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Working in a smart home environment: examining the impact on productivity, well-being and future use intention

Working from
a smart home
environment

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Abstract

Purpose – The coronavirus disease 2019 (COVID-19) pandemic has had a big impact on organisations globally, leaving organisations with no choice but to adapt to the new reality of remote work to ensure business continuity. Such an unexpected reality created the conditions for testing new applications of smart home technology whilst working from home. Given the potential implications of such applications to improve the working environment, and a lack of research on that front, this paper pursued two objectives. First, the paper explored the impact of smart home applications by examining the factors that could contribute to perceived productivity and well-being whilst working from home. Second, the study investigated the role of productivity and well-being in motivating the intention of remote workers to use smart home technologies in a home-work environment in the future.

Design/methodology/approach – The study adopted a cross-sectional research design. For data collection, 528 smart home users working from home during the pandemic were recruited. Collected data were analysed using a structural equation modelling approach.

Findings – The results of the research confirmed that perceived productivity is dependent on service relevance, perceived usefulness, innovativeness, hedonic beliefs and control over environmental conditions. Perceived well-being correlates with task-technology fit, service relevance, perceived usefulness, perceived ease of use, attitude to smart homes, innovativeness, hedonic beliefs and control over environmental conditions. Intention to work from a smart home-office in the future is dependent on perceived well-being.

Originality/value – The findings of the research contribute to the organisational and smart home literature, by providing missing evidence about the implications of the application of smart home technologies for employees' perceived productivity and well-being. The paper considers the conditions that facilitate better outcomes during remote work and could potentially be used to improve the work environment in offices after

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the pandemic. Also, the findings inform smart home developers about the features of technology which could improve the developers' application in contexts beyond home settings.

Keywords Productivity, Well-being, Smart homes, Adoption, COVID-19, Remote work

Paper type Research paper

1. Introduction

The coronavirus disease 2019 (COVID-19) pandemic is one of the worst emergency events in modern history, having adverse implications for people and economies (Venkatesh, 2020; Chatterjee *et al.*, 2021; Papagiannidis *et al.*, 2020). Self-isolation measures introduced by governments to fight the propagation of COVID-19 forced organisations to adapt to new working conditions. To ensure business continuity, organisations switched to remote working practices enabled by the rapid adoption of digital technologies (Carroll and Conboy, 2020; Barnes, 2020). The pandemic emergency set the conditions for examining the viability of remote working on an unprecedented scale. Those working from home repurposed home spaces, which they initially envisaged for personal activities, into home-offices. Blending the work and home environment into a hybrid one has affected the intended usage of systems, such as smart homes, originally designed for private use (Maalsen and Dowling, 2020).

A smart home represents “a high-tech network, linking sensors and domestic devices, appliances, and features that can be remotely monitored, accessed or controlled, and provide services that respond to the needs of its inhabitants” (Balta-Ozkan *et al.*, 2013). During the pandemic, family members started spending significantly more time at home (Umair *et al.*, 2021; Abdullah and Abdullah, 2021). Active engagement in household activities motivated individuals to seek ways to automate their lives and decrease domestic energy spending using smart home devices (Zanocco *et al.*, 2021; Umair *et al.*, 2021). In addition, intelligent functionality and the ability of smart homes to enhance users' comfort and efficiency have become useful in accommodating the needs of individuals, whilst working from home (Umair *et al.*, 2021; Abdullah and Abdullah, 2021), thus stimulating a growth in smart home adoption. For example, market reports provide evidence of an exponential increase in the usage of smart home devices, such as heating, air conditioning and lighting systems, smart speakers and energy metres (Umair *et al.*, 2021; Deloitte, 2021; Maalsen and Dowling, 2020; Zanocco *et al.*, 2021).

Smart home technology that was initially designed to make private life more comfortable has indirectly become integral to the home-work environment. It has become possible for workers to enjoy the automation of the work environment using voice-controlled assistants, light, temperature and sound management systems. As such, the embeddedness of smart homes in the home-workspaces has created new use experiences that could improve the perception of someone's working conditions. In light of the debates about the future of work after the pandemic (Venkatesh, 2020; Barnes, 2020), it is important to examine the implications of smart home utilisation and understand how such technologies may impact conditions whilst working from home.

There is a gap in the literature about the implications of smart home technology usage in the work environment. From the perspective of the literature on technology utilisation in organisational settings, studies predominantly focussed on systems that are designed for remote work, such as virtual teams (Choi and Cho, 2019; Gadeyne *et al.*, 2018). This is not surprising considering that such technologies are directly related to work tasks. Still, there are also technologies that may indirectly affect individual and work outcomes without being used for the implementation of work tasks. For instance, smart homes could positively affect employees (Papagiannidis and Marikyan, 2019), as the technology provides them with the opportunity to control and regulate the environment they work in (work context), which is important for employees' performance and satisfaction (Huang *et al.*, 2012; Zhang *et al.*, 2017). Given the above and the scale at which the pandemic has affected organisations worldwide,

there is a need to provide empirical evidence about the user-perceived implications of smart home embeddedness in the work context for individuals' productivity and well-being. From the perspective of the smart home literature, researchers have so far explored the adoption of technology intended for household tasks in home settings (Marikyan *et al.*, 2020; Mulcahy *et al.*, 2019; Shin *et al.*, 2018; Balta-Ozkan *et al.*, 2014a). The benefits that such applications can result in, when utilised in a different context, have not been studied. Given the long-term implication of COVID-19 for remote work practices, there is a need to explore the underpinnings of individuals' intention to utilise smart home technologies in their work environment even after the pandemic.

