Pandemic Pandemonium and Remote Working: An Investigation of Determinants and Their Contextual Behavior in Virtualization of Work-From-Home (WFH) Process

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Abstract. Disruption at the physical workplace, developed by threats like the coronavirus, triggers revisiting old assumptions and exploring opportunities for new ways of remote working. With the global epidemic spreading, businesses are gearing up with the managers and their respective teams to work from home (WFH). This research has offered a setting for advancing understanding of virtualization of WFH process by exploring the factors that enable or constrain the information and communication technology (ICT) enabled virtualization of processes in employee's WFH process through empirical support for the process virtualization theory (PVT). Setting pandemic outbreak as a context, outcome of this research is reliant on two independent studies conducted to examine the influencing factors. First study conducted just before the onset of pandemic outbreak, found that parts of the constructs proposed in the PVT had expected outcomes regarding the characteristics of process virtualization. Contrary to this, second study conducted after pandemic outbreak found that major constructs proposed in the PVT behaved otherwise regarding the characteristics of process virtualization. To fill the gaps in empirical knowledge, the enablers and inhibitors so found together may be motivations to anticipate business organizations and their workforces to experiment with this form of work process, predominantly improved flexibility for organizations and employees, improved productivity, quicker responsiveness to the needs and unexpected man-made and natural disasters, lower absenteeism, improved employee retention, greater cost control, along with more general social benefits.

Keywords: Work from home (WFH) process, information and communication technology (ICT), process virtualization theory (PVT)

1   Introduction

Disruption at physical work place, developed by threats like the coronavirus, triggers revisiting old assumptions and exploring opportunities for new ways of remote working

to stay ahead. With the global epidemic spreading, businesses are gearing up with the managers and their respective teams to work from home (WFH). The vision of having to work from home is becoming progressively more likely for a comprehensive swath of employees resulting into the disruption of modes and means of communication, team dynamics, work patterns etc. Although all processes do not qualify to be virtualized (Overby, 2008), imagination of life has now become implausible discounting online processes (Balci et al., 2014). Extant literature has acknowledged multiple factors influencing the IT-enabled virtualization of several services by extensively adopting various theoretical lenses like, the diffusion of innovation theory (Roberts et al., 2004; Beaudry et al., 2005; Agrawal, 2015), the technology acceptance model (Davis, 1989; Baker, 2010), the unified theory of acceptance and use of technology (Davis, 1989; Venkatesh et al., 2003; Kim et al., 2009; Dwivedi et al., 2019), the task-technology fit theory (Goodhue et al., 1995; Dennis et al., 2000), and the theory of planned behavior (Ajzen et al., 1992; Kim, 2010). There have been extensive use of these theoretical lenses in association with the acceptance of ICT-enabled activities for an individual level. Information systems (IS) literature is silent in measuring the process level and its associated requirements in remote working context.

Initially, this study began just before the onset of pandemic outbreak to understand the influencing factors on the ICT-enabled virtualization of WFH process but soon after the announcement of COVID-19 as a pandemic by World Health Organization (WHO), further extended to examine the behavior of identified factors at the intersection of separate contexts, first in pre-pandemic time and second after pandemic outbreak. This research also intends to assess whether derived factors behave as context-resistant stable factor(s) or context-driven dynamic factor(s) that can contribute to the body of knowledge in dynamic capability of firms, especially relating to remote working. These lead to the research questions *(i) what are the factors that influence the ICT-enabled virtualization of processes in employees' work-from-home (WFH) process?, and (ii) is/are the assessed factor(s) context resistant stable factor(s) or context driven dynamic factor(s)?*

Drawing upon the process virtualization theory (PVT) for evaluating determinants quantitatively, current study is investigating the factors that impact the ICT-enabled virtualization of processes in employee's WFH process. The rationale behind choosing it as analytical lens is grounded on its explaining and worthy concepts to measure which physical processes can (not) be virtualized and are (not) appropriate for online platforms than others (Overby, 2008). Outcomes are expected to add valuable insight in to the current body of knowledge in literature pertaining to PVT and remote working.

