sustainability

IMPACT FACTOR 3.889

CITESCORE 5.0

Article

Working in the Metaverse: Does Telework in a Metaverse Office Have the Potential to Reduce Population Pressure in Megacities? Evidence from Young Adults in Seoul, South Korea

Hyoung-Yong Choi

MDPI

https://doi.org/10.3390/su14063629

sustainability

MDPI

Article

Working in the Metaverse: Does Telework in a Metaverse Office Have the Potential to Reduce Population Pressure in Megacities? Evidence from Young Adults in Seoul, South Korea

Hyoung-Yong Choi

HUFS Business School, Hankook University of Foreign Studies, Seoul 02450, Korea; hchoi@hufs.ac.kr

Abstract: Despite the growing number of teleworkers and the unsustainable challenges (e.g., environmental pollution) facing megacities due to population pressure, few studies have investigated whether telework can reduce population pressure in megacities. This study conducts a scenario-based experiment and proposes that telework can reduce population pressure in megacities by enticing megacity residents to leave the megacity. Specifically, given the increasing number of companies that are adopting metaverse teleworking offices, this study classifies telework into metaverse telework and non-metaverse telework and empirically demonstrates that both types of telework positively influence an individual's intention to relocate from a megacity to a non-megacity. Additionally, this study further shows that metaverse telework has a greater impact on an individual's intention to relocate from a megacity to a non-megacity than non-metaverse telework. This study demonstrates how different types of telework can differentially reduce population pressure in megacities and provides practical recommendations for policymakers and strategy managers to support this practice.

Keywords: telework; metaverse; relocation; urbanization; megacity; sustainability

Citation: Choi, H.-Y. Working in the Metaverse: Does Telework in a Metaverse Office Have the Potential to Reduce Population Pressure in Megacities? Evidence from Young Adults in Seoul, South Korea. *Sustainability* **2022**, *14*, 3629. https://doi.org/10.3390/su14063629

Academic Editor: Fabrizio D'Ascenzo

Received: 7 February 2022
Accepted: 17 March 2022
Published: 19 March 2022

1. Introduction

A megacity is a very large city, usually with a population of more than 10 million people [1]. According to the United Nations, there are 33 megacities in the world, including Seoul in South Korea, Beijing and Shanghai in China, New York and Los Angeles in the United States, Deli in India, and Tokyo in Japan [2]. As populations move from rural to urban areas, the number of megacities is increasing [3]. Although living in a megacity, where opportunities are centralized, provides individuals with access to better labor markets, education, and services, megacities face challenges related to human health [4,5], crime and safety [6,7], traffic congestion [8–10], emergency response [11,12], and environmental pollution [4,13–15]. Accordingly, governments have tried to address these problems by reducing population pressure in megacities [16] and improving urban sustainability [17–19]. For example, since 1970, the South Korean government has implemented a series of industrial relocation policies by dispersing the economy and population from megacities [20]. Since 2015, the Beijing government has tried to reduce population pressure by relocating industries that do not fit into the city's strategic location, including the general manufacturing industry, several administrative departments and non-profit service institutions, regional logistics bases, and several educational organizations [16].

Managing population pressure in megacities and improving urban sustainability requires predicting population movement trends and understanding the impact of social, economic, and technological change on population movement. One of the recent major changes that could potentially affect population movement is the spread of telework during COVID-19 [21–23]. In response to the COVID-19 pandemic, people have avoided face-to-face contact to protect themselves from the risk of the virus [24], while governments' social distancing policies have prompted the use of information and communication technology (ICT) for virtual collaboration in the workplace [23,25]. Accordingly, during COVID-19, an

increasing number of companies adopted telework to ensure employee safety and provide continuity of economic activity [25]; thus, telework has increased significantly in Asia, Europe, and the United States [21–23].

Telework is a type of work performed remotely using ICT (e.g., smartphones, personal computers, tablets, and virtual conferencing tools such as Zoom) outside the employer's premises [26]. Because one of the main factors influencing an individual's decision-making about where to reside is where they work [16,27], telework, which allows people to live wherever they want (e.g., even in areas far from the employer's premises), can affect their residential location priorities [23]. Therefore, telework has the potential to entice people to move from megacities to places with better costs of living and environmental quality. However, despite the potential of telework to reduce population pressure in megacities through residential relocation [23], few studies have empirically investigated the relationship between telework and people's intentions to move from megacities to non-megacities.

The aim of this study is to investigate the influence of two different types of telework (i.e., metaverse telework and non-metaverse telework) on people's intentions to relocate from a megacity to a non-megacity. A metaverse is a three-dimensional (3D) virtual world where users, as avatars, can interact with each other and objects in real-time [28–30], and a non-metaverse is a physical or traditional virtual environment that does not use avatars [31]. In order to increase work efficiency and ensure employee safety during COVID-19, an increasing number of companies have adopted metaverse teleworking offices, allowing employees to commute to a metaverse office instead of commuting to a physical office. Accordingly, this study categorizes telework as metaverse telework or non-metaverse telework and argues that both types of telework positively affect people's intentions to relocate from a megacity to a non-megacity. Additionally, this study argues that people are more likely to relocate from a megacity to a non-megacity when working remotely from a metaverse office than when working remotely from a non-metaverse office. In order to support these lines of argument, this study answered the following research questions:

RQ1. *What is the impact of telework on people's intentions to relocate from a megacity to a non-megacity?*

RQ2. *Does teleworking in a metaverse office have a greater impact on people's intentions to relocate from a megacity to a non-megacity than teleworking in a non-metaverse office?*

To answer these research questions, this study conducted a within-subject, scenario-based experiment using a crossover design [32] in which the work type (non-telework, metaverse telework, or non-metaverse telework) was manipulated. The study participants live in Greater Seoul, South Korea's largest megacity, with a population of approximately 25 million people, more than 50% of the entire national population [33].

This article is presented as follows: Section 2 discusses the background of this research and presents the research hypotheses. Section 3 explains the research methodology, which is followed by Section 4, where the results from the data analysis are explored. In Section 5, the theoretical contributions and practical implications of the findings are discussed. The last part of this paper suggests limitations and conclusions.

2. Background and Hypothesis

2.1. Megacities and Sustainability

The development of urban agglomerations dates back to the era of the industrial revolution in Western Europe, where large-scale industrialization and widespread labor specialization have provided advantages on an unprecedented scale in large urban-industrial agglomerations [34]. Improvements in agricultural productivity freed workers from land labor and allowed them to move to urban industrial areas, while increased productivity in urban factories using machinery and fossil fuels prompted urbanization [35].

As more and more people have moved from rural to urban areas, the proportion of the population living in urban areas has increased over the past few decades [4]. Accordingly, across the world, the number of megacities—i.e., those with a population of 10 million or more—increased from 5 in 1980 to 30 in 2015 [2]. As people continue to move to cities every year, the number of megacities is projected to increase to 48 by 2035 [2]. Currently, about 0.6 billion people live in megacities, and most megacities are located in Asia. Megacities provide benefits such as high-paying jobs and high-quality educational opportunities and health care; however, overpopulation in megacities has created many unsustainable social and environmental problems [36–38].

One of the major problems that megacities face is air pollution from various sources such as transportation, fossil fuel burning, industrial emissions, and waste incineration [4,5,13–15]. In particular, at least 96% of the population of megacities is exposed to fine dust ($PM_{2.5}$: Particulate matter with a diameter of less than 2.5 μm) concentrations that exceed World Health Organization (WHO) guidelines [4]. Air pollution in megacities has increased the prevalence and severity of asthma [39,40] and allergic diseases [41], with a greater impact on children and young adults [42]. In addition to air pollution, the growing population density in megacities creates various unsustainable environmental challenges. For example, high population density often results in water quality and quantity crises and unmanageable amounts of urban and industrial waste [7]. Additionally, people living in megacities suffer from high crime rates and traffic congestion [6,8–10].