Following the above-mentioned research gap, this study pursues two objectives. The first research objective is to study the relationship between using smart home applications for controlling one's working environment and individuals' productivity and well-being. We draw on the literature on smart homes to propose a relationship between three groups of factors referring to the work environment, smart technology and individual factors with the perception of productivity and well-being. The second objective of the research is to study future intentions to use smart home technologies in the work environment, by exploring the correlation of use outcomes – productivity and well-being – with the intention to use smart homes in the home-office settings.

The study is structured as follows. The literature review section discusses prior research that has been done on smart homes and the applications of smart technologies in the work context. This section provides a conceptual overview of the research model. A justification of the relationships between the factors in the model is provided in the hypothesis development section. The fourth section presents the methodology of the study, followed by a discussion of the results and findings. The paper concludes with the contributions of the research, limitations and future research suggestions.

2. Literature review

2.1 Smart home

The smart home literature typically falls within two main groups, namely technical and user-oriented research (Ford *et al.*, 2017; Yang *et al.*, 2018; Teslyuk *et al.*, 2018; Marikyan *et al.*, 2021). The dominant one is the technical one, embracing research on the functionality and design, services and benefits of smart homes (Ford *et al.*, 2017; Yang *et al.*, 2018; Teslyuk *et al.*, 2018; Strengers *et al.*, 2020). Researchers focussing on functionality and design have explored the development and deployment of specific technologies, such as smart metres, smart lighting, smart sensors and cameras (Corbett, 2013; Yang *et al.*, 2018; Stolojescu-Crisan *et al.*, 2021; Wang *et al.*, 2021). They examined the architecture, connectivity and algorithms that transform technologies into smart ones (Yang and Cho, 2016; Elkhorchani and Grayaa, 2016; Xu *et al.*, 2016) and enable the services that are aimed at supporting comfort, monitoring, health therapy and support (Strengers *et al.*, 2020; Han and Lim, 2010; Talal *et al.*, 2019). Comfort can be realised by integrating smart lighting and thermostats into a single intelligent system, creating an ambient environment (Strengers *et al.*, 2020). Automated control over the home environmental conditions can result in increased perceptions of well-being (Marikyan *et al.*, 2019). The seamless interoperability of devices (e.g. energy, lighting and cameras) and intuitive interfaces makes it possible to develop a ubiquitous control and monitoring system (Han and Lim, 2010; Stolojescu-Crisan *et al.*, 2021; Wang *et al.*, 2021). Monitoring the status of all intercommunicating devices makes it possible to reduce energy consumption and contribute to environmental sustainability (Ford *et al.*, 2017; Han and Lim, 2010).

The user perspective on smart homes is concerned with the determinants and consequences of technology adoption (Marikyan *et al.*, 2019; Alam *et al.*, 2012). To examine users' behaviour, scholars have used three approaches. First, they have employed a fit-based approach to understand how the match between task requirements (e.g. automation) and technology helps

achieve efficiency and performance. Literature showed that the expectation of the fit of smart home services to tasks is either a direct determinant of intention to use technology and use behaviour or an indirect predictor, strongly associated with perceived usefulness (Marikyan *et al.*, 2021; Ling *et al.*, 2021). Secondly, scholars have focussed on smart home use factors, concerning the beliefs about the characteristics and the usability of the technology (Shin *et al.*, 2018; Marikyan *et al.*, 2021; Hubert *et al.*, 2019). They have examined the role of beliefs concerning the expected performance of technology and the complexity of its use (Shin *et al.*, 2018; Marikyan *et al.*, 2021). Also, researchers have explored the effect of the specific factors conducive to innovative systems, such as trialability, result demonstrability, compatibility and visibility (Hubert *et al.*, 2019; Shin *et al.*, 2018). The third perspective focussed on the beliefs about personal benefits and risks resulting from the use of smart homes. The literature provides evidence related to the importance of utilitarian and hedonic values and the inhibiting effects of privacy and financial concerns (Shin *et al.*, 2018; Kim *et al.*, 2017). When it comes to the consequences of smart home utilisation, research showed that smart home usage contributes to satisfaction and well-being (Marikyan *et al.*, 2020, 2021; Shin *et al.*, 2018; Shuhaiber and Mashal, 2019). Satisfaction and well-being result from the technology meeting users' hedonic and utilitarian needs (Marikyan *et al.*, 2021; Sequeiros *et al.*, 2021).

