Keefe (1982)
		I want a good status in my organization	IA3	1–5	Ettlie and O’Keefe (1982)
		I give opinions in staff meetings and decision making processes	IA4	1–5	Ettlie and O’Keefe (1982)
		I work with teams to lead and solve complex problems	IA5	1–5	Ettlie and O’Keefe (1982)
	Innovative Task	I am creative at my work	ITA1	1–5	Tierney et al. (1999)
		I take risks of trying new ideas in doing my job	ITA2	1–5	Tierney et al. (1999)
		I adopt an innovative approach to solve any problems at work	ITA3	1–5	Tierney et al. (1999)
		I often come up with innovative ideas in my work	ITA4	1–5	Tierney et al. (1999)
		I encourage my colleagues to practice innovative tasks such as client handling, idea generation	ITA5	1–5	Tierney et al. (1999)
	Innovative Knowledge Sharing	I often share knowledge with colleagues in my organization	IKS1	1–5	Yun and Lee (2017)
		I share my new skills gained through staff training with other colleagues	IKS2	1–5	Yun and Lee (2017)
		I often share work documents and important information with other colleagues	IKS3	1–5	Yun and Lee (2017)
		Our employees participate in different activities such as sports, cultural, office party	IKS4	1–5	Singh and Power (2014)
		Employees at my organization work in teams and engage with knowledge sharing	IKS5	1–5	Singh and Power (2014)
Scale for COVID-19 Pandemic	-----	The COVID-19 pandemic has impacted negatively on our company business	CP1	1–5	Conway et al. (2020)
		The COVID-19 pandemic has affected my ability to work effectively	CP2	1–5	Conway et al. (2020)
		The COVID-19 pandemic has affected my satisfaction and motivation at work	CP3	1–5	Conway et al. (2020)
		The COVID-19 pandemic has impacted on my financial position	CP4	1–5	Conway et al. (2020)
		The COVID-19 pandemic has impacted negatively on my mental/psychological health	CP5	1–5	Conway et al. (2020)

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