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Factors influencing home-based telework in Hanoi (Vietnam) during and after the COVID-19 era

Minh Hieu Nguyen¹ 

Abstract

During the era of COVID-19 (CORonaVIRus Disease of 2019), telework has been adopted extensively in developing countries for the first time. This study analyzes data of 355 tele-workers in Hanoi (Vietnam) during April 2020, the period of social distancing, to examine various factors associated with (1) complete home-based telework (HBT), (2) the perception of HBT, and (3) the attitude toward the combination between HBT and conventional work at workplace post-COVID-19. It finds that the company's closure policy and the frequency of working from a distance before the social distancing period were the primary determinants of exclusively teleworking. Regarding the perception of HBT, while the fear of COVID-19 was a strong positive factor, difficulties in focusing on work and accessing data were negative factors. Regarding the attitude toward the future development of HBT, attitudinal factors, commute distance, gender, children in household, and the perception of HBT in the social distancing period were the main predictors. The presence of more than one child negatively affected the perception of telework but positively affected the attitude toward establishing the hybrid work mechanism. The findings suggested that HBT has the potential to alleviate traffic congestion in developing countries and it can be promoted by emphasizing its environment-related benefits. The sample used in this research was collected in the initial stage of constrained mobility and it was not well representative; therefore, this study serves as a proof of concept for ongoing wider analyses on HBT post-COVID-19 or in the subsequent lockdown periods.

Keywords Telework · Telecommuting · COVID-19 · Social distancing · Home · Hanoi

Introduction

Working outside the workplace (i.e., telework), especially from home, can be a win–win strategy for all stakeholders such as employees, employers, and societies to obtain substantial benefits (Bailey and Kurland 2002; Elldér 2020; Felstead and Henseke 2017; Helminen and Ristimäki 2007; Henderson and Mokhtarian 1996; Hobbs and Armstrong 1998; Scott and Eric 2005; Mokhtarian et al. 1995; Nilles 1976; O'Brien and Yazdani Aliabadi

✉ Minh Hieu Nguyen
hieunm@utc.edu.vn; minhhieutc@gmail.com

¹ Faculty of Transport Economics, University of Transport and Communications, Hanoi, Vietnam

2020; Pendyala et al. 1991; Tremblay 2002). Individuals can gain more active transport (e.g., walking and cycling) and improved work performance with higher productivity, better work–life balance, less stress and interruption and thus greater job satisfaction, together with avoidance of lost time and cost of commuting. For companies, they can save overhead costs and profit from a wider labor market through hiring persons facing difficulties in coming to the workplace (e.g., mothers with small children and people with disabilities). The public may enjoy better environment and feel safer thanks to the reductions in traffic congestion, emissions, and accidents. Additionally, more people can be employed. Because of a variety of potential advantages, working from home has attracted the assiduous attention of researchers from a host of developed countries (e.g., the Netherlands [Muhammad et al. 2007], Great Britain [Cerqueira et al. 2020], France [Aguilera et al. 2016], Turkey [Iscan and Naktiyok 2005], Finland [Helminen and Ristimäki 2007], Korea [Kim et al. 2015], Canada [Tremblay 2002; Wilton et al. 2011], and the US [Pendyala et al. 1991; Singh et al. 2013; Stiles and Smart 2020]), and a few developing countries such as China (Loo and Wang 2018) and Taiwan (Yen 2000).

Telework has been a field of interest for transport researchers since the last decade of the twentieth century (Andreev et al. 2010). Initially, authors focused on using data of pilot programs to measure reductions in trips and travelled distances for both teleworkers and their households to demonstrate telework’s transport-specific advantages (Helminen and Ristimäki 2007; Henderson and Mokhtarian 1996; Mokhtarian et al. 1995; Pendyala et al. 1991). However, some scholars such as Cerqueira et al. (2020), de Abreu e Silva and Melo (2018), and Zhu and Mason (2014) contradicted the above advantages by using large-scale datasets. Other scholars focused on the state-of-the-art practices of telework in developed countries to conclude that telework has been emerging but far below the initial expectations of its advocates such as Handy (1984), Nilles (1976). In fact, evidence from European countries and the US (Aguilera et al. 2016; Melo and de Abreu e Silva 2017; Noonan and Glass 2012; Welz and Wolf 2010) shows that telework, with its gradual development, is still an informal work mechanism, despite being considered a motor theme in the future of work since the late 1990s (Santana and Cobo 2020). Since the early 1990s, research has primarily focused on exploring and examining the factors associated with the measurements of the prevalence of HBT (i.e., opportunity, choice, frequency, and preference) with both qualitative and quantitative analyses (Helminen and Ristimäki 2007; Loo and Wang 2018; Mannering and Mokhtarian 1995; Mokhtarian and Salomon 1997, 1994; Peters et al. 2004; Singh et al. 2013; Wilton et al. 2011; Haddad et al. 2009). Understanding the facilitators (i.e., positive factors) and constraints (i.e., negative factors) in different contexts is crucial to developing policies for telework (Mokhtarian and Salomon 1994). Studies on telework’s impacts on travel behavior and environment together with the practices of telework have contributed to a deeper understanding of the determinants (Sener and Reeder 2012).

At the end of 2019, the outbreak of a novel coronavirus SARS-CoV-2, in Wuhan, China, has rapidly become an epidemic, officially named COVID-19 (i.e., COronaVirus Disease of 2019) (Shereen et al. 2020). A series of proactive interventions such as social distancing, lockdown, confinement, and quarantine are adopted to prevent the spread of COVID-19 in countries because less interpersonal interaction effectively limits human-to-human transmission of SARS-CoV-2. As a result, the World Health Organization and governments highly recommended working from home to protect employees’ health while continuing with economic activities (World Health Organization 2020). Consequently, telework, beyond a travel demand management strategy, has become a key double solution for global health risks and the economic crisis (Belzunegui-Eraso and Erro-Garcés 2020; OECD 2020). This study focuses on Hanoi, the capital of Vietnam, where a large number

of people, nearly without any preparation and experience, had to familiarize themselves with working from home daily.

The study explores home-based telework (HBT), defined as working from home during regular work hours in Hanoi. The specific research objectives are to investigate factors associated with the following: (1) the adoption of completely working from home (against working at both home and workplace) in the social distancing period; (2) the good perception of HBT in the social distancing period; and (3) the positive attitude toward the promotion of HBT after the social distancing period.

This study adds values to the literature in four ways. First, it provides novel insights into factors governing HBT in a developing country, where HBT has been intensively and rapidly adopted due to the spread of a pandemic. Second, it is the first research that considers the perception of HBT and finds the positive association between the perception and the preference for working from home. The consideration of perception is essential because there is a great change in the working context (i.e., from the presence to the absence of COVID-19). Third, this study demonstrates the important role of the setting with the fear of disease in perceiving the introduction of HBT. Fourth, this research provides some notes on the future development of HBT, which should be considered as a multifunctional measure related to health, transport, and economics in developing countries.

This study is outlined as follows. The “Literature review” section presents the terminologies and definitions related to telework before synthesizing previous findings of factors associated with HBT and recent publications on HBT during the era of COVID-19. The “Data and methods” section presents the methods of collecting and analyzing data. The “Results and discussions” section is devoted to the results of binary logit models and discussion about roles of factors governing the frequency, perception of HBT during the era of COVID-19, and the attitude toward further development of HBT after the end of COVID-19; it also presents some policy implications with respect to promoting HBT in developing countries. Finally, the “Conclusions” section summarizes the main findings and highlights this research’s limitations and future research directions.

Literature review

Terminologies and definitions

In the literature, there is an array of terminologies used interchangeably to describe working outside the workplace, such as telework, telecommuting, remote work, distance work, home-working, e-work, flexplace, and electronic cottage (Bailey and Kurland 2002; Teo and Lim 1998). The two most common terminologies are telework and telecommuting, with the former being preferred by European and Asian scholars and the latter by American and Canadian authors (Andreev et al. 2010; Wilton et al. 2011). The main reason for the heavy use of telecommuting in the US is that “telecommuting” was coined and has emerged since the late 1970s as an innovation to address societal issues (e.g., traffic congestion and air pollution) through decreasing automobile-based travel between home and workplace in American cities such as Los Angeles (Nilles 1976; Stiles 2020). The notion behind telecommuting is that the increased and continuous flow of information on advanced telecommunication networks enables a substitute of a portion of traffic flow pertaining to commuting between home and work (Yen 2000). In this sense, telecommuting can serve as a “mode” of travel to work (Pisarski 2006) and its development is considered

as a travel demand management strategy (de Abreu e Silva and Melo 2018). Telecommuting, as its name indicates (i.e., commuting), is a term orienting toward transport. Telework, meanwhile, is a more general term orienting toward a new and innovative form of working, many aspects of which have been studied in academia by researchers from various disciplines, such as transportation science (Aguilera et al. 2016; Cerqueira et al. 2020; Helminen and Ristimäki 2007; Loo and Wang 2018; Mokhtarian et al. 1995), urban planning (Mokhtarian et al. 2004), information science (Iscan and Naktiyok 2005), organizational behavior (Bailey and Kurland 2002; Santana and Cobo 2020; Stiles 2020), and sociology (Hobbs and Armstrong 1998; Mokhtarian et al. 1998a; Tremblay 2002).