In order to address the challenges that megacities face and improve urban sustainability, previous research studies suggest that governments need to try to use green energy, develop convenient high-speed public transportation, and protect and scientifically plan urban water resources [9,17–19]. However, a more fundamental solution to managing problems facing megacities is to entice megacities' residents to migrate to other cities, thereby alleviating population pressures [9,16]. Therefore, we need to understand the factors affecting the people's migration from megacities to other cities in order to establish effective government policies to reduce population pressure in megacities. One of the factors that can potentially affect the movement of people from megacities to other cities is teleworking.

2.2. Telework

Telework is a type of work performed remotely using ICT outside the employer's premises [26]. Telework promotes work flexibility for employees and organizational flexibility for employers, and helps businesses evolve from fixed to flexible production systems to quickly and inexpensively adapt to market changes [43]. The population of teleworkers has steadily grown since the advent of ICT, which allows employees to perform work without commuting to the employer's premises [44,45]. During the COVID-19 pandemic, businesses' adoption of teleworking has increased dramatically to ensure employee safety and business continuity [21–23,25]. For example, teleworking in Greece has increased by around 50% during the pandemic [23].

The use of telework varies across industrial sectors and occupations. According to an OECD report, telework is most common in knowledge-intensive services such as professional and ICT services, and less common in less knowledge-intensive services, such as manufacturing, retail and transportation, and non-market services such as health and social services [44]. This may be because many highly skilled occupations in knowledge-intensive industries can be performed remotely using ICT, while many occupations in less knowledge-intensive services and non-market services are more likely to require a physical presence [44].

Telework has several advantages for employees, employers, and society. For example, from an employee's point of view, telework promotes work flexibility and work–family balance by allowing employees to spend less time commuting and more free time with their families at home [25]. From an employer's point of view, telework reduces real estate rental and operating costs, improves chances of hiring better talents, and offers

greater organizational flexibility [45]. In addition, telework is a sustainable type of work in modern society, which suffers from air pollution and greenhouse gases, because it reduces the environmental impact of mobility [25]. Telework also has several disadvantages for employees and employers. For example, from an employee's point of view, telework reduces the spatial separation of home and office and the life of external relationships, and from an employer's point of view, telework increases the difficulty of remote worker management [45].

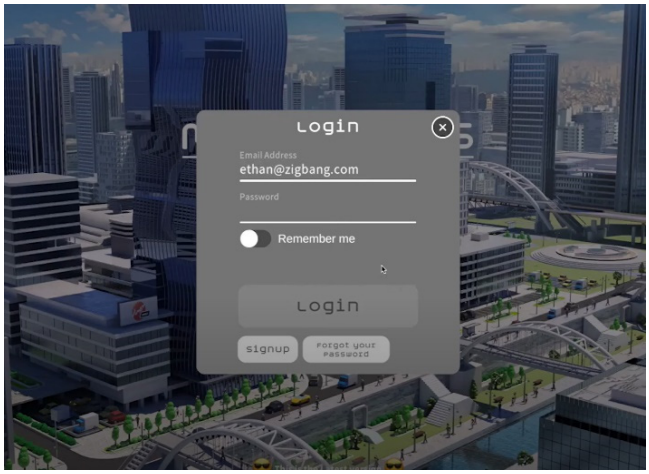
The International Labour Organization (ILO) classifies telework into regular home-based telework, high mobile telework, and occasional telework based on the location and frequency of telework [26]. Specifically, regular home-based telework refers to working from home on a regular basis using ICT, high mobile telework refers to working regularly using ICT in various places outside the employer's premises and occasional telework refers to working occasionally using ICT in one or more places outside the employer's premises [25,26]. As can be seen from the above description of telework modalities, telework cannot be performed without the help of ICT, such as smartphones, personal computers, tablets, and virtual conferencing tools. However, there have been few studies on telework that focus on the types of ICT used for teleworking. Given the important role of ICT in telework and the increasing number of companies that are adopting metaverse offices enabled by recent technological developments in ICT, this study classifies telework into metaverse telework and non-metaverse telework.

2.3. Metaverse Telework and Non-Metaverse Telework

Recently, the metaverse has received tremendous attention around the world with the development of related technologies such as the fifth generation mobile network, blockchain, Virtual Reality (VR), Augmented Reality (AR), and head-mounted display (HMD) [28]. In 2021, Nvidia's CEO revealed that the company's next step would be to create a metaverse, and Facebook has renamed itself Meta [29]. The term "metaverse" originates from the science fiction novel *Snow Crash*, and it is a compound word of "meta," which means "beyond," and the "verse" of "universe" [46]. Metaverse, which is considered to be a kind of next-generation internet, is a digital world that exists beyond the physical world in which we live [29,30]. Although there is still no clear consensus on how "metaverse" should be defined, the common attributes of a metaverse are described as a shared three-dimensional (3D) virtual environment, the use of avatars, interoperability, continuity of entities, and synchronization [29]. Therefore, a metaverse can be defined as a 3D virtual world where users, as avatars, can interact with each other and objects in real time [28–30]. The recent COVID-19 pandemic has increased the adoption of metaverses in various areas to replace offline human experiences [30,47]. For example, American musician Lil Nas X held an online concert on the Roblox, UC Berkeley held its graduation ceremony in Minecraft, LG Electronics has recruited and trained employees at its metaverse campus, and the Chinese University of Hong Kong has created a prototype of a metaverse campus to enrich the campus life of university students and faculty [30].

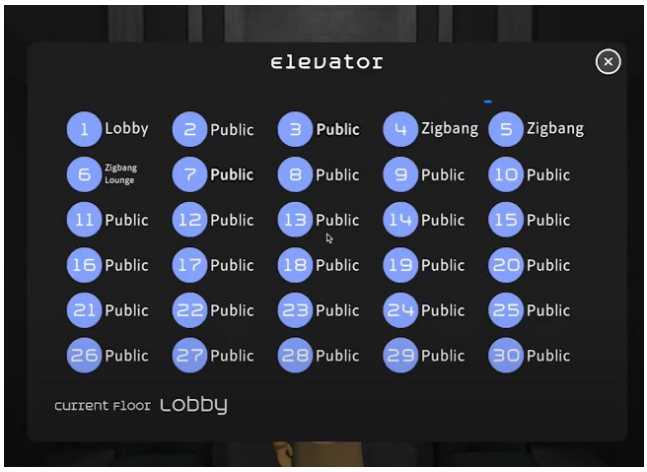
As metaverses are introduced into various areas of our lives, telework has begun to take place in metaverse offices. Accordingly, an increasing number of companies are adopting metaverse offices for telework, and teleworkers around the world are using immersive, interactive, and collaborative metaverse platforms created by Gather, Teamflow, Meta, or the company they work for [48]. One of the companies that created their own metaverse platform for telework is Zigbang, the leading company in the Korean PropTech (PropTech: Property technology is the application of information technology to real estate markets.) industry. In 2021, Zigbang created a metaverse platform called Metapolis, which is used as a tool for telework. Zigbang eliminated its headquarters in Seoul, and all of Zigbang's employees use Metapolis as their metaverse office. Zigbang's metaverse office is part of a 30-story virtual building that can accommodate up to 300 people at a time on each floor. Zigbang uses the fourth and fifth floors of the Metapolis building and leases other floors to other organizations. As shown in Figure 1, Zigbang employees log in to

Metapolis, select an avatar, take the elevator to move up to their virtual workplace, and move their avatars to their respective desks to work with their colleagues. In Zigbang's metaverse office, as an avatar approaches another avatar, the webcam above the avatar's head and their mic both turn on, allowing face-to-face conversations. In addition, as an avatar moves away from another avatar, the faces displayed above the avatars gradually shrink and disappear, and the mic turns off.