2   Theoretical background

Historically, replacements to traditional commuting immediately became important subsequent to the world oil crisis of 1970 when the concept of technology enabled remote working process became a widespread focus for academic debate (Baruch et al., 2000). Development of technologies in the last quarter of twentieth century facilitated the commercial usage of the Internet along with email and other communication tools

and made the commuting more sustainable (Siha et al., 2006). Rapid developments in technologies and associated IT infrastructure in this century has made it more affordable and accessible thereby accelerating attention towards the technology enabled virtual working process (van Winden et al., 2004; Roukis, 2006). In order to be successful, organizations in current times need to respond and operate in a dynamic work environment by offering better service beyond traditional business hours, attracting and retaining capable workforce in a close fitting labor market and reacting to the changing global demographic with respect to the workforce (Scholefield, 2009).

Disaster, like Covid-19, is a sudden event with widespread disruptive consequences. It has disrupted the setting of work, creating an ethos of ambiguity with shifting priorities for individuals as well as organizations. Technology enabled work from home (WFH), when considered in current context, is gradually endorsed as an effective means to restore and ensure operational capacity in complicated disaster environments (Alvaro et al., 2011). Moreover, it enables a relocation of available work tasks across distributed workforces when allocated work locations are inaccessible (due to geographical lockdown) and hazardous (due to virus transmission). For organizations that operate under such circumstances, WFH plays a critical role in ensuring the continuation of tasks at hand (Noelle Donnelly et al., 2015). Influential factors for ICT-enabled virtualization of WFH process is arguably non-existent in academic research. As current study first aims to investigate the factors that impact the ICT-enabled virtualization of processes in employees' WFH process, the term 'work-from-home (WFH)' in this study is used in alignment with the terms used by other scholars in the literature (Morgan, 2004; Sanchez et al., 2007) and express it as 'full-time paid employees conducting their jobs from home using information and communication technologies (ICT).'

3   Research model

A process, as defined in the literature of PVT, is a group of multiple steps meant to accomplish an objective of a phenomenon (Overby, 2008). It is either physical or virtual. In physical process there is physical interaction between people or between people and objects. On the other hand in virtual process there is no physical interaction between people or between people and objects. Process virtualization is the setting in which a physical process shifts to a virtual process. The rationale behind choosing PVT as analytical lens is grounded on its explaining and worthy concepts to measure which physical processes can (not) be virtualized and are (not) appropriate for being conducted online than others (Overby, 2008). Few studies (Balci et al., 2014; Graupner et al., 2015; Ofoeda et al., 2018) have been identified from the literature for its applicability in several other contexts. Thus it provides the ideal beginning point for investigating the WFH process between employee and employer.

Process virtualization theory proposes the independent variables in two groups, first group constitutes the characteristics of the process and second group constitutes the characteristics of the virtualization mechanism. First group is further comprised of sensory requirements, relationship requirements, synchronism requirements, and identification and control requirements. Considering all other things constant, these constructs are perceived to have resistance on process virtualizability. Here sensory requirements

refer to the "need for process participants to be able to enjoy a full sensory experience of the process and the other process participants and objects. Sensory experience of the process includes seeing, hearing, smelling, touching, and tasting" (Overby, 2008). The lesser the sensory requirements of a process, the greater is the amenability of the process to being conducted virtually and vice-versa. Below hypothesis is established.

H1: The higher the sensory requirements of the WFH process, the lower is the amenability to being conducted virtually and vice versa.

Relationship requirements state "the need for process participants to interact with each other in a social or professional context" (Overby, 2008). Social interactions among people leverage knowledge, grow trust and develop friendship (Overby, 2008). In general, relationships in physical settings are resilient and more advanced and therefore negatively influence the intention to practice processes online (Balci, 2014). Building upon these results, below hypothesis is established.

H2: The higher the relationship requirements of the WFH process, the lower is the amenability to being conducted virtually and vice versa.

Synchronism requirements refers "the degree to which the activities relating to a process need to follow immediately with minimal delay" (Overby, 2008). In physical process participants and objects can interact usually without any delay. Therefore more the synchronism requirements relating to a process, less likely the process is to being conducted virtually and vice versa. Building upon all these outcomes into the WFH perspective, below hypothesis is established.

H3: The higher the synchronism requirements of the WFH process, the lower is the amenability to being conducted virtually and vice versa.

Next independent variable representing the characteristics of the virtualization mechanism is identification and control requirements. It refers "the degree to which process participants need credentials of other process participants and the capability to regulate their behavior" (Overby, 2008). As physical inspection of others to endorse their identity cannot be done by process participants in processes which are virtual they are susceptible to identity deception and control difficulties. Building upon these, following hypotheses are established.