There has not been a universal definition of telework; however, all existing definitions emphasize the place of telework and the supportive role of technologies. According to Eurofound and the International Labour Office (2017), telework is defined as working outside the employer's premises by means of using information and communication technologies (ICTs), such as computers. Similarly, Santana and Cobo (2020) state that telework entails performing work in locations distant from main offices or production buildings based on telecommunication between teleworkers and their co-workers. The place of telework can be a satellite office closer to home compared with the conventional workplace (Mannering and Mokhtarian 1995), a public transport vehicle or a station (Gripsrud and Hjorthol 2012), a café or a library (Stiles and Smart 2020); yet the most common (Stiles 2020) and (perhaps) perfect alternative to the workplace must be the home because the proliferation of ICT has made it a communication hub well suited for working electronically (Hjorthol and Gripsrud 2009). This is reflected by the major concentration of prior studies on HBT (Santana and Cobo 2020).

Factors influencing home-based telework in normal circumstances

There are four ways to measure the prevalence of telework: opportunity, preference, choice, and frequency (Haddad et al. 2009). The opportunity is defined as whether employees have options of telework (Peters et al. 2004; Singh et al. 2013) while preference is defined as whether employees desire teleworking (more) (Haddad et al. 2009; Peters et al. 2004) or whether employees have a favorable attitude toward teleworking (Iscan and Naktiyok 2005). The choice is involved in whether employees actually adopt telework or a specific type of telework (e.g., the whole-day telework or the part-day telework) when they have opportunities (de Graaff and Rietveld 2007; Loo and Wang 2018; Sener and Reeder 2012; Yen 2000). Analyzing the frequency of telework considers how many times employees actually telework within a particular period such as a week (Haddad et al. 2009; Mannering and Mokhtarian 1995; Sener and Reeder 2012; Singh et al. 2013). The choice of telework can be examined in an analysis of the frequency with a non-adoption choice represented by a zero-frequency class (Haddad et al. 2009; Hjorthol and Gripsrud 2009; Mannering and Mokhtarian 1995). This current study considers teleworking as completely from home versus teleworking for some days at home; thus, it should be an analysis of the frequency of HBT. The attitude toward promoting HBT post-COVID-19 can be treated as the preference for teleworking further.

In the literature, the same lists of variables can be used to predict some of the opportunity, preference, choice and frequency of telework simultaneously (e.g., the preference and frequency [Haddad et al. 2009], the opportunity, choice, and frequency [Singh et al. 2013], and the preference and choice [Peters et al. 2004]). That is, variables used to model the choice would be good candidates to do so for the preference and the frequency.

Factors

associated with the opportunity for teleworking were excluded in this review because many of them are related to employers (Singh et al. 2013) while the rest of them are similar to those affecting the practice (i.e., choice and/or frequency) of telework.

There exist mixed empirical findings on factors associated with the preference, choice, and frequency of HBT (see Table 1). These factors can be categorized into five main clusters: (1) socio-demographic characteristics, (2) household characteristics, (3) company-related variables, (4) attitudes toward work and telework, and (5) previous experience.

Socio-demographic characteristics

Individual characteristics are of great importance to characterize who desires to and/or who is fit for teleworking (Bailey and Kurland 2002). Gender has been found to be a determinant of the choice (Loo and Wang 2018; Sener and Reeder 2012; Singh et al. 2013; Yen 2000), the preference (Iskan and Naktiyok 2005), and the frequency (Mannering and Mokhtarian 1995; Sener and Reeder 2012) of HBT. Compared with men, women pay more attention to family duties; thus, they are attracted more by HBT, which assists them in balancing work and family responsibilities (Mokhtarian et al. 1998b). Other studies examine the interactions between gender and the presence of small children or the marital status (Sener and Reeder 2012; Yen 2000).

Age is another factor associated with the practice of HBT but not with the preference. Generally, middle-aged persons (e.g., 36–50 years) are less likely to telework as frequently as younger ones because they tend to keep management positions requiring them to be present in the workplace (Sener and Reeder 2012; Singh et al. 2013).

Employees with higher educational levels can better negotiate with their employers for an option to telework (Singh et al. 2013); therefore, the association between education and the adoption of HBT has been well reported (de Graaff and Rietveld 2007; Loo and Wang 2018; Peters et al. 2004). However, Peters et al. (2004) and Sener and Reeder (2012) did not find statistically significant relationships of educational levels with the preference and the frequency of telework, respectively.

Household characteristics

The presence or the number of children, especially small ones, drives a choice for telecommuting (Mokhtarian and Salomon 1994), as demonstrated by a series of empirical results (Iskan and Naktiyok, 2005; Loo and Wang, 2018; Sener and Reeder 2012; Singh et al. 2013; Yen 2000). The reasons would be that many employees may need more flexibility in working time to take care of their children and meet their children's travel demands such as escorting them from/to school (Tremblay 2002; Wilton et al. 2011). As a result, these employees would be more interested in teleworking (Iskan and Naktiyok 2005) and more likely to do so (Loo and Wang 2018; Singh et al. 2013) but only occasionally (Singh et al. 2013).

Employees with a higher income level tend to be more interested in teleworking (Loo and Wang 2018; Mannering and Mokhtarian 1995; Sener and Reeder 2012). With a larger budget, an employee may have greater accessibility to the telecommunication tools necessary for teleworking (Sener and Reeder 2012). Furthermore, a considerable number of low-income employees are blue-collar workers in industrial sectors, wherein teleworking is nearly infeasible (He and Hu 2015).

Table 1 Synthesis of factors associated with the preference, choice, and frequency of home-based telework

Factor groups	Factors	Choice	Preference/Positive attitude	Frequency
Socio-demographic characteristics	Gender	(Loo and Wang 2018): (S)	(Haddad et al. 2009): (NS)	
		(de Graaff and Rietveld 2007): (NS)	(Peters et al. 2004): (NS)	(Haddad et al. 2009): (NS)
Age		(Sener and Reeder 2012): (S)*	(Iscan and Naktiyok 2005): (S)	(Mannering and Mokhtarian 1995): (S)*
		(Singh et al. 2013): (S)		(Sener and Reeder 2012): (S)*
		(Peters et al. 2004): (NS)		(Singh et al. 2013): (NS)
		(Yen 2000): (S)*		(Beck et al. 2020): (NS)
		(de Graaff and Rietveld 2007): (S)	(Haddad et al. 2009): (NS)	
Education		(Sener and Reeder 2012): (S)	(Peters et al. 2004): (NS)	(Haddad et al. 2009): (S, +)
		(Loo and Wang 2018): (NS)		(Sener and Reeder 2012): (S)
		(Peters et al. 2004): (S)		(Singh et al. 2013): (S)
		(Singh et al. 2013): (NS)		(Beck et al. 2020): (NS)
		(de Graaff and Rietveld 2007): (S)	(Peters et al. 2004): (NS)	(Sener and Reeder 2012): (NS)
		(Sener and Reeder 2012): (S)		(Singh et al. 2013): (S)
		(Loo and Wang 2018): (S)		
(Peters et al. 2004): (S)				
(Singh et al. 2013): (S)				

Table 1 (continued)