(**1**) Log in with ID and password.

(**2**) Select an avatar.



(**3**) Select a floor.

(**4**) Move an avatar, and work with colleagues.

Figure 1. Zigbang's Metaverse Office.

As in Zigbang's metaverse office description above, telework in a metaverse office offers more efficient communication between employees than non-metaverse telework. Specifically, employees working in a metaverse office exist in the same virtual space and can immediately communicate with colleagues whenever they want by moving their avatars. Accordingly, unlike non-metaverse teleworkers who need to use phones, email, or SNS to contact their colleagues, metaverse teleworkers do not need to send messages or emails to colleagues to arrange meetings or request documents. Therefore, metaverse telework provides a communication environment similar to that of non-telework in a physical office (see Table 1).

Table 1. Similarities and differences between metaverse telework, non-metaverse telework, and non-telework.

	Metaverse Telework	Non-Metaverse Telework	Non-Telework
Avatar	O	X	X
Employees exist in the same space	O (virtual space)	X	O (physical space)
Immediate face-to-face communication	O	X	O
Method of communicating with colleagues	Move an avatar and communicate with colleagues	Email, call, SNS, virtual conferencing (need to arrange a meeting and connect to the virtual conferencing tool)	Move physically and communicate with colleagues
Physical work location	Anywhere with internet access	Anywhere with internet access	On the employer's premises
Regular commute	O (commute to metaverse office)	X	O (commute to physical office)

Although the efficiency of communication between employees who carry out metaverse telework and non-metaverse telework are different, both types of telework allow employees to work from anywhere with internet access. Because one of the main factors influencing an individual's decision about where to reside is where they work [16,27], telework, which allows employees to live wherever they want (e.g., even in areas far from their employer's premises), can affect their residential location decisions [23]. According to the theory of reasoned action (TRA), individuals who believe that certain behaviors will lead to desirable outcomes are more likely to have positive attitudes toward certain behaviors [49,50]. While megacities offer benefits, such as high-paying jobs, they also have many unsustainable problems, such as air pollution, high costs of living, and traffic congestion [4–6,8–10,15,41]. Therefore, megacity residents may have positive attitudes toward moving to places with lower costs of living and better environmental quality because they may believe that moving out of the megacity will lead to desirable outcomes. According to the TRA, attitude is a predictor of behavioral intention [49,50]. Therefore, if megacity residents can work remotely, such as what is enabled by metaverse or non-metaverse teleworking, they may consider moving from megacities to places with lower costs of living and better environmental quality. Thus, this study hypothesizes the following:

Hypothesis 1. *Metaverse teleworking has a positive impact on an individual's intention to relocate from a megacity to a non-megacity.*

Hypothesis 2. *Non-metaverse teleworking has a positive impact on an individual's intention to relocate from a megacity to a non-megacity.*

This study further theorizes that metaverse teleworkers are more motivated than non-metaverse teleworkers to move from megacities to places with better quality of life. When employees work in a metaverse office, they commute on the network (i.e., commuting to the metaverse office) and share the same virtual space with colleagues during work time. Metaverse teleworkers can even complete small talks to build relationships with colleagues. In addition, as mentioned earlier, metaverse teleworkers can perform almost any task efficiently in a metaverse office, just as if they were working in a physical office on the employer's premises. Therefore, compared to non-metaverse teleworkers, metaverse teleworkers may be able to go longer periods of time between visits to their company's physical office. According to the theory of planned behavior (TPB), when an individual believes that they can successfully perform a specific behavior (i.e., high perceived be-

havioral control), they are much more likely to have the intention to execute the specific behaviors [49]. Teleworkers working in a metaverse office may be more confident than a teleworker working in a non-metaverse office that they can successfully perform telework even in areas far from their employer's premises. Accordingly, metaverse teleworkers may be more motivated to move from megacities to places with lower costs of living and better environmental quality than non-metaverse teleworkers. Thus, this study hypothesizes that:

Hypothesis 3. *Metaverse teleworking has a greater impact on an individual's intention to relocate from a megacity to a non-megacity than non-metaverse teleworking.*

The research model is presented in Figure 2.

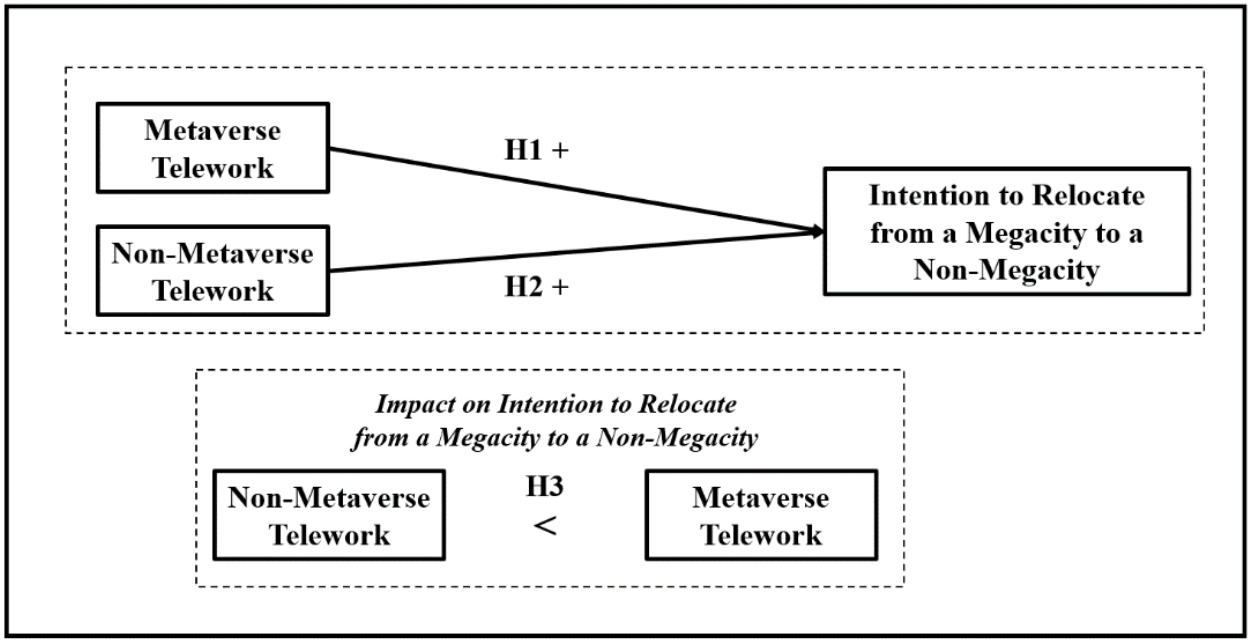


Figure 2. Research Model.

3. Method

3.1. Experimental Design and Participants

This study conducted a within-subject scenario-based experiment using a crossover design [32] in which the work type (metaverse telework vs. non-metaverse telework vs. non-telework) was manipulated. Telework (both metaverse telework and non-metaverse telework) is a type of work that has recently been introduced in the study context (i.e., South Korea); therefore, at this point in the telework adoption process, scenario-based experiment is appropriate to operationalize the manipulations and to control over unmanageable variables [51]. This study measures the subjects' intention to relocate from a megacity to a non-megacity as the dependent variable of interest. Behavioral intention is a good predictor of an individual's future behavior when, as in the context of this study, behavior is volitional and individuals have information to shape their behavioral intentions [52,53]. The study participants are business school students (young adults from three universities in Seoul, aged from 20 to 35) who live in Greater Seoul, South Korea's largest megacity, with a population of approximately 25 million people, more than 50% of the entire national population [33]. Due to COVID-19, participants have experienced online learning, which allows them to take classes from anywhere with internet access using ICT (e.g., smartphones, personal computers, tablets, and virtual conferencing tools such as Zoom). Therefore, study participants, business school students who have experienced online learning, and have a good understanding of the advantages and disadvantages of teleworking in employment. The experiment was conducted via Qualtrics. A total

of 95 young adults participated in the study. Twenty responses were excluded from further analysis due to missing values and manipulation and attention check failures, which were determined based on manipulation check and attention check questions; 75 usable responses were obtained; The average age of participants was 24.2 years; 34.7% of the participants were male (n = 26), and 65.3% were female (n = 49).