H4: The higher the identification requirements of the WFH process, the lower is the amenability to being conducted virtually and vice versa.

H5: The higher the control requirements of the WFH process, the lower is the amenability to being conducted virtually and vice versa.
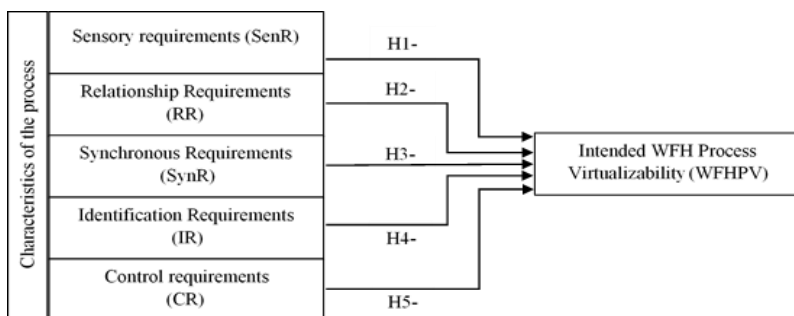

Fig. 1. Research model for WFH process virtualization (adapted and modified from Overby, 2008)

4   Research methodology

Measurement items for this research were adapted from the review of extant literature (Balci, 2014b; Barth et al., 2011b; Overby et al., 2008; Overby et al., 2010; Balci et al., 2013; Venkatesh et al., 2003; Graupner et al., 2015) with appropriate revision to ensure the consistency of the survey items in line with the setting of current study. For the purpose of this study all measurement items were developed and ranked on a five-point Likert scale from strongly disagree (1) to strongly agree (5) (Likert, 1932).

Post pilot study, for the exploration of the PVT in the employee's work from home context, final sample data using same survey instrument for both studies, Study-1 and Study-2, were collected through online setting from managers and business executives representing leading service sector organizations across India. To have a representative sample for the Study-1 (pre-pandemic time), 154 (40.2%) questionnaires out of 383 were received (Oct-Nov 2019) and for Study-2 (representing pandemic time), a total of 516 participants were targeted (Apr-May 2020) and 296 (57.4%) questionnaires were considered further.

5   Data analysis and findings

Table 1 represents the demographic distribution and sample characteristics of the respondents involved in both studies. Structural equation modelling (SEM) with partial least squares (PLS) regression is used for the evaluation of proposed model in SmartPLS 3.0 (Hair et al., 2017), as presented in Table 3, 4 and 5.

Table 1. Summary of demographic statistics (Study-1 and Study-2)

Category	Study-1		Study-2	
	Number	Percent	Number	Percent
Gender				
Male	96	62.3	153	51.7
Female	58	37.7	143	48.3
Age (years)				
<=30	44	28.6	60	20.3
31-45	58	37.7	128	43.2
46-60	38	24.7	62	20.9
>60	14	9.1	45	15.2
Education				
Professional	36	23.4	55	18.6
Masters	54	35.1	130	43.9
Bachelors	47	30.5	60	20.3
Others	17	11.0	51	17.2
Work experience (years)				
<=10	99	64.3	172	58.1
>10	55	35.7	124	41.9
Firm age (years)	*Percent (%)*			
	Study-1		Study-2	
<=10	29.2		22.6	
11-20	27.9		38.9	
21-30	26.6		25.3	
>30	16.2		13.2	

Table 2. Constructs, item description, and factor loading (Study-1 and Study-2)