Given the above, the research on smart homes has mainly revolved around the drivers of the utilisation in home settings, technology's capabilities to improve living conditions and the performance of household tasks (Marikyan *et al.*, 2019; Talal *et al.*, 2019). Despite the propositions put forward about the potential benefits of smart home devices in organisational settings in order to make offices smart (Papagiannidis and Marikyan, 2019), system applications beyond the home environment have not been empirically investigated. The COVID-19 pandemic resulted in a unique set of conditions that found many working from home. Considering that many homes featured smart devices, it became possible to investigate the role that such technologies can play beyond the home context. Such a line of inquiry is justified by research suggesting that smart home technology use in the workplace can improve employees' levels of comfort (Papagiannidis and Marikyan, 2019). Considering the increase in the usage of smart home solutions following the shift to remote work due to the COVID-19 pandemic (Umair *et al.*, 2021; Zanoocco *et al.*, 2021; Maalsen and Dowling, 2020), the next section will discuss the rationale for empirically exploring the applications of workspaces in smart homes.

2.2 Smart home-office spaces

The positive implications of working in a smart home-office space derive from prior research discussing the benefits of controlling the work environment for employees and their productivity (Papagiannidis and Marikyan, 2019). Temperature is the primary factor that correlates with individuals' performance at work (Huang *et al.*, 2012; Zhang *et al.*, 2017). A temperature in the office of between 21 and 22 °C is perceived to be optimal for employees (Seppanen and Fisk, 2004; Seppanen *et al.*, 2004; Niemelä *et al.*, 2002). However, this finding represents an average thermal range, which may greatly vary for individuals (Maula *et al.*, 2016). The second factor contributing to employees' well-being and productivity is lighting conditions in the office space (Schuster, 2008). When space is poorly lit it can cause visual discomfort, consequently resulting in poor job performance and dissatisfaction (Boyce, 2014; Schuster, 2008). Although organisations utilise smart technologies to regulate thermal and lighting conditions, such systems are difficult to effectively utilise for all employees. For example, temperature levels are usually centrally controlled, rather than by the employees working in the space. In the conditions of a large-scale shift to remote work (such as during the COVID-19 pandemic), the opportunity to control the home-office environment using smart home technologies can be beneficial for employees and their productivity.

3. Hypothesis development

Given the findings of the literature on smart homes and the research on their potential application in the work environment, there are three groups of factors that can predict organisational and individual outcomes resulting from the use of smart home applications in remote workspaces (Marikyan *et al.*, 2021; Ling *et al.*, 2021; Kim *et al.*, 2017; Shin *et al.*, 2018). Work environment factors reflect the suitability of the technology services for improving and controlling conditions in home-office spaces. Smart technology factors embrace the variables measuring the perceptions associated with the utilisation of the technology. Individual factors involve users' concerns, the value of use and personality differences. A discussion and a theoretical justification of the relationship between each factor and outcomes, as well as the role of those outcomes in driving intention to use smart homes in the work context in the future, follows below.

3.1 Work environment

The work environment factors include task-technology fit, service relevance and control over the work environment conditions. The examination of task-technology fit is important as the utilisation of technology can be discontinued, if users find a lack of fit between task requirements and the capabilities of technology to implement them (Goodhue and Thompson, 1995; Marikyan *et al.*, 2021). The perception that technology matches tasks improves the perception of the usefulness of the technology. In turn, perceived usefulness increases the likelihood of using the technology (Lee *et al.*, 2012; Wu and Chen, 2017). The perception of task-technology fit strengthens the positive attitude towards technology and contributes to the perception of the benefits of any task that unfolds (Osmonbekov, 2010). In contrast, a lack of fit has a negative effect on the success of information systems performance (Goodhue and Thompson, 1995). In the context of this study, task-technology fit reflects the degree to which smart home technologies address the requirements of remote workers for managing conditions in the home spaces where they work. Users' requirements can be two-fold. First, a smart home can ensure higher efficiency in carrying out home micro-tasks, such as switching lights and plugs on and off, manually adjusting the temperature and turning sound on/off. Whilst remote workers typically lose time when they switch between work and home activities (Rocchi and Bernacchio, 2022), smart home appliances enable individuals to implement home micro-tasks without their involvement. Thus, the use of technology can increase personal efficiency (Marikyan *et al.*, 2019). The saved time and physical resources can be refocussed on adapting and working efficiently in a home-office context, which may positively affect job productivity and well-being. For example, evidence suggests that employees believe that smart solutions help streamline micro-tasks and focus on business functions, which can boost satisfaction and job performance (Bogdan *et al.*, 2021; Khanna and Jha, 2021). Also, researchers found that the benefits of digital assistants are positively associated with satisfaction, leading to job engagement and productivity (Marikyan *et al.*, 2022). Secondly, efficiency in home-related activities may translate into positive perceptions about job-related achievements. This assumption is driven by a study demonstrating a positive correlation between high performance in personal tasks, work experiences and job satisfaction (Fonner and Stache, 2012). Drawing on the above, it is proposed that smart homes fit the requirements of remote workers and contribute to job productivity and individual well-being.

H1a. Task-technology fit positively correlates with perceived productivity in a smart home-office environment.

H1b. Task-technology fit positively correlates with well-being in a smart home-office environment.