3.2. Procedure

The sequence of tasks involved in the experiment is described in Figure 3, and the protocol for the experiment is presented in Appendix A. First, participants were asked to read a set of instructions and watch a video about different work types. Next, participants were given information about three work types (i.e., metaverse telework, non-metaverse telework, non-telework) and asked about their intention to relocate from a megacity to a non-megacity. The order in which participants received information about three work types was randomized. Next, participants were asked to answer a set of questions that included manipulation checks and an attention check. Finally, participants were asked to provide demographic information.

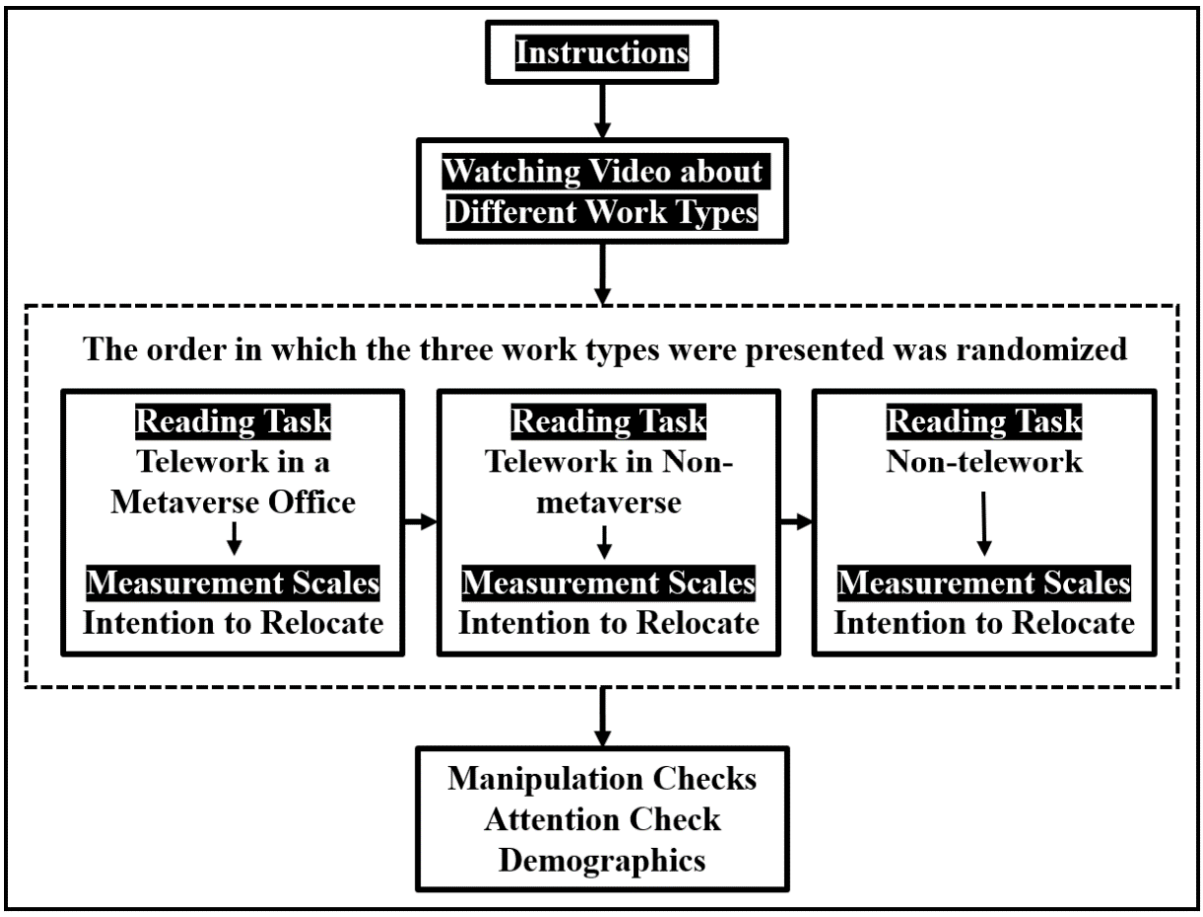


Figure 3. Flowchart of Experiment.

3.3. Construct Measures

The dependent variable of this study, intention to relocate from a megacity to a non-megacity, was measured using three items that were adapted from Kwak et al. [54] (i.e., "If I work for company X, (1) I am willing to relocate my residence from a megacity to a non-megacity, (2) I have no intention of relocating my residence from a megacity to a non-megacity (reversed item), and (3) I will move my residence from a megacity to a non-megacity").

3.4. Manipulation Check

To assess the effectiveness of the work type (metaverse telework, non-metaverse telework, or non-telework) manipulation, several manipulation checks were conducted [55]. The first step was to examine whether participants correctly answered a manipulation check question that prompted them to select three work types that they were introduced to from the following list of five: non-telework, metaverse telework, non-metaverse telework, work in educational institutions, and work in rural areas. The next step was to examine whether participants correctly answered three manipulation check questions that prompted them to select the respective description for each of three work types to which they had been introduced. Participants who correctly answered the manipulation check questions were included in the subsequent data analysis.

3.5. Order Effect

This study examined whether the order in which participants received information about the three different work types influenced their intention to relocate from a megacity to a non-megacity. Regression analysis showed no significant influence of treatment order on relocation intention in each manipulation (i.e., metaverse telework, non-metaverse telework, or non-telework). In addition, hypothesis testing results were robust in all six groups of participants who received information about the three work types in a different order.

4. Data Analysis and Results

4.1. Measurement Model

To assess the measurement model of the dependent variable, the convergent validity and reliability of the construct were evaluated. Convergent validity was evaluated by examining the significance of item loadings and the average variance extracted (AVE). All factor loadings were greater than 0.9 (i.e., 0.91, 0.93, 0.95) and were significant at $p < 0.001$. The AVE is 0.864, which suggests good convergent validity [56]. The Cronbach's alpha of the dependent variable is 0.95, which demonstrates excellent reliability. The mean value and standard deviation are 3.03 and 1.68, respectively.

4.2. Testing of Hypotheses

First, the normality of the sample distributions and the homogeneity of variances of the dependent variable (i.e., intention to relocate from a megacity to a non-megacity in each manipulated condition) were examined. According to the results of the Shapiro–Wilk test and Levene's test, the data did not show normality and homogeneity of variances. Therefore, to test the hypotheses, this study used SPSS and a bias-corrected and accelerated bootstrap confidence interval for the mean difference with 2000 bootstrap samples [57–59]. Statistical inference from the bias-corrected and accelerated bootstrap confidence interval is robust when the normality and homogeneity of variances are not satisfied [58]. The mean and standard deviation of dependent variable in each manipulated condition are presented in Table 2.

Table 2. Mean and Standard Deviation of Dependent Variable in Each Manipulated Condition.