Construct and item description	Factor loading (***p<0.001)	
	Study-1	Study-2
Sensory requirements (SenR)		
SenR1: While working on official assignments it is important to me to see the relevant documents holding their hardcopies in hand	0.980***	0.876***
SenR2: I intend to see and listen to the concerned office colleagues and clients physically while working on official assignments	0.982***	0.733***
SenR3: It is not important to me to utilize office infrastructure while performing my job duties (reverse)	0.943***	0.947***
Relationship requirements (RR)		
RR1: To me, the social and professional interaction with the concerned office colleagues and clients is necessary and important	0.906***	0.793***
RR2: I like seeing and talking to the concerned office colleagues and/ or clients	0.899***	0.759***
RR3: I intend to establish a personal relationship with my office colleagues and/ or clients	0.906***	0.893***
RR4: Individual interaction with my office colleagues and/ or clients is not important to me while following the WFH process	0.900***	0.888***
Synchronism requirements (SynR)		
SynR1: I get bothered if the processing does not start straightaway with the availability of input	0.934***	0.981***
SynR2: I like to receive immediate confirmation of the input submission without delay via any form of mail or acknowledgements	0.957***	0.972***
Identification requirements (IR)		
IR1: To me, it is necessary to verify my identity while conducting ICT-enabled WFH process	0.985***	0.907***
IR2: Authentication tools are important to me in ICT-enabled WFH process	0.979***	0.923***
Control requirements (CR)		
CR1: I have restricted command over my official data and information while conducting the ICT-enabled WFH process	0.952***	0.927***
CR2: When conducting the ICT-enabled WFH process I get worried to think about losing my personal/official data and information by clicking the inappropriate link(s)	0.937***	0.944***
Intended ICT-enabled virtualization of WFH process (WFHPV)		
WFHPV1: In future I expect to use the ICT for the WFH process	0.868***	0.864***
WFHPV2: In future I intend to explore the ICT use for the WFH process	0.948***	0.950***
WFHPV3: Given a choice I would like to use the ICT while conducting the WFH process	0.700***	0.690***
WFHPV4: I will rate the ICT use for the WFH process as satisfactory	0.944***	0.946***

Table 3. Outcomes of Cronbach's α, Composite Reliability and AVE (Study-1 and Study-2)

Constructs	*Study-1*			*Study-2*		
	α	CR	AVE	α	CR	AVE
SR	0.879	0.943	0.892	0.822	0.891	0.734
RR	0.963	0.982	0.964	0.858	0.902	0.698
SynR	0.896	0.925	0.759	0.952	0.976	0.953
IR	0.926	0.947	0.816	0.806	0.911	0.837
CR	0.967	0.979	0.938	0.858	0.933	0.875
WFHPV	0.882	0.944	0.894	0.893	0.924	0.754

CR=Control requirements; IR=Identification requirements; SynR=Synchronous requirements; RR=Relationship requirements; SenR=Sensory requirements; WFHPV=WFH process virtualization

Table 4. Outcome of discriminant validity (Study-1 and Study-2)

Constructs	Study-1						Study-2					
	CR	IR	SynR	RR	SenR	WFHPV	CR	IR	SynR	RR	SenR	WFHPV
CR	.944						.935					
IR	.387	.982					.434	.915				
SynR	.603	.419	.945				.050	.323	.976			
RR	-.007	-.079	-.192	.903			.033	-.008	.473	.835		
SenR	.605	.438	-.158	.054	.969		-.028	-.231	.416	.052	.857	
WFHPV	.303	.477	-.162	.075	.944	.871	-.139	-.281	-.150	.616	-.087	.868

In the model (Figure 2 and Figure 3), results show that all hypothesized paths in both studies are significant. As shown in Table 5, identification requirements and control requirements are found to have significant positive effects on intended WFH process virtualization. Further, the R-square value of 0.574 demonstrates that good variance can be explained.

Table 5. Statistical analysis outcome (Study-1)

Constructs	β coefficients	P-value	Result
SR -> WFHPV	-0.460	<0.001	H1:Supported
RR -> WFHPV	-0.097	<0.05	H2:Supported
SynR -> WFHPV	-0.280	<0.05	H3:Supported
IR ->WFHPV	0.586	<0.001	H4:Not supported
CR -> WFHPV	0.522	<0.001	H5:Not supported
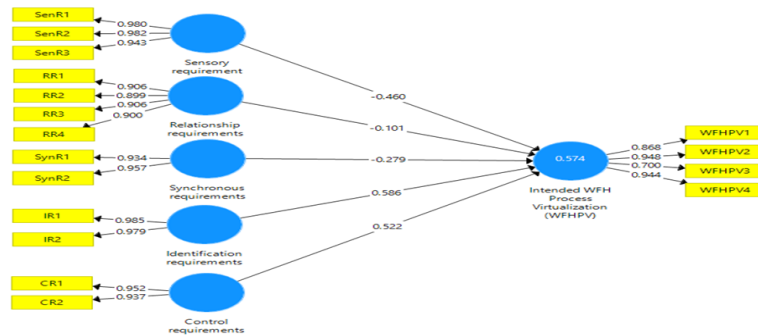
Fig. 2. PLS-SEM result showing β-coefficient and R-square values (Study-1)

As shown in Figure 3 and represented in Table 6, sensory requirements, relationship requirements and identification requirements are found to have significant positive effects on WFHPV. The R-square value of 0.658 demonstrates that good variance can be explained in the dependent variable.