Service relevance could be conceptualised as the degree to which the services offered by the system are applicable to individuals' jobs (Venkatesh and Davis, 2000). Service relevance positively contributes to the perceived usefulness of technology (Hu *et al.*, 2003) and moderates the relationship between perceived usefulness and the intention to use (Kim, 2008; Kim and Garrison, 2009). In the smart home-office context, service relevance refers to individuals' beliefs regarding the relevance of services made possible by smart home technology for controlling workplace conditions. Remote work creates the conditions in which the line between work and home domains is erased due to the behaviour uniting these two domains (Edwards and Rothbard, 2000). In such conditions, there is a high relevance of smart home technology services, such as lighting, sound and thermal systems, for creating favourable work conditions, which are important for ensuring productivity, satisfaction and well-being (Khanna and Jha, 2021). For example, a survey showed that the use of smart devices for ambient control is amongst the preferred services in the smart office environment (Bogdan *et al.*, 2021). Satisfaction with how such technology delivers such services leads to productivity and job engagement (Marikyan *et al.*, 2022). Therefore, it is proposed that the creation of a comfortable environment and the automation of administrative tasks are relevant for individuals working remotely. Service relevance, in turn, has positive implications for productivity at work and well-being. Given that, we hypothesise the following:

- H2a.* Smart home service relevance positively correlates with perceived productivity in a smart home-office environment.
- H2b.* Smart home service relevance positively correlates with well-being in a smart home-office environment.

The outcome of work practices is contingent on environmental factors, such as lighting, ambient sound and temperature in a workplace (Papagiannidis and Marikyan, 2019; Seppanen *et al.*, 2004, 2006a, 2006b; McCartney and Humphreys, 2002). They contribute to employees' comfort, which can positively affect their productivity (McCartney and Humphreys, 2002; Huang *et al.*, 2012; Saari *et al.*, 2006; Maula *et al.*, 2016; Banbury and Berry, 2005). However, the regulation of these conditions in organisations is challenging due to employees' limited access to the control of environmental systems and the differences in individual preferences (Maula *et al.*, 2016). For instance, men have a lower thermal comfort level compared to women (Mallawaarachchi *et al.*, 2017; Silva *et al.*, 2017). When it comes to noise, individuals have a different perception of acceptable noise or background sounds (Banbury and Berry, 2005; Mak and Lui, 2012). The noise level is especially critical in an open-plan office, as such conditions are almost impossible to keep under control. As far as workplace designs are concerned, whilst some office layouts are more convenient for work practices, the perceptions by employees can differ depending on personal preferences and tastes. Therefore, it is impossible to use a personalised approach to the development of office design (Kang *et al.*, 2017; Brennan *et al.*, 2002). Given the above, organisations cannot ensure the optimal configuration of environmental factors to meet everyone's needs.

Since the pandemic, the use of smart home technology to control work environmental factors has become more widely accessible (Marikyan *et al.*, 2019, 2020; Balta-Ozkan *et al.*, 2014b). Research started emerging about the concepts of smart offices (Marikyan *et al.*, 2022; Khanna and Jha, 2021; Bogdan *et al.*, 2021). Employees prefer connected devices, which enable the automated regulation of temperature and light (Bogdan *et al.*, 2021). Ambient control of environmental conditions can simplify micro-tasks, leaving more time for core work duties (Khanna and Jha, 2021). Also, the use of voice-controlled digital assistants can create favourable sonic conditions. Digital assistants can help regulate the noise level by ambient sounds and can be useful for designing ergonomic spaces to ensure comfort and accommodate job-related needs. The utility of smart home devices in the work context can

lead to the augmentation of work-related outcomes, such as productivity and job engagement (Marikyan *et al.*, 2022). Given the above, smart homes can enable remote workers to control temperature, sound and lighting to ensure optimal conditions and subdue ambient noise. Hence, this study states that:

- H3a.* Control over the workplace environment using smart home technologies positively correlates with perceived productivity in a smart home-office environment.
- H3b.* Control over the workplace environment using smart home technologies positively correlates with well-being in a smart home-office environment.

3.2 Smart technology

Smart technology factors include individuals' beliefs about technology performance and capabilities, which are important whilst working from home in emergency situations (Davis, 1989). The factors include perceived usefulness and perceived ease of use. According to the research on technology acceptance, perceived ease of use and perceived usefulness are the beliefs which can translate into technology use behaviour (Davis *et al.*, 1992; Davis, 1989). Perceived usefulness is defined as "*the degree to which a person believes that using a particular system would enhance her or his job performance*" (Davis, 1989, p. 320). Perceived ease of use is defined as "*the degree to which an individual believes that using a particular system would be free of effort*" (Davis, 1989, p. 320). It refers to individuals' beliefs regarding the effort they need to invest to use smart home technology in the remote work context. The information systems literature suggests that the evaluation of the performance of new applications depends on the cognitive effort required for technology operation. The lower the effort, the more positive is the perception of the output of the technology use (Saade *et al.*, 2014). The usefulness of technology and low complexity in use improves the attitude towards it and satisfaction (Buil *et al.*, 2020; Manis and Choi, 2019; Han *et al.*, 2020). Perceived ease of use can affect use behaviour and continuous intention to use directly and indirectly through perceived usefulness (Marikyan *et al.*, 2021; Davis, 1989; Tam *et al.*, 2020). Given the benefits of smart homes in creating comfort in the home environment (Papagiannidis and Marikyan, 2019; Marikyan *et al.*, 2019) and empirical evidence about the perception of employees of digital assistants and connected devices in offices (Marikyan *et al.*, 2022; Bogdan *et al.*, 2021; Khanna and Jha, 2021), the applications of smart homes can, therefore, be useful in improving the conditions of remote work. This, in turn, is very much needed for higher job productivity and well-being (Papagiannidis and Marikyan, 2019).