Factor groups	Factors	Studies and effects of factors on	Choice	Preference/Positive attitude	Frequency
Household characteristics	Children in household	Choice	(de Graaff and Rietveld, 2007): (NS)	(Haddad et al. 2009): (S, +)	(Manning and Mokhtarian, 1995): (S)*
			(Sener and Reeder, 2012): (S)*	(Peters et al. 2004): (S)	(Sener and Reeder, 2012): (S)
			(Loo and Wang, 2018): (S)	(Iscan and Naktiyok, 2005): (S)	(Singh et al. 2013): (S)
			(Peters et al. 2004): (NS)		
			(Singh et al. 2013): (S)		
			(Yen, 2000): (S)*		
			(Sener and Reeder, 2012): (S)		(Sener and Reeder, 2012): (NS)
			(Loo and Wang, 2018): (S, +)		(Singh et al. 2013): (NS)
			(Singh et al. 2013): (NS)		(Manning and Mokhtarian, 1995): (S, +)
					(Beck et al. 2020): (S, +)
Company-related	Type of company Commute distance	Commute distance	(He and Hu, 2015): (S)		
			(Yen, 2000): (S)		
			(Helminen and Ristimäki, 2007): (S, +)	(Haddad et al. 2009): (S, -)	(Haddad et al. 2009): (S, +)
			(Loo and Wang, 2018): (S, +)	(Iscan and Naktiyok, 2005): (S, +)	(Manning and Mokhtarian, 1995): (NS)
			(Singh et al. 2013): (S)	(Singh et al. 2013): (S)	
				(Hjorthol and Gripsrud, 2009): (NS)	

Table 1 (continued)

Factor groups	Factors	Studies and effects of factors on		
		Choice	Preference/Positive attitude	Frequency
Previous experience	Internet use time	(Loo and Wang, 2018): (S) (Singh et al. 2013): (S)		(Singh et al. 2013): (NS) (Sener and Reeder, 2012): (S)
	Familiar with telework	(Sener and Reeder, 2012): (NS) (Yen, 2000): (S)		
Attitudes towards work and telework	Workaholic	(Loo and Wang, 2018): (S, +)**		(Mannering and Mokhtarian, 1995): (S)
	Enjoyment at workplace Environmental benefit	(Loo and Wang, 2018): (S, +)**		(Mannering and Mokhtarian, 1995): (S)

(S), statistically significant; (NS), not statistically significant; (+), refers to a (continuous) facilitator; (-), refers to a (continuous) constraint; *Refers to the referenced variable being examined in combination with another variable; **Refers to an underlying factor extracted from attitudinal statements

Company-related variables

One of the drivers of implementing HBT is burdensome commute, which can be represented in part by a one-way distance between home and workplace. The longer the distance the greater the likelihood of teleworking, teleworking frequently, and having positive attitudes toward HBT (Helminen and Ristimäki 2007; Iscan and Naktiyok 2005; Loo and Wang 2018). However, the effect of a commute distance is only significant when it is large enough, such as over 20 miles in San Francisco, the US (Singh et al. 2013). Helminen and Ristimäki (2007) found that distances of up to 80 km did not markedly influence the percentage of teleworkers in Finland. Notably, Haddad et al. (2009) reported that a longer commute was associated with less desire to telework while Mannerling and Mokhtarian (1995) did not see any significant relationship between the frequency of telework and the home-work distance in City of San Diego, San Francisco, and Sacramento, the US. Similarly, although there was a tendency for employees teleworking more frequently when travelling farther to work, the difference in commute distances was not significant (Hjorthol and Gripsrud 2009). This phenomenon was seen for both the part-day and whole-day teleworks.

Type of organization may be an exploratory variable of the adoption of telework. In the case of Taiwan, government employees were less likely to telework than others (Yen 2000).

Attitudes toward work and telework

Workaholics, those who are willing to work overtime or late because of a desire to get more work done, are most likely to work full-day and part-day at home (Loo and Wang 2018), which is in line with both the theoretical statement (Mokhtarian and Salomon 1994) and the practical evidence (Wilton et al. 2011) that working more hours to get more work done is a motivation for employees to telework. Nevertheless, possibly owing to a desire for a relatively stable environment to work effectively, workaholics would prefer to exclusively work at home or in the office over teleworking on an irregular basis (Mannerling and Mokhtarian 1995).

A noticeable strength of working at the workplace than at home is the ability to have personal interactions and receive colleagues' and managers' appreciation for work done; thus, employees can gain much enjoyment working at the workplace. Pleasure at workplace is a negative factor for the choice of telework (Loo and Wang 2018).

A strong concern about the environment may motivate some employees to telework to reduce emissions and improve air quality (Mokhtarian and Salomon 1994; Wilton et al. 2011). Mannerling and Mokhtarian (1995) posit that those with willingness to reduce driving to enhance air quality are more likely to telecommute frequently.

Previous experience

Experience in using the internet and teleworking can be significant factors affecting the choice of (re-)telework and the frequency of telework. Employees who are familiar with working from home are more likely to telecommute (Yen 2000) because teleworking is normalized and attractive to them (Wilton et al. 2011). The proliferation of ICT has removed technological barriers to the development of telework. To telework effectively,

teleworkers need the heavy use of telecommunications. This explains the findings that persons using the internet frequently are more likely to telework (Loo and Wang 2018; Singh et al. 2013) or telework at a higher frequency (Sener and Reeder 2012).

Mokhtarian and Salomon (1994) highlighted the importance of considering the historical experience with working at home when modelling a teleworker's behavior. For example, a teleworker may stop working from home due to considerable distractions from his/her family members. However, there has not been any empirical evidence of effects of facing issues at home on the preference for further HBT.

Telework during the COVID-19 period

Although telework has been highly encouraged by the World Health Organization and widely adopted, it has not been explored widely, particularly from a developing country perspective.

Kawashima et al. (2020) examined the age and occupation-based relationship between the adoption of telework and the presence of a surrogate indicator of COVID-19 infection (i.e., temperature > 37.5 °C) employing data from 275,560 respondents aged over 15 years collected between 5 March and 6 April in Japan via the LINE app. They found that among company employees, non-teleworkers aged 25–29 and 30–59 years old had statistically significant higher fever rates.

Through a search on the internet, economic journals, and press from March 1–16, 2020, Belzunegui-Eraso and Erro-Garcés (2020) collected a sample of 27 international organizations from different sectors (e.g., energy, banking, and telecommunications). By synthesizing how companies introduced teleworking as a response to the coronavirus crisis, the authors noted that the intensive adoption of telework was forced by the pandemic and was primarily aimed at ensuring employees' health; thus, safety factors were relevant for further research on telework in the context of COVID-19.

Using two datasets collected from March 30 to April 15 with 476 observations and from May 23 to June 15 with 705 observations in Australia, Beck et al. (2020) estimated two ordered logit models for the frequency of HBT. They found the significant role of an employer in the number of times his/her employee teleworked for both waves. Specifically, having a choice to work from home before the pandemic and being encouraged/enforced to do so during the pandemic time were positively associated with the frequency. Notably, all attitudinal variables were statistically significant for the dataset of wave 2 but not for that of wave 1. These findings may have resulted from the change in attitudes toward HBT over time. Among the socio-demographics, age and gender were not influential factors while household income was a facilitator.

Based on the above-mentioned review, investigating factors associated with the frequency of adopting HBT during the era of a health disaster and the preference for the development of HBT in the post-pandemic period is a research gap. Moreover, it would be interesting to investigate factors influencing the perception of HBT, the research gap missed in previous literature.¹ The perception of telework during the time of COVID-19

¹ Previous authors have researched the perceived attributes of telecommuting (e.g., advantages and disadvantages [Mokhtarian et al. 1998a]) rather than the perceived experience with telecommuting and its influential factors.

may be a determinant of the attitude toward the further embrace of HBT. More knowledge from a developing country will contribute to an advance in the understanding of telework.

Data and methods

Data collection

This research was conducted in Hanoi, the capital of Vietnam, a low-middle income country. Hanoi is a typical example of a city struggling with transport-related issues, such as unrelenting traffic congestion, accidents, and extensive air pollution, due to limited public transport services and heavy use of motorcycles (Nguyen et al. 2019, 2020; Nguyen and Pojani 2018; Nguyen-Phuoc et al. 2020; Truong and Nguyen 2019; Viet Hung and Huyen 2011; Khac and Quoc 2020). Before COVID-19, HBT was a new work arrangement in Hanoi.²

According to official statistics as of June 18, 2020, Vietnam has successfully handled the COVID-19 pandemic with no single coronavirus-related death. Out of 335 patients, 325 have recovered and there has not been any new transmissions over 60 consecutive days (Ministry of Health 2020) despite its long border with China (CNN 2020), where the global outbreak of the novel coronavirus emerged (Wu et al. 2020) and where 4.6 thousand patients among 84.9 thousand of confirmed cases have died (WHO 2020). Owing to the early and decisive actions of the government³ and its efforts in public health systems and awareness of the danger of COVID-19 to the public, Vietnam evaded new infections over three weeks in the middle of February. However, a spike in the daily numbers of confirmed cases from March 6, 2020, and emergence of epicenters (e.g., the Bach Mai hospital, one of the biggest ones in Vietnam, Buddha Bar & Grill) in both Hanoi and Ho Chi Minh City prompted the prime minister to issue Directive 16 mandating nationwide social distancing on March 31, which aimed to limit physical interpersonal interactions. Lockdowns were strictly imposed on all persons connected to hotspots. Numerous companies and institutions in Hanoi closed partly or completely and their employees were asked to work remotely from home. As shown in Fig. 1, the number of COVID-19 cases decreased significantly owing to the social distancing in April. New patients were those previously quarantined in the government facilities; therefore, the risk of community transmission was minimized. The social distancing was due to end on April 22 for provinces without patients and April 30 for cities at higher risk such as Hanoi. Since May 1, 2020, companies and enterprises have been operating normally.