Table 6. Statistical analysis outcome (Study-2)

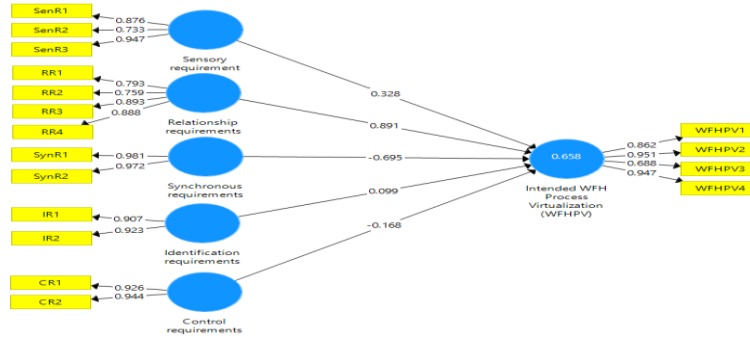| Constructs	β coefficients	P-value	Result
SR -> WFHPV	0.328	<0.001	H1:Not supported
RR -> WFHPV	0.891	<0.001	H2:Not supported
SynR -> WFHPV	-0.695	<0.001	H3:Supported
IR ->WFHPV	0.099	<0.01	H4:Not supported
CR -> WFHPV	-0.168	<0.001	H5:Supported

Fig. 3. PLS-SEM result showing β-coefficient and R-square values (Study-2)

6   Discussion

This paper takes the increasing use of ICT-enabled virtualization of WFH as motivation and uses a theoretical foundation of PVT to understand the context driven dynamic factors influencing intended virtualization of WFH process. Being one of the recent IS theories, this research provides novel empirical setting for a native IS theoretical lens that remains untested so far in WFH context in general and in particular assesses the context driven dynamic factors influencing intended virtualization of WFH process. Upon analysis, findings from Study-1 are mostly in agreement to the original PVT and other prior studies (Barth et al., 2011b; Overby, 2008; Balci et al., 2013; Balci, 2014). Whereas results from Study-2 show that sensory requirements, relationship require-ments and identification requirements are enablers of intended virtualization of WFH process. Although one of the previous studies (Graupner et al., 2015) found positive relation for synchronism requirements construct but outcomes of the Study-2 are in contrast to the original PVT and other prior studies (Barth et al., 2011b; Overby, 2008; Balci et al., 2013; Balci, 2014) which have reported negative relations for above con-structs.

The result is intelligible for a WFH process virtualization context. Conventionally, presence and need of physical interaction discourages a participant in a virtual process to establish a sensory connection to objects and/or participants (Overby, 2008). This is well supported in Study-1 relating to sensory requirements. In pandemic era, the nature of work is increasingly remote, online, stress free and safer. Considering the mandate to maintain physical distancing (Harris et al., 2020) as one of the evident choices left before organizations in the pandemic age, higher sensory requirements, as found in Study-2, relating to touch, see, hear, smell, and taste rather facilitated the ICT-enabled virtualization of WFH process. Likewise, as a general acceptance, physical environ-ments usually have established and stronger relationships. This is well supported in Study-1 relating to relationship requirements. Considering social distancing (Harris et al., 2020), which refers in this context a set of measures established to avoid the spread of a contagious disease by keeping a physical distance among people and decreasing

the frequency of people coming into close contact with one another especially at workplace, as an obvious choice available for organizations amid corona crisis, higher relationship requirements, as found in Study-2, rather turned as enabler to the ICT-enabled virtualization of WFH process. As defined in original PVT (Overby, 2008), synchronism requirements is the degree to which the activities in a process need to occur quickly with minimal delay. Both the studies have found worthy support to this end.

Increasing adoption of various face to face communication technologies by organizations in recent times has narrowed the scope of identity spoofing and real time recognition system has also diluted several identification issues integrated in the organizational work portfolio. The hypothesis relating to identification requirements is therefore stable and not supported in both the studies. As hypothesized, Study-2 found support for control requirements which demonstrates that capability to regulate the behavior of WFH process participants outweigh the degree to which process participants need credentials of other process participants.