Variables	Mean (SD)
MT [(1)]	3.62 (1.73)
NMT [(2)]	3.36 (1.72)
NT [(3)]	2.12 (1.11)

[(1)] MT: intention to relocate from a megacity to a non-megacity in the metaverse telework condition. [(2)] NMT: intention to relocate from a megacity to a non-megacity in the non-metaverse telework condition. [(3)] NT: intention to relocate from a megacity to a non-megacity in the non-telework condition.

First, the difference between the intention to relocate from a megacity to a non-megacity under the metaverse telework condition and the intention to relocate from a megacity to a non-megacity under the non-telework condition (H1) were examined. As

shown in Table 3, the mean difference between the intention to relocate from a megacity to a non-megacity under the metaverse telework condition and the intention to relocate from a megacity to a non-megacity under the non-telework condition is 1.50. Lower- and upper-level bias-corrected 95% confidence intervals do not include zero (1.046, 1.958), supporting H1. In other words, people's intention to relocate from a megacity to a non-megacity is greater when they work remotely (i.e., telework) in a metaverse office than when they work in a traditional physical office.

Table 3. Differences of Intention to Relocate from the Megacity.

	Paired Differences			*t*	Sig. (2-Tailed)	Hypotheses Testing
	Mean (SD)	95% Confidence Interval [4] of the Difference				
		Lower	Upper			
MT [1]–NT [3]	1.50 (1.98)	1.046	1.958	6.56	0.000	H1: supported
NMT [2]–NT	1.24 (1.90)	0.807	1.681	5.67	0.000	H2: supported
MT-NMT	0.26 (0.72)	0.093	0.423	3.11	0.003	H3: supported

[1] MT: intention to relocate from a megacity to a non-megacity in the metaverse telework condition. [2] NMT: intention to relocate from a megacity to a non-megacity in the non-metaverse telework condition. [3] NT: intention to relocate from a megacity to a non-megacity in the non-telework condition. [4] Bias-corrected and accelerated bootstrap confidence interval

Second, the difference between the intention to relocate from a megacity to a non-megacity under the non-metaverse telework condition and the intention to relocate from a megacity to a non-megacity under the non-telework condition (H2) were examined. As shown in Table 3, the mean difference between the intention to relocate from a megacity to a non-megacity under the non-metaverse telework condition and the intention to relocate from a megacity to a non-megacity under the non-telework condition is 1.24. Lower- and upper-level bias-corrected 95% confidence intervals do not include zero (0.807, 1.681), supporting H2. In other words, people's intention to relocate from a megacity to a non-megacity is greater when they work remotely (i.e., telework) in a non-metaverse office than when they work in traditional physical office.

Third, the difference between the intention to relocate from a megacity to a non-megacity under the metaverse telework condition and the intention to relocate from a megacity to a non-megacity under the non-metaverse telework condition (H3) were examined. As shown in Table 3, the mean difference between the intention to relocate from a megacity to a non-megacity under the metaverse telework condition and the intention to relocate from a megacity to a non-megacity under the non-metaverse telework condition is 0.26. Lower- and upper-level bias-corrected 95% confidence intervals do not include zero (0.093, 0.423), supporting H3. In other words, people's intention to relocate from a megacity to a non-megacity is greater when they work remotely in a metaverse office than when they work remotely in a non-metaverse office (see Figure 4).

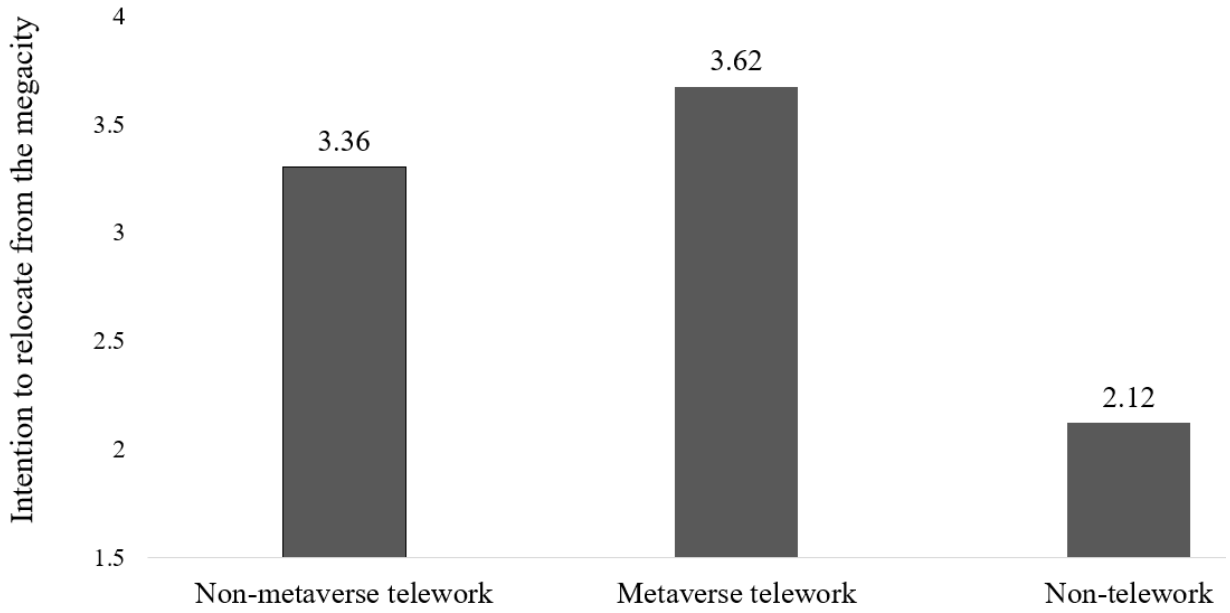


Figure 4. Intention to Relocate from a Megacity to a Non-Megacity under Each Manipulated Condition.

5. Discussion

This study demonstrated that telework has a positive impact on an individual's intention to relocate from a megacity to a non-megacity. Specifically, this study classifies telework into metaverse telework and non-metaverse telework and shows that both types of telework positively influence an individual's intention to relocate from a megacity to a non-megacity. Moreover, the study showed that metaverse telework has a greater impact than non-metaverse telework on an individual's intention to relocate from a megacity to a non-megacity.

5.1. Theoretical Implications

This study contributes to several important research streams. Specifically, this study contributes to telework and sustainability literature by empirically investigating the association between the implementation of telework and the relocation intentions of megacity residents. The population of teleworkers has steadily grown since the advent of ICT [45], and, during the COVID-19 pandemic, businesses' adoption of teleworking has increased dramatically to ensure employee safety and business continuity [21–23,25]. In addition, megacities face many unsustainable challenges such as air pollution [4,5,13–15] and unmanageable amounts of urban and industrial waste [7]. However, few studies have examined whether telework can positively influence the sustainability of megacities. One of the major factors reducing the sustainability of megacities is their overpopulation, which has caused many unsustainable social and environmental problems [36–38]. Therefore, a fundamental solution to managing the problems facing megacities is to entice megacities' residents to migrate to other cities, thereby alleviating population pressures [9,16]. Given that metaverses are being introduced into various areas of our lives and that telework has begun to take place in metaverse offices [30,47], this study classifies telework into metaverse telework and non-metaverse telework and empirically shows how different types of telework can differentially reduce population pressure in megacities. Specifically, this study demonstrates that both types of telework positively influence an individual's intention to relocate from a megacity to a non-megacity and that metaverse telework has a greater impact than non-metaverse telework on an individual's intention to relocate from a megacity to a non-megacity.

5.2. Practical Implications

This study has several important practical implications for policymakers. First, this study suggests that policymakers looking to improve the sustainability of megacities should establish policies to encourage businesses in megacities to adopt telework. Megacities face unsustainable challenges, and previous government policies have focused on reducing population pressure by relocating industries. Thus, previous research has examined how to encourage businesses to resettle to areas outside of megacities to mitigate the adverse effects of overpopulation [16,20]. However, as demonstrated in this study, telework has a positive effect on individuals' intentions to relocate from a megacity to a non-megacity. Therefore, by promoting the adoption of telework in businesses, policymakers can reduce population pressures in megacities.