Therefore, we hypothesise that:

- H4a.* Perceived usefulness of smart home technology positively correlates with perceived productivity in a smart home-office environment.
- H4b.* Perceived usefulness of smart home technology positively correlates with well-being in a smart home-office environment.
- H5a.* Perceived ease of use of smart home technology positively correlates with perceived productivity in a smart home-office environment.
- H5b.* Perceived ease of use of smart home technology positively correlates with well-being in a smart home-office environment.

3.3 Individual factors

The group of individual factors includes individual attitudes, beliefs and personality traits, facilitating the utilisation of the technology. These factors reflect a strong disposition and motivational orientation, which enhances the positive evaluation of technology use outcomes

irrespective of the context and the technology being investigated (Dhir *et al.*, 2021; Mishra *et al.*, 2014; Minton *et al.*, 2018; Agarwal and Prasad, 1998; Ramos-de-Luna *et al.*, 2016; Ryan and Deci, 2000). Attitude is a pillar in technology utilisation research (Yang and Yoo, 2004; Kim *et al.*, 2009; Mullins and Cronan, 2021; Fishbein and Ajzen, 1981). It represents a behavioural belief reflecting an individual's disposition towards a specific behaviour resulting from their overall evaluation of that behaviour. Scholars have often considered attitude as a proxy of behaviour (Yang and Yoo, 2004; Kim *et al.*, 2009; Mullins and Cronan, 2021). Through attitude, scholars have explored individuals' purchasing intention, technology adoption, satisfaction, well-being as well as the likelihood of job-related outcomes (Minton *et al.*, 2018; Moore and Benbasat, 1996; Dawkins and Frass, 2005; Adesina *et al.*, 2016; Fleishman, 1965; Iyer and Muncy, 2016). Given evidence suggesting the relationships between attitude, well-being and productivity (Hussein *et al.*, 2021; Adesina *et al.*, 2016; Iyer and Muncy, 2016), we hypothesise the following:

- H6a.* Attitude towards the smart home-office positively correlates with perceived productivity in a smart home-office environment.
- H6b.* Attitude towards the smart home-office positively correlates with well-being in a smart home-office environment.

Innovativeness is a personality trait which explains individuals' inclination to engage in a new behaviour. Innovative individuals tend to be early adopters of technology (Agarwal and Prasad, 1998). Given that the application of smart homes in the work environment is an emerging phenomenon, it is important to examine the role of the innovativeness trait in a remote working context as it directly and indirectly predicts users' behaviour and outcomes (Ramos-de-Luna *et al.*, 2016; Liébana-Cabanillas *et al.*, 2015; Mun *et al.*, 2006). Individuals with a high innovativeness trait tend to be more experienced and knowledgeable about new technologies, services and potential performance (Agarwal and Prasad, 1998). This suggests that innovative people are more open to experimentation, such as employing smart home technology to improve conditions whilst working remotely and, consequently, enjoy higher productivity and well-being. Therefore, we suggest the following hypothesis:

- H7a.* Individual innovativeness positively correlates with perceived productivity in a smart home-office environment.
- H7b.* Individual innovativeness positively correlates with well-being in a smart home-office environment.

The theoretical underpinning of individuals' perception towards certain behaviour is rooted in motivational and self-determination theories (Deci and Ryan, 1985). Individuals engage in certain behaviours due to intrinsic and extrinsic motivators (Ozturk *et al.*, 2016). Intrinsic motivation triggers behaviour because it is inherently enjoyable and interesting. Extrinsic motivation plays a role when an individual embarks on behaviour because it leads to rewards (Ryan and Deci, 2000). Following the conceptualisation of intrinsic and extrinsic motivations, Babin *et al.* (1994) introduced the concepts of hedonic and utilitarian values, which measure individuals' perceptions of the values that they gain after engaging in a certain action (Overby and Lee, 2006; Ozturk *et al.*, 2016; Van der Heijden, 2004). Utilitarian value is captured by the perceived usefulness concept, referring to the smart home technology group of factors. The utilitarian value of smart homes concerns cost savings on energy bills, time efficiency resulting from the automation of services, ease of use and other benefits stemming from the rational evaluation of technology performance (Marikyan *et al.*, 2019, 2021; Schill *et al.*, 2019). In the context of technology use in the home-office environment, utilitarian value is captured by the operational aspect of use, such as time and service management efficiency. Hedonic value refers to individual factors, as it measures the level of perceived enjoyment, playfulness

and fun resulting from the interaction with smart home technologies. The users of smart devices in home offices may also experience pleasure, fun and playfulness from experimenting with the application of systems in a novel context. Several studies have empirically confirmed the direct and indirect relationships of hedonic values with technology adoption (Atulkar and Kesari, 2017; Chang *et al.*, 2014; Kim and Hwang, 2012). For instance, hedonic value has a direct positive effect on individuals' intention to use mobile applications (Ozturk *et al.*, 2016) and influences outcome satisfaction and use behaviour through task-technology fit (Marikyan *et al.*, 2021). Also, the literature suggests that the use of smart home devices creates a feeling of satisfaction, consequently resulting in job productivity and engagement (Marikyan *et al.*, 2022). Given the above evidence, the next hypothesis states that:

- H8a. Hedonic beliefs positively correlate with perceived productivity in a smart home-office environment.
- H8b. Hedonic beliefs positively correlate with well-being in a smart home-office environment.