This study was initiated mid-March 2020 following a rise in the number of confirmed cases and anticipation of the social distancing period. Because of the constrained mobility, face-to-face interviews were inappropriate. Telephones, too, were inappropriate because telephones are becoming uncommon in Hanoi with the number of subscribers decreasing dramatically from 976,000 in 2014 to 574,000 in 2018 (Hanoi Statistics Office 2019).

² The author has searched for *telework in Vietnam* on databases of Google Scholar, International Labour Organization, Organisation for Economic Cooperation and Development, the Vietnamese department of labor, and official yearly statistics of Vietnam; however, there has been no available information about it.

³ In an emergency government meeting at the end of January, the Prime Minister Xuan Phuc NGUYEN declared the war against COVID-19 with the motto being "Fighting this epidemic is like fighting an enemy."

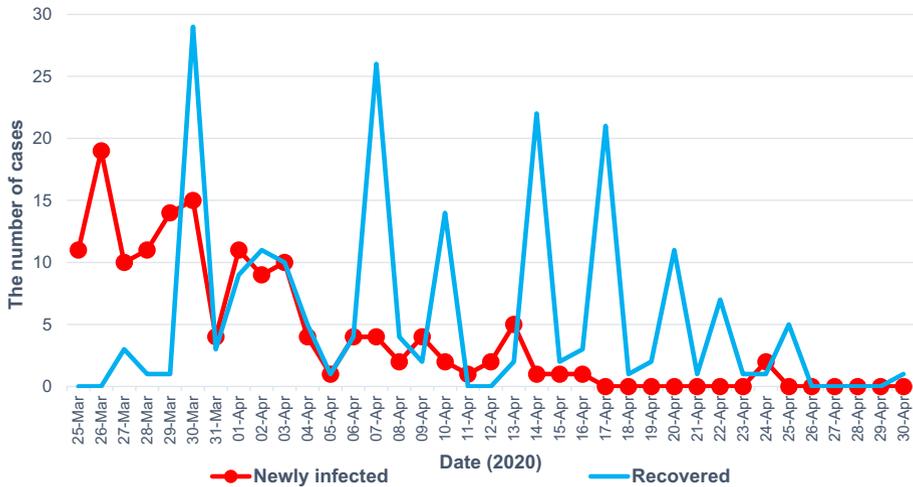


Fig. 1 The practice of COVID-19 in Vietnam from March 25 to April 30, 2020 (re-drawn by the author based on data published on the official website of the Ministry of Health 2020)

Therefore, emails and online surveys were chosen as the appropriate tools for data collection. Since email and online questionnaire-based investigations usually have low response rates and are accessible to those with internet or an email address (Armoogum et al. 2014), it would be unfeasible to acquire a representative sample of the worker population in Hanoi using these techniques. Because of this reason, instead of attempting to access a representative sample of workers to obtain a representative sample of teleworkers in Hanoi, this study’s scope was limited to teleworkers only. The author did not set an aim to collect a representative sample of teleworkers in the social distancing time because telework was novel in Hanoi and thus the population of teleworkers was unknown. To enhance the sample size, snowball sampling was applied. Furthermore, to gain a high response rate and a wide share of the surveys, initial seeds in snowball sampling for email-based surveys were determined as former students at the University of Transport and Communications (UTC). Facebook was chosen as the environment for distributing online questionnaires because it is the most popular social networking platform in Vietnam with about 64 million users out of 95 million citizens (Statista 2020); the platform has been demonstrated as an effective tool for scientific research (Baltar and Brunet 2012).

The overall purpose of this research is to analyze changes in e-activities (i.e., HBT and e-shopping) due to the COVID-19 pandemic. Consequently, a five-page questionnaire with six sections was designed: (1) a cover page, (2) profiles of respondent and household, (3) profile of company and experience of adopting HBT and using the internet, (4) perceived and attitudinal statements in relation to HBT, (5) attitudinal statements on e-shopping, and (6) the practice of doing e-shopping in the social distancing phase. These sections are explained as follows:

-
1. The cover page explained the survey objectives and emphasized that only persons who worked at home at least one weekday during the last week⁴ should give further responses.
 2. The second section requested information on age, gender, education of the respondent, and his/her household's monthly income together with the number of children. Children become more independent with regard to playing, studying, and travelling with age (Scheiner 2016; Susilo and Waygood 2012), thus distracting their parents less. Similar to de Graaff and Rietveld (2007), this study chose the 0–11 years bracket for children. The respondent's occupation was excluded for five reasons. First, this information has frequently been included in prior studies using representative samples of the population of employees working in a nation or region to investigate which occupations are suitable for HBT (Beck et al. 2020; Haddad et al. 2009; Mannering and Mokhtarian 1995; Sener and Reeder 2012; Singh et al. 2013). In contrast, this study could not gather a representative sample; thus, it could not conclude persuasively which occupations were the most appropriate for HBT in the pandemic period. Previous findings on jobs with higher likelihood of HBT were used in this research to determine potential participants (e.g., clerks, researchers, professionals etc.) of surveys using emails and online questionnaires. Second, as claimed by Mokhtarian et al. (1998a), occupational classes are not universally defined because workers tend to consider the mixture of the type of work and the work status (title or rank). Therefore, the same job may be labeled differently and thus the self-reported data of occupation would be unreliable. Third, occupation is not a significant variable and it is not considered in many prior studies (Helminen and Ristimäki 2007; Iscan and Naktiyok 2005; Loo and Wang 2018; Peters et al. 2004; Yen 2000). Fourth, by ignoring occupation information, the questionnaire was shorter, thereby possibly increasing the response rate (Galesic and Bosnjak 2009). The last reason involves the official classification of occupational categories announced by Hanoi Statistics Office (2019). Among 10 groups, some categories include occupations that are available (e.g., sales) and unavailable (e.g., protective workers) for telework. Hence, it would be difficult to compare the distribution of occupations of teleworkers surveyed with that of workers in Hanoi.
 3. The third section gathered data on the type of company, the one-way distance to commute from home to workplace, and the closure policy of companies during the period of social distancing. This part also asked for the respondent's previous experience of using the internet and adopting telework or teleconference.⁵ Teleconference was considered for its similarity to telework; it is a working situation based on telecommunications. Besides, the participants were asked if they worked entirely at home or simultaneously partially at home and office during the last week.
 4. In the fourth section, questions grounded in workaholic and enjoyment at workplace (Loo and Wang 2018) were adapted and reused. In addition, the fear of human-to-human transmission of COVID-19 was measured by two questions (*see* Table 3). The respondents were asked their opinion on the environmental benefits of HBT using two items. One of the biggest concerns in Hanoi has been air pollution while HBT has been widely advertised and partially demonstrated as an environmentally friendly activity.

⁴ Last week here was defined as preceding seven days. For example, when a respondent was asked on Tuesday, the period between yesterday (Monday) and Tuesday of last week was regarded.

⁵ Teleconference refers to undertaking a live meeting of at least two participants in different places via telephone or network connection (Andreev et al. 2010).