Second, this study suggests that policymakers should allocate resources to encourage businesses to develop and use metaverse offices. For example, policymakers can allocate resources to facilitate research on metaverse-related technologies, such as virtual reality (VR), augmented reality (AR), head-mounted display (HMD), sixth generation mobile network, and blockchain. Additionally, policymakers can allocate resources to foster human capital in these areas. Given the findings of this study, allocating resources to encourage businesses to develop and use metaverse offices can entice megacities' residents to migrate to other cities, thereby alleviating population pressures.

6. Limitations and Directions for Future Research

This study has some limitations that merit future research. First, this study measures an individual's intention instead of actual behavior; thus, additional research is needed to confirm whether the obtained results lead to actual behaviors. Second, for the purposes of designing an experiment with clear manipulations, this study instructed study participants to assume that companies with three manipulated work types have the same working conditions in terms of commuting time, salary, culture, work intensity, and in-house welfare. Additionally, in this study, two types of telework were manipulated as regular full-time telework. Since working conditions can affect an individual's decision–making about where to reside, future studies need to examine how the results of this study vary according to various working conditions. Third, this study was conducted in a megacity, Seoul, South Korea. Given that culturally different values across countries can influence the residential location decisions of teleworkers working in a metaverse office or a non-metaverse office, future research needs to examine whether the theorized relationships between constructs are valid in different megacities to generalize the findings of this study. Fourth, the respondents of this study are young adults (university students, aged from 20 to 35 years) who are not yet married and have not settled with their own families. Future research needs to investigate the effect of telework (i.e., metaverse telework and non-metaverse telework) on the intention to relocate from a megacity to a non-megacity of different age groups, such as those who are employed in the megacities and settle there with their children. Fifth, this study was conducted in a megacity with a population of more than 10 million people. Future research needs to examine whether the theorized relationships between constructs are valid in the context of large cities with populations greater than 1 million to examine the boundary conditions of the findings. Finally, even though almost all industries are adopting telework due to COVID-19, the extent to which telework is used varies by industry sector and occupation. Therefore, future research needs to investigate how the results of this study vary by industry sector and occupation.

7. Conclusions

Despite the growing number of teleworkers and the unsustainable challenges facing megacities due to population pressure, few studies have investigated the impact of telework on individuals' intentions to move from a megacity to a non-megacity. Given that the recent COVID-19 pandemic has increased the adoption of metaverses in various areas to replace offline human experiences and that telework has begun to take place in metaverse offices,

this study classifies telework into metaverse telework and non-metaverse telework and shows how two types of telework influence individuals' relocation intentions. Specifically, this study empirically demonstrates that both types of telework positively influence an individual's intention to relocate from a megacity to a non-megacity and that metaverse telework has a greater impact on an individual's intention to relocate from a megacity to a non-megacity than non-metaverse telework. This study contributes to telework and sustainability literature by empirically investigating the association between the implementation of telework and the relocation intentions of megacity residents. This study suggests that policymakers looking to improve the sustainability of megacities should establish policies to encourage businesses in megacities to adopt metaverse telework. It is expected that this study will lead to additional research on the social impact of telework and individual decision-making in the context of the metaverse.

Funding: This work was supported by Hankuk University of Foreign Studies Research Fund of 2021.

Informed Consent Statement: Not applicable.

Data Availability Statement: Not applicable.

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

Appendix A. Manipulated Condition and Study Instrument

Appendix A.1. Instruction

In this online survey, I would like to introduce you to three work types: metaverse telework, non-metaverse telework, and non-telework. On the next three pages, I will provide descriptions of each of these work types.

Please take at least 30 s to carefully read the three descriptions of each of these work types. After reading each description, you will be asked several questions.

As you are reading these descriptions of the work types, please assume that:

- You are living in Seoul.
- Headquarters of companies A, B, and C are located in Seoul.
- It takes 70 min to go to each company by taking public transportation.
- Companies A, B, and C have the same business models in the areas of investment, trading, IT, manufacturing, and retail.
- Companies A, B, and C provide the same working conditions in terms of salary, culture, work intensity, and in-house welfare.

Appendix A.2. Reading Task: Metaverse Telework

While reading this page and answering the questions, please assume you are working for Company A. The work type in Company A is metaverse telework.

At 9 a.m. during work days, you need to log in to Company A's virtual metaverse office, select an avatar, and move your avatar to your desk in the metaverse office to work with your colleagues, who are shown as their avatars, until 6 p.m. While working in Company A's metaverse office, you can be located anywhere with internet access (e.g., your house, café, etc.). As shown in Figure A1, in Company A's metaverse office, as an avatar approaches another avatar, the webcam above the avatar's head and the mic turns on, enabling face-to-face conversations. In addition, as an avatar moves away from another avatar, the faces displayed above the avatars disappear and the mic turns off. Whenever you need to talk to a colleague, you can move your avatar to your colleague's avatar. Therefore, telework in the Company A's metaverse office provides a communication environment similar to that of non-telework in a physical office.

Figure A1. Company A.

Appendix A.3. Measurement: Intention to Relocate from a Megacity to a Non-Megacity (1 Strongly Disagree . . . 7 Strongly Agree)

Based on the information you read about Company A's work type, which is metaverse telework (and based on the assumptions mentioned earlier), please indicate your level of disagreement or agreement with the following statements.

If I work for Company A,

1. I am willing to relocate my residence from a megacity to a non-megacity.
2. I have no intention of relocating my residence from a megacity to a non-megacity (reversed item).
3. I will move my residence from a megacity to a non-megacity.

Appendix A.4. Reading Task: Non-Metaverse Telework

While reading this page and answering the questions, please assume you are working for Company B. The work type in Company B is non-metaverse telework.

From 9 a.m. to 6 p.m. during work days, you can work anywhere with internet access (e.g., your house, café, etc.). Whenever you need to contact your colleagues, you can use email, SNS, or a phone call. As shown in Figure A2, if you need face-to-face conversations with your colleagues, you can arrange a meeting (using email, SNS, or a phone call) or have a virtual conference call using Zoom.

Figure A2. Company B.

Appendix A.5. Measurement: Intention to Relocate from a Megacity to a Non-Megacity (1 Strongly Disagree . . . 7 Strongly Agree)

Based on the information you read about Company B's work type, which is non-metaverse telework (and based on the assumptions mentioned earlier), please indicate your level of disagreement or agreement with the following statements.

If I work for Company B,

1. I am willing to relocate my residence from a megacity to a non-megacity.
2. I have no intention of relocating my residence from a megacity to a non-megacity (reversed item).
3. I will move my residence from a megacity to a non-megacity.

Appendix A.6. Reading Task: Non-Telework

While reading this page and answering the questions, please assume you are working for Company C. The work type in Company C is non-telework (i.e., work in a physical office).

You need to go to Company C's office by public transportation by 9 a.m. When you arrive, you move to your desk in Company C's office to work with your colleagues until 6 p.m. While working in the company, you need to work at your desk. As shown in Figure A3, if you need face-to-face conversations with your colleagues, you can move to your colleagues to have conversations.