To effectively increase technology enabled virtualization, organizations should understand the type of determinants that drive and motivate employees to conduct services through WFH virtualized process. As such, availability of single pane of glass access to all services, intensive networking and socializing, seamless access to data, upgraded equipment and Internet connectivity, all the support when and where needed, strong security, ability to use any app, on any device, anytime, from anywhere without inconvenience altogether seem to have diluted the motivation of resistance of discussed constructs to ICT-enabled intended virtualization of WFH process.

6.1   Theoretical contributions and practical implications

Present study aims to contribute to the restricted number of studies on virtualization of processes (Barth et al., 2011a, 2011b; Balci et al., 2014; Graupner et al., 2015; Ofoeda et al. 2018). Specifically, this is the first study to contribute elaborated insights on ICT-enabled virtualization of work-from-home process, largely to the body of knowledge on virtualization of processes, workforce engagement, and associated factors like sensory, relationship, synchronous, identification and control requirements on the remote working. By exploring the behavior of context dependent determinants relating to process virtualization in remote working, the learning outcomes also deepen deliberations on the quality, involvement, delivery and execution of virtual processes across firms. To this end, present study contributes greatly to the body of knowledge in remote working under full virtual setting with emphasis on extended flexibility for employees and organizations, improved productivity, lower absenteeism, better employee retention, extended cost control, along with more general social benefits. This benefits scholars understand behavior of each construct separately as no evidence exists about their interrelationships. Moreover, this research also assesses the behavior of derived factors and categorizes them into context-resistant stable factor(s) and context-driven dynamic factor(s), thereby contributing to the body of knowledge in dynamic capability of firms, especially relating to remote working. Such dynamic capabilities, if attained by the organizations, in terms of crafting, fine-tuning, implementation, and renovation into the design and set-up of business models, may exploit their ability to assimilate, build, and

reconfigure internal competences leading to changes in the business environment thereby making them able to redesign and adjust business models and preserve cost-effectiveness over the long term (Teece, 2018). Other than research, this study, by informing the management of organizations and key policymakers, also provided significant contributions to practice as it could equip practitioners with extended information on what employees intend virtualization of processes and how they can maximize benefit out of it, both under normal circumstances and in context driven testing times. At present, pandemic has augmented the volatility, uncertainty, complexity and ambiguity (VUCA) all around the technological as well as social setting (Saleh et al., 2017). Since VUCA landscape is still unpredictable (Fletcher et al., 2020), so practitioners, amid pandemic crisis, can also utilize the discussed setting to measure varying processes and sub-processes under WFH virtualization for their amenability by considering their process characteristics.

6.2   Limitations and directions for future research

Given the context driven dynamic nature of factors proposed in PVT, future research can complement the model proposed here to conceptualize and validate the discussed relationships in the virtualization of similar processes under different contexts. Moreover, scholars could also examine the impact of demographic characteristics relating to different firms across industries on the process virtualization of remote working. Furthermore, future studies can assess the generalizability of findings of this study under 'new normal' settings. Finally, the outcomes of this study can be useful to explore other settings where complete physical process can be virtualized using information and communication technology, like in service sector organizations.

7   Conclusion

Primarily, to fill the gaps in empirical knowledge, this research has established a setting for advancing understanding of virtualization of work from home (WFH) process using process virtualization theory (PVT). Pandemic has made process virtualization obligatory for all sectors, especially business organizations. ICT-enabled virtualization of processes is not considered now as an option or an available add-on that may be used when required rather it is becoming a need towards attaining digital maturity as early as possible. Therefore the enablers and inhibitors found in this study together may be motivations to anticipate business organizations and their workforces to experiment with this form of work process, predominantly given the speedy growth of advance information and communication technologies. These motivations include improved flexibility for organizations and employees, improved productivity, quicker responsiveness to the needs and unexpected man-made and natural disasters, lower absenteeism, improved employee retention, greater cost control, along with more general social benefits. Being only empirical study conducted so far in this context, the results enrich the existing knowledge domain by providing unique and elaborated understanding of the context dependent influencing factors that impact intended ICT-enabled virtualization

of processes in employee's WFH process. Other than research, this study also provided significant contributions to practice as it could equip practitioners with extended information on what employees intend virtualization of processes and how they can maximize benefit out of it, especially in testing times. Practitioners, amid COVID-19 crisis, can also utilize the discussed model to measure varying processes and sub-processes under WFH virtualization for their amenability by considering their process characteristics.

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12

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