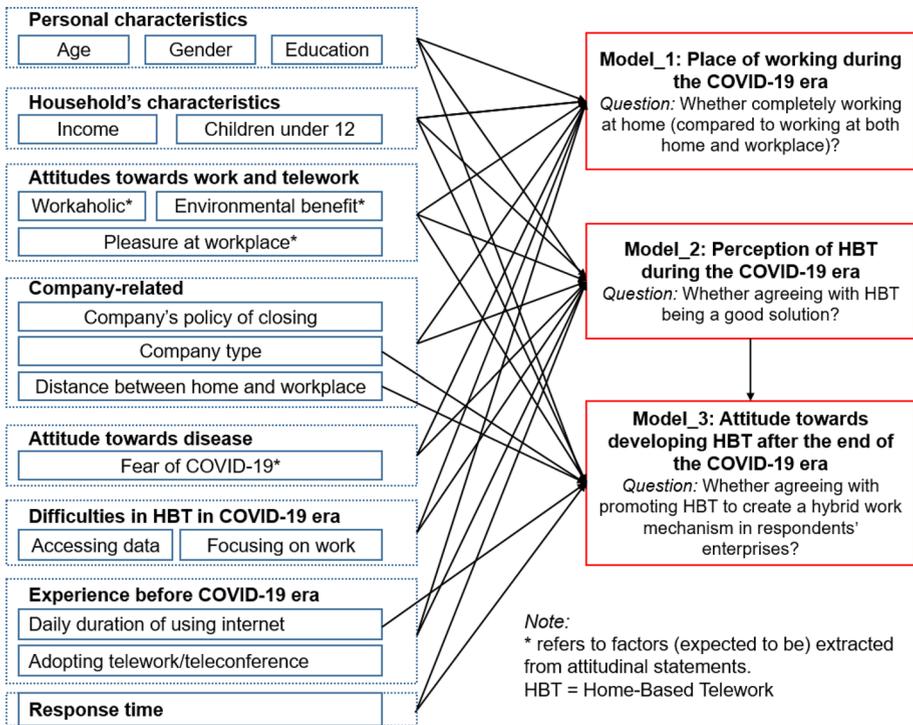


Fig. 2 Graphical description of three binary logit models used in this study

The participants were also requested to declare how much they agreed or disagreed with statements that (1) HBT was a good solution for the respondent in the era of COVID-19, and (2) HBT should be enhanced and applied in parallel with working at workplace in the respondent's enterprise after successful control of the community transmission of COVID-19. All questions regarding perceptions and attitudes were measured by a five-point Likert scale (strongly disagree to strongly agree). Because HBT in Hanoi was a (nearly) mandatory arrangement with little preparation time, teleworkers possibly encountered some problems. Two questions with respect to difficulties in focusing on work and accessing data at home were added.

5. Because this study excluded e-shopping, question groups 5 and 6 are not presented here.

Data collection was implemented during the four-week social distancing period, from April 6 to April 30. Over the first two weeks, questionnaires were distributed to over 400 former students of the Faculty of Transport Economics under UTC via emails. For each response, an email acknowledgement and a request for forwarding the questionnaire to other relevant candidates was sent back to the respondent. From April 20, an online survey, created via Google Forms, was shared via a post on Facebook. For the sake of wider coverage, this post was also shared with big (closed) groups on Facebook (e.g., VietPhd.org with more than 2000 members), at which the author was a member. Finally, the author collected 422 responses, 52 of which came from those not living in Hanoi, hence removed. Fifteen responses were invalid owing to the lack of answers to questions. Among 355 participants

whose answers were eligible for further analyses, 134 provided their responses via emails. Of the 134, 112 were former students.

Method

Exploratory factor analysis (EFA) was implemented to derive underlying variables (i.e., factor) from responses to attitudinal questions (see Table 3). Then, three binary logit regression models were estimated to examine factors associated with HBT (see Fig. 2), as follows:

In Model_1, the dependent variable was whether teleworkers completely worked at home. Factors investigated included characteristics of respondents, their households, their companies, their experience of adopting telework/teleconference and browsing the internet pre-COVID-19, and difficulties in working at home during the social distancing period, along with attitudes toward work/telework and the pandemic.

In Model_2, the dependent variable was whether teleworkers agreed that HBT was a good solution during the COVID-19 period.⁶ Besides being the same list of independent variables as Model_1, time of response was included because personal attitudes toward HBT may change when the pandemic revolutionized⁷ (Beck et al. 2020).

In Model_3, the dependent variable was whether teleworkers agreed that HBT should be enhanced to create a hybrid work mechanism in the respondents' enterprises post-COVID-19. Because of the change in the context with the end of the COVID-19 pandemic, the variables such as the company's policy of closing, difficulties when working at home, and experience of teleworking/teleconference were excluded. Conversely, perception, which was the dependent variable of Model_2, was included with a hypothesis that a good perception was associated with a positive attitude toward the future development of HBT.

For regression models, multicollinearity has adverse effects on data interpretation because it leads to unstable and biased standard errors and thus unstable p -values for evaluating the statistical significances of independent variables (Mela and Kopalle 2002; Vatcheva et al. 2016). Because this study concentrated on individual effects of predictors on binary dependent variables, it investigated the potential of multicollinearity. For each model, a correlation matrix including all predictors was estimated. If all correlations between variables were weak (i.e., less than 0.4 for psychological research [Dancey 2014]), the risk of multicollinearity was neglected. Alternatively, if there was at least a moderate/high correlation with a significant coefficient being equal to or greater than 0.4, variance inflation factors (VIFs) for independent variables were computed. For each predictor, VIF should be smaller than 4 to be safely kept without a concern about multicollinearity (O'Brien 2007). All statistical analyses were undertaken using Stata 15.0.

⁶ The dependent variables in Models 2 and 3 were originally measured by a five-point Likert scale. They were recoded to be equal to 1 if teleworkers voted "agree" or "strongly agree" for the statements, and 0 if otherwise. The reason for converting these variables into binary ones is that they were initially treated as ordinal dependent variables in two ordered logit models; however, the results of Brant tests showed that both models violated the parallel regression assumption. Therefore, the ordered logit models were not suitable, and binary logit models were used as alternatives.

⁷ The author appreciates one of the reviewers for noting the potential importance of response time in explaining teleworkers' attitudes toward HBT.

Results and discussions

This section first describes the sample and factors extracted from attitudinal statements using the EFA technique. Next, as the sample could not be representative, its bias is discussed to better interpret findings on factors associated with the frequency, perception, and preference for HBT later.

Descriptive results

Table 2 summarizes the variables used in this study. The Hanoi sample comprised a balanced gender-based distribution with most falling into the 20–30-year age bracket (62%) compared with a minority (11.8%) aged over 45 years old. This may stem from using emails and online surveys to collect data. The respondents were well-educated with 62% completing a graduate level and 24.8% being post-graduates.

More respondents had a monthly income of 10,000–24,999 VND (42.5%) than other groups. The next populous category (28.5%) was those earning 25,000–39,999 VND per month. Slightly more than half (51.8%) of the respondents did not live with any children yet. The figures for households with one child and at least two children were similar at around 24% for each. The largest number of teleworkers (164) came from companies allowing employees to go to their workplace on demand while only 87 were working for enterprises with offices that were completely closed. The average one-way commute distance was approximately 7 km.

Before social distancing, the use of technology for work from a distance was novel for 70.7% of participants. Only 45 out of 355 respondents performed telework/teleconference at least twice per week. Medium users (2–5 h daily) and heavy users of internet (over 5 h daily) accounted for similar percentages at around 41% for each. Most teleworkers struggled to access data (63.9%) and concentrate at work (67.9%). Most data were collected in the last two weeks (64%) of the survey while only 12.4% of responses were gathered in the first week (Table 2).

More participants worked entirely at home compared with counterparts working at both home and workplace (209 vs. 146). The numbers of teleworkers having and not having positive perception of HBT during the COVID-19 era were nearly equal. A similar phenomenon was seen for respondents' opinions on the development of a hybrid work mechanism after the end of the COVID-19 pandemic.

Results of exploratory factor analysis and tests of multicollinearity

Four factors extracted from 10 items were labeled: (1) pleasure at workplace, (2) workaholic, (3) environmental benefit, and (4) fear of disease (see Table 3). Results of a series of metrics (e.g., KMO, Bartlett test, and variance explained) showed that EFA was an appropriate technique, and they found that factors provided a reasonable explanation of variations of attitudinal statements.