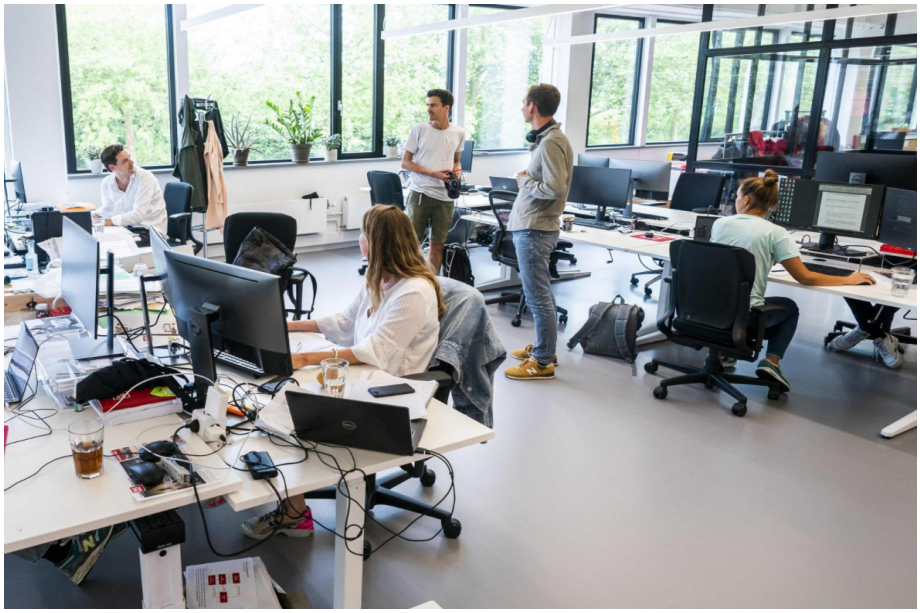


Figure A3. Company C.

Appendix A.7. Measurement: Intention to Relocate from a Megacity to a Non-Megacity (1 Strongly Disagree . . . 7 Strongly Agree)

Based on the information you read about Company C's work type, which is non-telework (and based on the assumptions mentioned earlier), please indicate your level of disagreement or agreement with the following statements.

If I work for Company C,

1. I am willing to relocate my residence from a megacity to a non-megacity.
2. I have no intention of relocating my residence from a megacity to a non-megacity (reversed item).
3. I will move my residence from a megacity to a non-megacity.

References

1. Oxford Dictionaries. Available online: https://dictionary.cambridge.org/dictionary/english/megacity (accessed on 4 January 2022).
2. Desa, U. *World Urbanization Prospects 2018*; United Nations Department for Economic and Social Affiars: New York, NY, USA, 2018.
3. Brunn, S.D.; Zeigler, D.J.; Hays-Mitchell, M.; Graybill, J.K. *Cities of the World: Regional Patterns and Urban Environments*, 7th ed.; Rowman & Littlefield: Lanham, MD, USA, 2020.
4. Krzyzanowski, M.; Apte, J.S.; Bonjour, S.P.; Brauer, M.; Cohen, A.J.; Prüss-Ustun, A.M. Air pollution in the mega-cities. *Curr. Environ. Health Rep.* **2014**, *1*, 185–191. [CrossRef]
5. Najmeddin, A.; Keshavarzi, B.; Moore, F.; Lahijanzadeh, A. Source apportionment and health risk assessment of potentially toxic elements in road dust from urban industrial areas of Ahvaz megacity, Iran. *Environ. Geochem. Health* **2018**, *40*, 1187–1208. [CrossRef]
6. Liotta, P.H.; Miskel, J.F. *The Real Population Bomb: Megacities, Global Security & the Map of the Future*, 1st ed.; Potomac Books, Inc.: Dulles, VA, USA, 2012.
7. Ardalan, A.; Rad, M.K.; Hadi, M. Urban water issues in the megacity of Tehran. In *Urban Drought*, 1st ed.; Ray, B., Shaw, R., Eds.; Springer: Singapore, 2019; pp. 263–288.
8. Zhao, P.; Hu, H. Geographical patterns of traffic congestion in growing megacities: Big data analytics from Beijing. *Cities* **2019**, *92*, 164–174. [CrossRef]
9. Li, D.; Ma, J.; Cheng, T.; van Genderen, J.L.; Shao, Z. Challenges and opportunities for the development of megacities. *Int. J. Digit. Earth* **2019**, *12*, 1382–1395. [CrossRef]
10. Wen, Y.; Zhang, S.; Zhang, J.; Bao, S.; Wu, X.; Yang, D.; Wu, Y. Mapping dynamic road emissions for a megacity by using open-access traffic congestion index data. *Appl. Energy* **2020**, *260*, 114357. [CrossRef]
11. Chen, N.; Zhou, D.; Ma, Y.; Chen, A. Evolution prediction of unconventional emergencies via neural network: An empirical study of megacities. *Int. J. Disaster Risk Reduct.* **2019**, *39*, 101243. [CrossRef]
12. Hansnat, M.; Islam, M.; Hadiuzzaman, M. Emergency response during disastrous situation in densely populated urban areas: A GIS based approach. *Geogr. Tech.* **2018**, *13*, 74–88.
13. Calderón-Garcidueñas, L.; Kulesza, R.J.; Doty, R.L.; D'Angiulli, A.; Torres-Jardón, R. Megacities air pollution problems: Mexico city metropolitan area critical issues on the central nervous system pediatric impact. *Environ. Res.* **2015**, *137*, 157–169. [CrossRef]
14. Jain, S.; Aggarwal, P.; Sharma, P.; Kumar, P. Vehicular exhaust emissions under current and alternative future policy measures for megacity Delhi, India. *J. Transp. Health* **2016**, *3*, 404–412. [CrossRef]
15. Taksibi, F.; Khajehpour, H.; Saboohi, Y. On the environmental effectiveness analysis of energy policies: A case study of air pollution in the megacity of Tehran. *Sci. Total Environ.* **2020**, *705*, 135824. [CrossRef]
16. Geng, K.; Wang, Y.; Ettema, D.; Anderson, J.R. Exploring the effects of congestion charge on relocation decisions under non-capital functions relieving strategy in Beijing. *Res. Transp. Bus. Manag.* **2021**, *38*, 100469. [CrossRef]
17. Bulkeley, H. Urban sustainability: Learning from best practice? *Environ. Plan.* **2006**, *38*, 1029–1044. [CrossRef]
18. Alberti, M. Measuring urban sustainability. *Environ. Impact Assess. Rev.* **1996**, *16*, 381–424. [CrossRef]
19. Shen, L.-Y.; Ochoa, J.J.; Shah, M.N.; Zhang, X. The application of urban sustainability indicators–A comparison between various practices. *Habitat Int.* **2011**, *35*, 17–29. [CrossRef]
20. Bai, X. Industrial Relocation in Asia: A Sound Environmental Management Strategy? *Environment* **2002**, *44*, 8–21.
21. De Haas, M.; Faber, R.; Hamersma, M. How COVID-19 and the Dutch 'intelligent lockdown'change activities, work and travel behaviour: Evidence from longitudinal data in the Netherlands. *Transp. Res. Interdiscip. Perspect.* **2020**, *6*, 100150.
22. Shamshiripour, A.; Rahimi, E.; Shabanpour, R.; Mohammadian, A.K. How is COVID-19 reshaping activity-travel behavior? Evidence from a comprehensive survey in Chicago. *Transp. Res. Interdiscip. Perspect.* **2020**, *7*, 100216. [CrossRef]
23. Mouratidis, K.; Papagiannakis, A. COVID-19, internet, and mobility: The rise of telework, telehealth, e-learning, and e-shopping. *Sustain. Cities Soc.* **2021**, *74*, 103182. [CrossRef]
24. Bojdani, E.; Rajagopalan, A.; Chen, A.; Gearin, P.; Olcott, W.; Shankar, V.; Cloutier, A.; Solomon, H.; Naqvi, N.Z.; Batty, N. COVID-19 pandemic: Impact on psychiatric care in the United States. *Psychiatry Res.* **2020**, *289*, 113069. [CrossRef]
25. Belzunegui-Eraso, A.; Erro-Garcés, A. Teleworking in the Context of the COVID-19 Crisis. *Sustainability* **2020**, *12*, 3662. [CrossRef]
26. Messenger, J.; Vargas Llave, O.; Gschwind, L.; Boehmer, S.; Vermeylen, G.; Wilkens, M. *Working Anytime, Anywhere: The Effects on the World of Work*; International Labour Organization and Eurofound: Luxembourg; Geneva, Switzerland, 2017.
27. Arentze, T.; Timmermans, H. Congestion pricing scenarios and change of job or residential location: Results of a stated adaptation experiment. *J. Transp. Geogr.* **2007**, *15*, 56–61. [CrossRef]
28. Duan, H.; Li, J.; Fan, S.; Lin, Z.; Wu, X.; Cai, W. Metaverse for social good: A university campus prototype. In Proceedings of the 29th ACM International Conference on Multimedia, Chengdu, China, 20 October 2021; pp. 153–161.
29. Kim, J. Advertising in the Metaverse: Research Agenda. *J. Interact. Advert.* **2021**, *21*, 141–144. [CrossRef]
30. Ng, W.C.; Lim, W.Y.B.; Ng, J.S.; Xiong, Z.; Niyato, D.; Miao, C. Unified resource allocation framework for the edge intelligence-enabled metaverse. *arXiv* **2021**, arXiv:2110.14325.
31. Davis, A.; Murphy, J.D.; Owens, D.; Khazanchi, D.; Zigurs, I. Avatars, people, and virtual worlds: Foundations for research in metaverses. *J. Assoc. Inf. Syst.* **2009**, *10*, 90–117. [CrossRef]