3.4 Intention to use smart home technologies

The relationship between productivity in a smart home-office environment, well-being and intention to work in a smart home-office in the future is rooted in evidence that individuals tend to continue the behaviour that produces positive outcomes (Kim *et al.*, 2014a, 2014b; Kim and Qu, 2014; Anitsal, 2005). From the cost-benefit perspective, productivity and well-being can be regarded as behavioural benefits outweighing costs and triggering future use intention (Lee, 2004; Scott, 2000). The organisational behaviour literature postulates that satisfaction with the outcomes works as a motivational factor (Culibrk *et al.*, 2018). The appraisal of the benefits resulting from the behaviour activates affective commitment, which stimulates engagement with the same types of activities in the future (Agarwal and Sajid, 2017). Although the current research has limited evidence about the relationship between productivity and continuous behaviour, the perception of productivity is positively associated with intention (Anitsal, 2005). For example, the perception that self-service technology can improve productivity correlates with the willingness to use that technology in the future (Kim *et al.*, 2014a). In a similar vein, it is expected that the positive implications of technology use for individuals' well-being will induce the desire to continue using the technology to receive similar benefits in the future. Given the above, this study postulates that if embedding smart home technologies in the home-workspaces brings positive results, such as productivity and well-being, individuals will have the intention to work in a smart home-office in the future.

- H9a. Perceived productivity in a smart home-office environment positively correlates with intention to use smart home technologies in the future when working from home.
- H9b. Well-being in a smart home-office environment positively correlates with intention to use smart home technologies in the future when working from home.

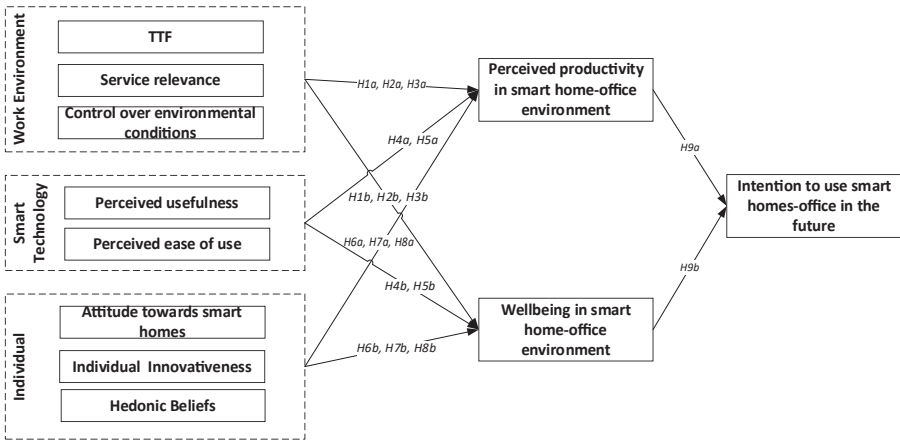
Figure 1 presents the research model illustrating the proposed relationships between the variables.

4. Methodology

4.1 Data collection and sample

For this study, a cross-sectional research design and a survey data collection tool were employed. The survey consisted of questions about the socio-demographic profile and

Figure 1.
Research model



measurement items of 11 constructs. Before embarking on data collection, a pilot test was conducted. The results helped make minor corrections to the questionnaire to improve the clarity of the questions and test the length of time needed to complete the survey. After the pilot, an independent research company helped recruit respondents using a purposive sampling technique. The company provided access to members of a consumer panel who met three conditions: (1) they lived in the UK, (2) they worked from home during the pandemic and (3) they had used smart home devices in their homes. The survey was distributed to the individuals, who first confirmed that they met the sampling criteria and provided consent to participate in the study. As a result, 528 valid responses were collected, which we further used for the analysis. The profile of the respondents presented in [Table 1](#) demonstrates that the majority of the participants were in the ages between 25 and 34 years old (37.5%) and between 35 and 44 years old (24.4%). The distribution by males and females is almost balanced. The profile of the respondents by age and gender reflects the main trends in the smart home usage market ([Statista, 2022](#)). Almost half of the respondents had a bachelor's degree (50.9%) and 26.9% of the sample had completed some college degree. The majority of the participants had mainly worked from home during the pandemic (73.1%). In terms of family size, 89.8% of the sample shared their homes with other members of the family. In terms of the experience of using smart home devices, 76.9% of the respondents had used the technology for over 2 years. The most popular devices were home assistants/smart hubs (91.1%), smart plugs (41.9%) and smart lighting systems (46.8%).