Regarding multicollinearity examinations, almost all correlation coefficients were less than 0.4 with(out) statistical significance at the 0.05 level. The figure for significant

Table 2 Descriptive statistics of variables

Variables	Values	Freq	Percent
Age	Youngest (20–30 years old)	220	62.0
	Middle (31–45 years old)	93	26.2
	Eldest (≥ 46 years old)	42	11.8
Gender	Male	177	49.9
	Female	178	50.1
Educational level	Undergraduate or without qualification	47	13.2
	Graduate	220	62.0
	Post-graduate	88	24.8
Monthly income before the COVID-19 period	Less than 10 million VND	55	15.5
	10—less than 25 million VND	151	42.5
	25—less than 40 million VND	101	28.5
	40 million VND or over	48	13.5
	0	184	51.8
Number of children under 12 years old	1	87	24.5
	≥ 2	84	23.7
Type of enterprise	State-owned	124	34.9
	Private	188	53.0
Enterprise's policy of closing	Foreign-invested	43	12.1
	Completely closing and requiring employees to telework	87	24.5
	Allowing employees to go to workplace on demand	164	46.2
	Arranging employees to work alternatively at workplace	104	29.3
Distance from home to workplace	<i>Continuous variable (Km)</i>	6.961*	5.202**
	Nearly never	251	70.7
Adopting teleconference/telework before the COVID-19 period	Sometimes (1–2 times/month)	59	16.6
	Frequent or regular (at least 1–2 times/week)	45	12.7

Table 2 (continued)

Variables	Values	Freq	Percent
Daily internet use time before the COVID-19 period	Less than 2 h	63	17.8
	2–5 h	151	42.5
	Over 5 h	141	39.7
Limited access to data when teleworking from home	Yes	227	63.9
	No	128	36.1
Difficulty in focusing on work at home	Yes	241	67.9
	No	114	32.1
Response time	First week	44	12.4
	Second week	84	23.7
	Third week	133	37.5
	Fourth week	94	26.5
Place of working during the COVID-19 period	Completely working from home	209	58.9
	Working at both home and workplace	146	41.1
Home-based teleworking during the COVID-19 period is a good choice***	Yes/Agree	178	50.1
	Not yes/Not agree	177	49.9
After an end of the COVID-19, home-based teleworking should be promoted in my enterprise***	Yes/Agree	181	51.0
	Not yes/Not agree	174	49.0

* Refers to the *Mean* value;

** Refers to the *Standard Deviation* value;

*** Refers to questions originally measured by a 5-point Likert scale. *Yes/Agree* includes responses being “strongly agree” or “agree” while *Not yes/Not agree* comprises responses being “neutral” or “disagree” or “strongly disagree.”

Table 3 Results of exploratory factor analysis of attitudinal statements

Statements/Items	Extracted factors			
	Pleasure at workplace	Workaholic	Environmental benefit	Fear of disease
Working with colleagues at workplace brings me lots of fun	0.7992			
I feel happy while my colleagues and managers visually recognize and assess my workload and achievements	0.7085			
For me, communicating with colleagues at workplaces is important to deal with problems and complete tasks/missions	0.7687			
I usually work late/overtime		0.8328		
I am interested in deploying new technologies to enhance my work		0.6070		
Working is one of the most important parts of my life		0.7017		
I am seriously concerned about the quality of air in Hanoi			0.7237	
Teleworking from home is a good solution to enhance the air quality			0.8715	0.8699
With the spread of COVID-19, the danger of being infected from the public is high				0.8132
If a person working/living in the building of my workplace is infected, the risk of being infected from him/her is high				

The Kaiser–Meyer–Olkin (KMO) Measure of Sampling Adequacy = 0.693

Bartlett test of sphericity: chi-square = 559.636; degree of freedom = 45; *p* value = 0.000 (H0: variables are not intercorrelated)

Extraction method: Principal component analysis with eigenvalue > 1

Rotation method: Oblimin with Kaiser normalization

Score estimation method: Regression

Variation (of items) explained by four factors extracted = 0.6472

correlation between educational level and type of company was at 0.4144. However, VIFs for such variables in binary logit models were smaller than 1.5.

Limitations of data collected

The sample used in this study could not be representative of the worker/teleworkers population in Hanoi due to the selection biases caused by the use of telecommunications and snowball sampling technique to recruit participants. Because these biases may have impacts on the findings of this research, it would be important to clarify them before interpreting the factors associated with HBT estimated from logit models.⁸

First, 112 respondents were former students of UTC, most of whom had clerical or administrative or sales-related jobs, according to the profiles of alumni and information obtained via email-based re-contact. Facebook groups, where the online questionnaires were shared, include respondents who are doing research, teaching, monitoring and dispatching transport services, and working as professionals/technicians. Therefore, the sample encompassed respondents whose occupations are generally appropriate for teleworking in normal conditions. However, the sample's distribution of occupational classes was unknown.

Second, a participant may share the questionnaire with his/her co-workers, probably leading the sample to be biased toward teleworkers of some specific companies in particular sectors rather than being representative of the population of teleworkers in Hanoi during the pandemic period. This bias may inflate the factors associated with companies.

Factors associated with completely teleworking at home in the social distancing period

Table 4 reveals the statistical insignificance of personal demographics and household attributes coupled with the commute distance. These results were inconsistent with the findings of several prior studies concerning the frequency of telework in normal conditions (Haddad et al. 2009; Mannering and Mokhtarian 1995; Sener and Reeder 2012; Singh et al. 2013).

On the contrary, company-related factors were the most important factors. Employees from enterprises where working onsite was optional (coef = - 2.480) or mandatory based on companies' re-arrangement (coef = - 3.526) were less likely to exclusively work at home compared with counterparts from closed companies. Thus, teleworkers tended to go to their companies once there was a chance of working at their workplace.

Respondents who were frequently allowed to adopt telework or teleconference prior to the outbreak of COVID-19 (coef = 1.200) were more likely to completely work at home. Therefore, a respondent who is familiar with using telecommunications for his/her job will most likely adapt to telework. Another possible explanation is that it would be easier for a company that is intensively deploying technology in operations and business to encourage its employees to work from home; however, this study could not confirm this because the Hanoi data included only employees and not employers.

Foreign companies (coef = - 1.213) were less likely to opt for complete HBT compared to state-owned ones. Almost all organizations controlled and/or funded by (local)

⁸ The author would like to thank a reviewer for this recommendation.

Table 4 Binary logit regression results of Model_1: Place of working

Independent variables and their values	Coef	Std. Err	<i>P</i> > <i>z</i>
<i>Age (ref=youngest (20–30 years old))</i>			
Middle (31–45 years old)	– 0.157	0.380	0.680
Eldest (≥ 46 years old)	– 0.524	0.431	0.224
<i>Gender (ref= male)</i>	– 0.179	0.289	0.536
<i>Educational level (ref= undergraduate or without qualification)</i>			
Graduate	– 0.445	0.409	0.277
Post-graduate	0.772	0.516	0.135
<i>Monthly income before COVID-19 period (ref= less than 10 million VND)</i>			
10—less than 25 million VND	0.011	0.412	0.978
25—less than 40 million VND	– 0.098	0.445	0.827
40 million VND or over	0.242	0.527	0.647
<i>Number of children under 12 (ref=0)</i>			
1	– 0.296	0.355	0.405
≥ 2	0.335	0.402	0.404
<i>Daily internet use time before COVID-19 period (ref= less than 2 h)</i>			
2–5 h	0.531	0.399	0.183
Over 5 h	0.620	0.406	0.126
<i>Adopting telework/teleconference before the COVID-19 period (ref= nearly never)</i>			
Sometimes (1–2 times/month)	– 0.206	0.367	0.575
Frequent or regular (at least 1–2 times/week)	1.200	0.460	0.009
<i>Types of enterprise (ref= state-owned)</i>			
Private	– 0.523	0.380	0.168
Foreign-invested	– 1.213	0.513	0.018
<i>Enterprise's policy of closing (ref= completely closing and requiring employees to telework)</i>			
Allowing employees to go to workplace on demand	– 2.480	0.500	0.000
Arranging employees to work alternatively at workplace	– 3.526	0.522	0.000
<i>Distance from home to workplace</i>	– 0.017	0.028	0.543
<i>Limited access to data (ref= no)</i>	– 0.458	0.296	0.122
<i>Difficulty in focusing on work (ref= no)</i>	0.178	0.302	0.554
<i>Pleasure at workplace</i>	– 0.085	0.148	0.567
<i>Workaholic</i>	– 0.088	0.145	0.545
<i>Environmental benefit</i>	0.386	0.143	0.007
<i>Fear of disease</i>	0.157	0.144	0.277
_cons	3.168	0.857	0.000

The dependent variable is equal to 1 if the respondent worked completely from home during the last week since the surveyed day. Otherwise, it is equal to 0;

N = 355; Log likelihood = – 169.58503; LR chi2(25) = 141.72; Pseudo R2 = 0.2947

governments receive numerous visits from the public every day and were expected to be models of physical distancing; hence, they were required to close completely. In contrast, many companies with foreign investment, located in industrial parks, kept operating at a lower level with a reduced number of workers in production buildings.