32. Shadish, W.R.; Cook, T.D.; Campbell, D.T. *Experimental and Quasi-Experimental Designs for Generalized Causal Inference*; Houghton Mifflin: Boston, MA, USA, 2002.
33. Brinkhoff, T. Major Agglomerations of the World. Available online: https://www.citypopulation.de/ (accessed on 4 January 2022).
34. Kourtit, K.; Nijkamp, P. In praise of megacities in a global world. *Reg. Sci. Policy Pract.* **2013**, *5*, 167–182. [CrossRef]
35. Davis, K. The origin and growth of urbanization in the world. *Am. J. Sociol.* **1955**, *60*, 429–437. [CrossRef]
36. Zhang, W.; Li, W.; Zhang, C.; Hanink, D.M.; Liu, Y.; Zhai, R. Analyzing horizontal and vertical urban expansions in three East Asian megacities with the SS-coMCRF model. *Landsc. Urban Plan.* **2018**, *177*, 114–127. [CrossRef]
37. Chung, U.; Choi, J.; Yun, J.I. Urbanization effect on the observed change in mean monthly temperatures between 1951–1980 and 1971–2000 in Korea. *Clim. Chang.* **2004**, *66*, 127–136. [CrossRef]
38. Civerolo, K.; Hogrefe, C.; Lynn, B.; Rosenthal, J.; Ku, J.-Y.; Solecki, W.; Cox, J.; Small, C.; Rosenzweig, C.; Goldberg, R. Estimating the effects of increased urbanization on surface meteorology and ozone concentrations in the New York City metropolitan region. *Atmos. Environ.* **2007**, *41*, 1803–1818. [CrossRef]
39. Cruz, Á.A.; Stelmach, R.; Ponte, E.V. Asthma prevalence and severity in low-resource communities. *Curr. Opin. Allergy Clin. Immunol.* **2017**, *17*, 188–193. [CrossRef]
40. Lin, S.-C.; Lin, H.-W.; Chiang, B.-L. Association of croup with asthma in children: A cohort study. *Medicine* **2017**, *96*, 7667. [CrossRef]
41. Carlsten, C.; Rider, C.F. Traffic-related air pollution and allergic disease: An update in the context of global urbanization. *Curr. Opin. Allergy Clin. Immunol.* **2017**, *17*, 85–89. [CrossRef] [PubMed]
42. Ponte, E.V.; Cruz, A.A.; Athanazio, R.; Carvalho-Pinto, R.; Fernandes, F.L.; Barreto, M.L.; Stelmach, R. Urbanization is associated with increased asthma morbidity and mortality in Brazil. *Clin. Respir. J.* **2018**, *12*, 410–417. [CrossRef] [PubMed]
43. Messenger, J.C.; Gschwind, L. Three generations of Telework: New ICT s and the (R) evolution from Home Office to Virtual Office. *New Technol. Work. Employ.* **2016**, *31*, 195–208. [CrossRef]
44. Organisation for Economic Co-operation and Development. *Productivity Gains from Teleworking in the Post COVID-19 Era: How Can Public Policies Make It Happen?* OECD: Paris, France, 2020.
45. Buomprisco, G.; Ricci, S.; Perri, R.; De Sio, S. Health and telework: New challenges after COVID-19 Pandemic. *Eur. J. Environ. Public Health* **2021**, *5*, em0073. [CrossRef]
46. Sparkes, M. What is a metaverse. *New Sci.* **2021**, *251*, 18. [CrossRef]
47. Bick, A.; Blandin, A.; Mertens, K. *Work from Home after the COVID-19 Outbreak*; working paper; Arizona State University: Tempe, AZ, USA, 2020.
48. Park, S.-M.; Kim, Y.-G. A Metaverse: Taxonomy, components, applications, and open challenges. *IEEE Access* **2022**, *10*, 4209–4251. [CrossRef]
49. Madden, T.J.; Ellen, P.S.; Ajzen, I. A comparison of the theory of planned behavior and the theory of reasoned action. *Personal. Soc. Psychol. Bull.* **1992**, *18*, 3–9. [CrossRef]
50. Ajzen, I.; Fishbein, M. Attitude-behavior relations: A theoretical analysis and review of empirical research. *Psychol. Bull.* **1977**, *84*, 888–918. [CrossRef]
51. Dong, B.; Evans, K.R.; Zou, S. The effects of customer participation in co-created service recovery. *J. Acad. Mark. Sci.* **2008**, *36*, 123–137. [CrossRef]
52. Hsieh, J.P.-A.; Rai, A.; Keil, M. Understanding digital inequality: Comparing continued use behavioral models of the socio-economically advantaged and disadvantaged. *MIS Q.* **2008**, *32*, 97–126. [CrossRef]
53. Ajzen, I. The theory of planned behavior. *Organ. Behav. Hum. Decis. Process.* **1991**, *50*, 179–211. [CrossRef]
54. Kwak, D.H.; Ma, X.; Polites, G.; Srite, M.; Hightower, R.; Haseman, W. Cross-level moderation of team cohesion in individuals' utilitarian and hedonic information processing: Evidence in the context of team-based gamified training. *J. Assoc. Inf. Syst.* **2019**, *20*, 161–185. [CrossRef]
55. Hauser, D.J.; Ellsworth, P.C.; Gonzalez, R. Are manipulation checks necessary? *Front. Psychol.* **2018**, *9*, 998. [CrossRef] [PubMed]
56. Fornell, C.; Larcker, D.F. Evaluating structural equation models with unobservable variables and measurement error. *J. Mark. Res.* **1981**, *18*, 39–50. [CrossRef]
57. Wright, D.B.; London, K.; Field, A.P. Using bootstrap estimation and the plug-in principle for clinical psychology data. *J. Exp. Psychopathol.* **2011**, *2*, 252–270. [CrossRef]
58. Field, A. *Discovering Statistics Using IBM SPSS Statistics*, 4th ed.; Sage: New Delhi, India, 2014.
59. Tibshirani, R.J.; Efron, B. *An Introduction to the Bootstrap*, 1st ed.; Chapman & Hill: New York, NY, USA, 1993.