4.2 Measurements

The survey included 11 multi-item scales, which originated from prior studies and were adapted to the context of this research ([Table 2](#)). The task-technology fit scale derived from the study of [Yen et al. \(2010\)](#), the scale for service relevance was adapted from the study developed by [Venkatesh and Bala \(2008\)](#), the control measurements were adapted from the study conducted by [Venkatesh \(2000\)](#), perceived usefulness, perceived ease of use and future use intention scales were borrowed from the study by [Davis \(1989\)](#). For the attitude towards smart homes scale, we adapted the scale used in the study of [Elliott et al. \(2007\)](#). The innovativeness scale was borrowed from the research developed by [Agarwal and Prasad \(1998\)](#), whilst the hedonic belief measurements derived from the study conducted by [Voss et al. \(2003\)](#). To measure productivity in a smart home-office, we followed prior studies

Demographic characteristics	Type	Frequency (<i>n</i> = 528)	%
Age	18–24	96	18.2
	25–34	198	37.5
	35–44	129	24.4
	45–54	72	13.6
	55–64	25	4.7
	65 or older	8	1.5
Education	Completed some high school	9	1.7
	Completed some college (GCSE/AS/A-Level)	142	26.9
	Bachelor's degree	269	50.9
	Master's degree	85	16.1
	Other advanced degrees beyond a master's degree	10	1.9
	PhD	13	2.5
Gender	Male	251	47.5
	Female	276	52.3
Family size	Other	1	0.2
	1 (only you)	54	10.2
	2 members	155	29.3
	3 members	114	21.6
	4 members	135	25.6
	5 members	50	9.5
% of work done from home during the pandemic	6 members or more	20	3.8
	0–20%	12	2.3
	21–40%	31	5.9
	41–60%	37	7.0
	61–80%	62	11.7
	81–100%	386	73.1
% of work done from home before the pandemic	0–20%	366	69.3
	21–40%	69	13.1
	41–60%	31	5.9
	61–80%	18	3.4
	81–100%	44	8.3
	More than 6 years ago	19	3.6
Years of using smart homes	1 year ago	122	23.1
	2 years ago	170	32.2
	3 years ago	131	24.8
	4 years ago	45	8.5
	5 years ago	38	7.2
	6 years ago	3	0.6
Smart home devices	Smart thermostat (e.g. Nest, Hive, Tado)	200	37.9
	Connected lights (e.g. Philips Hue, LIFX, Elgato, Belkin)	247	46.8
	Home assistants/smart hub (e.g. Amazon Echo, Castle Hub, Google Home)	481	91.1
	Smart plugs (e.g. Belkin switch, Neo)	221	41.9
	Smart door lock (e.g. Ring, Danalock)	135	25.6
	Smart security camera (e.g. Nest Cam, Netatmo and Arlo)	162	30.7
	Smart smoke monitor and alarms (e.g. Kepler and Birdi)	105	19.9
	Smart kitchen appliances (e.g. fridge, oven, kettle, scales and vacuum cleaner)	179	33.9
	Grocery ordering (e.g. Amazon dash buttons, Hiku and GeniCan)	167	31.6
	Smart air quality device (e.g. HEPA and Pro Breeze)	95	18.0
	Smart bed	27	5.1
	Smart home fitness devices (e.g. Peloton Bike +)	122	23.1
Number of smart home devices	1	72	13.6
	2	102	19.3
	3	115	21.8
	4	67	12.7
	5	48	9.1
	6 and more	124	23.5

Working from
a smart home
environment

Table 1.
The profile of the
respondents

Measurement items	Loading	Mean (SD)	α	CR	AVE
<i>Task-technology fit</i> (Yen et al., 2010)		14.52 (4.34)	0.929	0.930	0.815
<i>When it comes to my home-office environment, while working from home during the pandemic . . .</i>					
smart home technologies have been suitable for controlling my home-office environment	0.894	4.70 (1.56)			
I have been able to use smart home technologies quickly and easily to control my home-office environment	0.928	4.85 (1.61)			
smart home technologies have been convenient and easy to use for controlling my home-office environment	0.886	4.97 (1.46)			
<i>Service relevance</i> (Venkatesh and Bala, 2008)		12.71 (4.60)	0.918	0.919	0.790
<i>For controlling my home-office environment while working from home during the pandemic, the usage of smart home technologies has been . . .</i>					
important	0.889	4.20 (1.76)			
relevant	0.903	4.44 (1.66)			
pertinent	0.874	4.07 (1.57)			
<i>Control</i> (Venkatesh, 2000)		14.40 (4.56)	0.924	0.925	0.804
<i>While working from my home-office during the pandemic . . .</i>					
I have had control over my home-office environment using smart home technologies	0.909	4.71 (1.67)			
I have had resources to control my home-office environment using smart home technologies	0.905	4.70 (1.66)			
it has been easy for me to use smart home technologies to control my home-office environment given the resources, opportunities and knowledge	0.875	5.00 (1.56)			
<i>Perceived usefulness</i> (Davis, 1989)		19.03 (5.82)	0.967	0.967	0.879
<i>While working from my home-office during the pandemic, the usage of smart home technologies . . .</i>					
has improved my control over my home-office environment	0.932	4.71 (1.51)			
has increased my control over my home-office environment	0.932	4.75 (1.54)			
has enhanced my control over my home-office environment	0.955	4.71 (1.49)			
has been useful to control my home-office environment	0.932	4.87 (1.55)			
<i>Perceived ease of use</i> (Davis, 1989)		15.52 (3.90)	0.929	0.930	0.815
<i>While working from my home-office during the pandemic . . .</i>					
my interaction with smart home technologies when controlling my home-office environment has been clear and understandable	0.894	5.15 (1.36)			
I have found smart home technologies easy to use when controlling my home-office environment	0.920	5.27 (1.38)			
I have found it easy to get smart home technologies to do what I want when controlling my home-office environment	0.894	5.10 (1.42)			
<i>Attitude towards smart homes</i> (Elliott et al., 2007)		22.20 (4.50)	0.933	0.934	0.779
<i>My attitude towards smart homes has been . . .</i>					
good	0.864	5.61 (1.22)			
favourable	0.904	5.49 (1.27)			
positive	0.852	5.56 (1.19)			
valuable	0.908	5.53 (1.24)			
<i>Individual innovativeness</i> (Agarwal and Prasad, 1998)		19.14 (5.56)	0.925	0.926	0.758
If I hear about new information technologies, I will look for ways to experiment with them	0.831	4.82 (1.47)			
Among my peers, I am usually the first to try out new information technologies	0.809	4.20 (1.77)			
In general, I am eager to try out new information technologies	0.916	5.11 (1.43)			