Table 5 Results of Model_2: Perception of HB T and Model_3: attitude towards the future development of HB T

Independent variables and their values	Model_2: Telework is a good solution during the COVID-19			Model_3: Developing telework after the COVID-19		
	Coef	Std. Err	P > z	Coef	Std. Err	P > z
<i>Age (ref= youngest (20–30 years old))</i>						
Middle (31–45 years old)	1.165	0.390	0.003	- 1.049	0.434	0.016
Eldes t (≥46 years old)	- 0.757	0.464	0.103	- 0.764	0.506	0.131
<i>Gender (ref= male)</i>	0.505	0.286	0.078	0.865	0.303	0.004
<i>Educational level (ref= undergraduate or without qualification)</i>						
Graduate	- 0.521	0.406	0.199	1.134	0.497	0.022
Post-graduate	- 0.173	0.550	0.753	0.773	0.627	0.217
<i>Monthly income before COVID-19 period (ref= less than 10 million VND)</i>						
10—less than 25 million VND	- 0.147	0.403	0.714	0.797	0.440	0.070
25—less than 40 million VND	- 0.478	0.445	0.283	0.165	0.463	0.721
40 million VND or over	- 1.286	0.554	0.020	- 0.371	0.554	0.504
<i>Number of children under 12 (ref= 0)</i>						
1	- 0.442	0.351	0.208	0.009	0.367	0.980
≥2	- 0.830	0.417	0.047	1.015	0.425	0.017
<i>Daily internet use time before COVID-19 period (ref= less than 2 h)</i>						
2–5 h	0.249	0.389	0.522	- 0.327	0.432	0.448
Over 5 h	- 0.009	0.394	0.982	- 0.130	0.432	0.764
<i>Adopting telework/teleconference before COVID-19 period (ref= nearly never)</i>				Not included		
Sometimes (1–2 times/month)	- 0.171	0.386	0.658			
Frequent or regular (at least 1–2 times/week)	0.863	0.425	0.042			
<i>Type of enterprise (ref= state-owned)</i>						
Private	0.306	0.381	0.423	- 0.396	0.413	0.338
Foreign-invested	0.008	0.513	0.987	- 0.289	0.570	0.613
<i>Distance from home to workplace</i>	0.004	0.030	0.905	0.081	0.034	0.018

Table 5 (continued)

Independent variables and their values	Model_2: Telework is a good solution during the COVID-19			Model_3: Developing telework after the COVID-19		
	Coef	Std. Err	P> z	Coef	Std. Err	P> z
<i>Enterprise's policy of closing (ref=completely closing and requiring employees to telework)</i>						
Allowing employees to go to workplace on demand	-0.587	0.368	0.110			
Arranging employees to work alternatively at workplace	-0.145	0.394	0.713			
Limited access to data (ref=no)	-0.886	0.302	0.003	Not included		
Difficulty in focusing on work (ref=no)	-0.843	0.324	0.009	Not included		
Pleasure at workplace	-0.082	0.154	0.592	-1.279	0.183	0.000
Workaholic	0.215	0.149	0.148	0.936	0.183	0.000
Environmental benefit	0.406	0.165	0.014	0.558	0.160	0.000
Fear of disease	1.172	0.183	0.000	Not included		
Teleworking is a good solution during the COVID-19 (ref=not yes)	Not included	0.983	0.316	0.002		
Response time (ref=first week)						
Second week	0.279	0.462	0.545	0.030	0.539	0.955
Third week	0.710	0.447	0.112	0.780	0.501	0.120
Fourth week	1.006	0.478	0.035	-0.206	0.536	0.701
_cons	0.389	0.804	0.628	-2.535	0.974	0.009
Log likelihood	-172.10461	-152.24741				
Likelihood Ratio Chi-Square	LR chi2(28) = 147.92	LR chi2(22) = 187.50				
Pseudo R2	0.3006	0.3811				

HBT during social distancing was enforced or highly encouraged by employers; therefore, the significant roles of company-specific variables were understandable. Additionally, the sample's bias toward some enterprises may contribute to the significant effects of factors related to companies. In contrast, since companies' closure policies oriented toward protecting the health of all workers rather than specific groups divided based on individual characteristics, socio-demographic variables were not significant, which was in line with the findings in Beck et al. (2020).

Among attitudinal factors, only environmental benefit (coef=0.386) had a statistically significant positive association with complete HBT. However, it would be problematic to claim that teleworkers did not go to their workplace because of the environmental benefits. Instead, companies' policies and schemes are the most influential factors.

Factors associated with the perception and the attitude toward home-based telework

Table 5 describes the results of two logit models. Model_2 tests associations of variables with respondents' agreement with HBT being a good solution during the social distancing period while Model_3 investigates associations of variables with respondents' attitude toward promoting HBT to boost a hybrid work mechanism in their enterprises after the end of COVID-19.

Discussing variables used in both models

Age had contrast correlations with the perception (Model_2) and the attitude (Model_3). Compared with teleworkers aged between 20 and 30 years old, 31–45-year-old counterparts were more likely to have a good perception of HBT but less likely to agree with developing HBT in the future. The middle-aged group was satisfied by HBT only in the context of COVID-19, and were actually against HBT. The result of age in Model_3 was not compatible with the statistically insignificant role of age found by Haddad et al. (2009), Sener and Reeder (2012).

Females were more likely to agree with both the good perception and the positive attitude toward HBT albeit with a weak(er) relationship for the former ($p=0.078$). The latter's result corroborated the observation in Turkey (Iscan and Naktiyok 2005). The reason for significantly more females supporting the future promotion of HBT would be the women's primary role in doing household chores and taking care of other household members in Vietnam (Knodel et al. 2005). In this sense, HBT for the female teleworkers was expected to be an effective way to achieve better balance between work and family.

Education was significant in Model_3 but not in Model_2. An opposite phenomenon was seen for monthly household income. Specifically, graduate teleworkers (coef=1.134) were more likely to have a positive view on the future development of HBT compared to those without or with a lower qualification. Regarding monthly income of household, employees living in the richest households (coef=-1.286) were less likely to consider HBT a good solution compared with those coming from the poorest families.

The number of children was a statistically significant variable in both Model_2 and Model_3 albeit with opposite effects. Compared with employees from non-child households, participants with more than one child in their households were less likely to agree with HBT being a good solution in the COVID-19 period (coef=-0.830) but more likely to agree with improving HBT after COVID-19 (coef=1.015). These contradictory findings

were congruent with the discussion of Mokhtarian and Salomon (1994) that the same variable, depending on settings, can be either a constraint or a facilitator. During the social distancing period, all schools and kindergartens were closed; hence, parents had to look after children and work at the same time. Furthermore, parents may need to share electronic devices with children who were learning online. Accordingly, children may serve as a source of distraction; teleworkers without children did not experience these problems. Nevertheless, when the COVID-19 pandemic is handled and children go back to school, the escorting-related pressure would lead employees with at least two children to desire a flexible working schedule (Haddad et al. 2009; Iscan and Naktiyok 2005; Peters et al. 2004).

The daily duration of internet use, although being a determinant of adopting HBT in (Loo and Wang, 2018; Singh et al. 2013), was not associated with both the perception and the attitude towards HBT here. Likewise, company type was not a significant factor in Model_2 and Model_3.

Three factors, including distance from home to workplace, pleasure at workplace and workaholic, were significant in Model_3 but not in Model_2. In this sense, during the course of COVID-19, teleworkers paid close attention to other factor(s) rather than those affecting the choice of telework in normal conditions (Helminen and Ristimäki 2007; Loo and Wang 2018). However, the commute distance (coef=0.081) and workaholic (coef=0.936) were associated with the greater likelihood of supporting an enhancement of HBT after the COVID-19 era whereas pleasure at workplace was a deterrent (coef=-1.279), indicating that the commute distance, workaholic, and pleasure at workplace factors were not only associated with the choice as reported in Loo and Wang (2018) but also the preference for more HBT.

Attitude toward environmental benefit of HBT correlated positively with both the perception of HBT (coef=0.406) and the opinion on promoting HBT (coef=0.558). Notably, this is the only one that was significant in both Model_2 and Model_3 by the same direction. Statistical significance of this variable would be opposite to earlier findings in European countries, wherein the environmental advantages of HBT were either not appreciated (Aguilera et al. 2016) or appreciated by only a minority of respondents (Wilton et al. 2011). The importance of environmental benefit in Model_2 and Model_3 may result from the fact that the air quality had been poor and subpar continuously in Hanoi before the COVID-19 pandemic, and the heavy use of private vehicles had been blamed for this disgraceful situation (VnExpress 2019). Yet, the air quality became better visually due to a marked reduction in travelling over the social distancing period (VnExpress 2020). Such change would affect positively respondents' views on the environmental effects of HBT.

Response time was a predictor of the perception with responses collected in the 4th week (coef=1.006) more inclined to have a positive perception of HBT compared to those gathered in the 1st week. This result emphasized the improved perception of HBT over time because teleworkers became more familiar with teleworking, thereby better addressing or adapting to challenges when working from home. Contrary to the perception, attitude toward the further development of HBT would not change by time as reflected by an insignificant effect of response time in Model_3.

Discussing variables used in Model_2 only

Respondents frequently teleworking or taking part in teleconference before the COVID-19 crisis (coef=0.863) were more likely to agree with HBT being a good solution compared

with those for whom working from a distance by telecommunications was new. This confirmed the finding that once telework becomes familiar and normalized, teleworkers tend to choose it again (Wilton et al. 2011). By contrast, a sudden and immediate adoption of HBT may result in an unsettling experience for teleworkers.

Companies' closure policies did not affect the perception of HBT. Unsurprisingly, the presence of difficulties in accessing data (coef = - 0.886) and concentrating on work (coef = - 0.843) was negatively associated with an agreement with the positive role of HBT.

Fear of the COVID-19 pandemic was a strong and statistically significant predictor (coef = 1.172). Teleworkers with the greater fear were more likely to agree with HBT being a good working mode in the COVID-19 era.

Discussing variables used in Model_3 only

As expected, respondents' perception of HBT had a positive association with their attitudes toward HBT. Employees agreeing that HBT was a good solution in the COVID-19 period (coef = 0.983) had the greater likelihood of agreeing with the further enhancement of HBT in their enterprises.

Summarizing effects of factors in two models

The occurrence of COVID-19 significantly and positively affected the perception of HBT in the time of COVID-19 through the fear of infection. Yet, the lack of familiarity with telework and preparation, represented by difficulty in accessing data, negatively influenced the perception. Owing to the presence of almost all household members, especially children at home, teleworkers were prone to more serious distractions, leading them to be less likely to agree with HBT being a good solution. Perhaps, because most concentration of teleworkers was given to fear of disease and issues with respect to working at home, variables representing benefits of working at home and at workplace (i.e., workaholic, pleasure at workplace, commute distance) were not significant predictors of the perception of HBT. The perceived experience with HBT seemed to be improved when teleworkers were more familiar with this working form.

Understanding of factors affecting the perception enables implementation of appropriate policies to encourage telework effectively in the era of not only a pandemic but also the post-pandemic because of the statistically significant effect of the perception on the attitude toward the further development of HBT. When there is a change in the context, such as from the presence to the absence of a health crisis, some factors (e.g., the number of children) may affect the perception and the preference differently; thus, it is crucial to investigate determinants of the perception of HBT.

In normal situations without the danger of COVID-19, the preference for teleworking more was associated with a variety of variables (e.g., workaholic, commute distance, gender, number of children, pleasure at workplace), effects of which were generally compatible with expectations formed based on findings related to the choice for HBT (Helminen and Ristimäki 2007; Loo and Wang 2018; Singh et al. 2013). Thus, the effects of many variables on the choice and preference for HBT would be similar, which is in line with the fact that employees with options of telework make decisions on whether to telework or not mainly based on their preference (Peters et al. 2004; Singh et al. 2013).

Because of the statistically insignificant roles of company-related variables, the sample's bias toward particular enterprises would be marginal or, at least, the impacts of this bias on the perception and the preference for HBT would be small.

Brief policy implications

Telework needs an exogenous shock to escape from gradual development and achieve a breakthrough (Aguilera et al. 2016). The COVID-19 disaster, although causing detrimental effects on both human and economic health, has induced employers to re-think carefully and positively about the promotion of HBT. During the era of COVID-19, telework is an ingenious approach to the continuity of business production and maintaining work relationship with employees, thus alleviating economic repercussions. In the context of the unknown emergence of COVID-19 and the potential occurrence of other global crises, more opportunities for telework may be offered for employees in developing countries. However, unlike working in the workplace, HBT is a work option, which may be rejected by workers. Hence, allowing telework may not result in its acceptance and becoming commonplace in enterprises. For example, in a research in the Netherlands, although being offered opportunities for teleworking, the vast majority (approximately 60%) of respondents did not telework because of no preference for it (Peters et al. 2004). Therefore, it is important to consider social factors when developing telework (Andreev et al. 2010). Based on the above analyses of factors, young employees aged up to 30 years, females, graduates, workaholics, those travelling long distances to work, or living with at least two children should be encouraged to telework first. When telework becomes more familiar and normalized, it can be re-adopted by teleworkers and accepted by other employees (Wilton et al. 2011). As HBT was more preferred by people living farther from workplace, the wide adoption of working from home possibly lessens traffic congestion by reducing long-distance commuting travel in cities of developing countries.

Environmental benefit was a favorable variable for both the perception and the attitude toward HBT; therefore, emphasizing positive impacts of telework on the environment would be an effective way to persuade employees to work from home. However, assigning the cause of the better air quality during the COVID-19 period to telework in Hanoi is problematic because of the stops of other possible sources of emissions such as construction and tourism travels. When educating the public about the positive effects of telework on the environment, it is better to concentrate on reduced emissions owing to a reduction in the number of commuting trips rather than all types of trips because more travelled kilometers of non-work and non-commute trips are seen for teleworkers (Cerqueira et al. 2020; de Abreu e Silva and Melo 2018; Helminen and Ristimäki 2007; Kim et al. 2015; Pendyala et al. 1991).

Conclusions

During the COVID-19 era, HBT has been adopted substantially to protect public health and continue production. This study presents factors associated with (1) completely working from home, (2) the perception of HBT during social distancing, and (3) the attitude toward the further development of HBT post-COVID-19 in Hanoi, where telework was a novelty pre-COVID-19. Company-related factors have primarily determined whether employees exclusively worked at home. The fear of the pandemic and

difficulties of working at home were the main facilitator and deterrents of the perception of HBT, respectively. Once there is a change in the context, it is important to consider the perception of telework to predict the preference, which is the major determinant of the choice to re-telework. To enhance telework after the end of COVID-19, the social aspects of employees should be considered to obtain more teleworkers, thereby normalizing this flexible working arrangement in enterprises. Raising employees' awareness about the environmental benefits of telework owing to reductions in commute trips would be a potential approach. As the development of telework facilitates the potential of eliminating a proportion of long-distance commuting trips it would be a pragmatic solution to relieve transport-specific challenges such as traffic congestion and polluted air in urban areas of emerging countries.

This study has two main limitations. First, as mentioned in the sub-section "Limitations of data collected," the sample could not be representative of the general population of teleworkers during COVID-19. Specifically, teleworkers with occupations suitable for telecommuting were overrepresented while teleworkers with other jobs were underrepresented. Therefore, the findings and conclusions in this study may apply generally to workers with jobs appropriate for teleworking, at least based on the characteristics of these occupations. Second, the study omits potential predictors of HBT, such as occupation, living space, and residential area (Bailey and Kurland 2002; Yen 2000). Because the pandemic keeps evolving unpredictably, further analyses of HBT are needed. This study serves as a proof of concept for these ongoing studies. In particular, future research may use a list of factors, both included and excluded in this study, to validate findings and extend knowledge on the further development of HBT and its determinants in the next lockdowns or post-COVID-19. Data collection by using technological methods (e.g., apps or online questionnaire) is still useful in the era of COVID-19 (Kawashima et al. 2020; Molloy et al. 2020). Nevertheless, it is crucial to limit selection bias through using probability sampling based on administrative units of the research area. With a representative sample, understandings of jobs appropriate and inappropriate for HBT in the era of pandemic can be attained. Furthermore, telework is two-sided (Singh et al. 2013). Besides considering employees, exploring factors affecting employers' decisions about allowing and/or promoting telework in their enterprises would be necessary. In the medium or long term, it would be vital to consider the possible negative effects of teleworking and estimate how vehicle kilometers travelled of teleworkers and their household members change.

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Author contributions MHN took responsibility for all of the procedures to create this paper, including study conception, data collection, data analysis and interpretation, manuscript preparation. The author has reviewed and approved the final version of the manuscript.

Compliance with ethical standards

Conflict of interest The author confirms that there is no conflict of interest regarding the publication of this paper.

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Minh Hieu Nguyen is a lecturer at Faculty of Transport Economics under University of Transport and Communications, Vietnam. He holds a Ph.D. in Economics from Université Gustave Eiffel (formerly IFSTTAR/AME/DEST), France in 2020 with the thesis topic being: Deriving trip characteristics from GPS-enabled travel surveys. He along with his colleagues is doing research on children's travel to school in Hanoi under impacts of the COVID-19 pandemic.