Table 2.
Measurement items of
constructs

(continued)

Measurement items	Loading	Mean (SD)	α	CR	AVE	Working from a smart home environment
I like to experiment with new information technologies <i>Hedonic belief</i> (Voss <i>et al.</i> , 2003) <i>While working from my home-office during the pandemic, the use of smart home technologies has been ...</i>	0.920	5.01 (1.47) 19.66 (4.54)	0.937	0.937	0.789	
fun	0.900	5.05 (1.28)				
exciting	0.878	4.85 (1.24)				
delightful	0.884	4.72 (1.22)				
enjoyable	0.890	5.04 (1.21)				
<i>Perceived productivity in a smart home-office</i> (Tam and Oliveira, 2016; Oseland, 1999; Goodhue and Thompson, 1995) <i>During the pandemic, being able to control my home-office environment using smart home technologies has made it possible to ...</i>		20.64 (7.01)	0.946	0.946	0.778	
do my job more quickly	0.859	4.28 (1.55)				
increase my productivity	0.884	4.37 (1.58)				
improve the quality of my work	0.884	4.02 (1.48)				
accomplish more work than would otherwise have been possible	0.898	4.02 (1.59)				
perform my job better <i>Wellbeing</i> (El Hedhli <i>et al.</i> , 2013) <i>During the pandemic, being able to control my home-office environment using smart home technologies has made it possible to ...</i>	0.884	3.96 (1.52) 14.15 (3.83)	0.852	0.855	0.664	
meet my overall needs	0.838	4.93 (1.30)				
play a very important role in my leisure well-being	0.757	4.41 (1.62)				
play an important role in enhancing the quality of life in my household	0.846	4.81 (1.42)				
<i>Future intention to use</i> (Davis, 1989) <i>After the pandemic ...</i>		16.14 (4.01)	0.965	0.965	0.901	
I intend to continue using smart home technologies to control my home-office environment when working remotely	0.927	5.37 (1.37)				
I predict I will continue using smart home technologies to control my home-office environment when working remotely	0.962	5.40 (1.39)				
I plan to continue using smart home technologies to control my home-office environment when working remotely	0.958	5.37 (1.38)				

Table 2.

(Tam and Oliveira, 2016; Oseland, 1999; Goodhue and Thompson, 1995). Finally, to measure well-being, we used the measurements developed by El Hedhli *et al.* (2013). To answer the questions, the respondents were asked to refer to their own experience of using smart home technology whilst working from home. All adapted measurement items were assessed by a 7-point Likert scale with anchors ranging from “1 – strongly disagree” to “7 – strongly agree”.

5. Results

5.1 Data analysis

For data analysis, this study employed a covariance-based structural equation modelling (CB-SEM) approach, which is justified by the objective of the study to test multiple relationships in the model simultaneously. As the study did not aim to develop a theory, by employing CB-SEM we were able to test both measurement and structural models (Hair *et al.*, 2014a, 2014b).

As such, we conducted the analysis in two steps. As a first step, we performed reliability analysis and confirmatory factor analysis (CFA) to establish the validity and reliability of the items that we used in the research model. IBM Statistical Package for Social Sciences (SPSS) 26 and AMOS v.26 statistical tools were employed for the analysis of the data. AMOS is a software package supporting the analysis of covariance-based structural equation models (Hair *et al.*, 2014b). The analysis of the reliability of the scales implemented with SPSS demonstrated average scores and standard deviation for each item (Mean and SD) and Cronbach's α values. Then, we conducted CFA using AMOS, which produced factor loadings and indices, making it possible to calculate composite reliability (CR), average variance extracted (AVE) values and establish convergent and discriminant validity. The coefficients of CR (>0.7), AVE (>0.5), Cronbach's α values (>0.7) and factor loadings (>0.7) were above the acceptable threshold, showing that there were no validity and reliability issues (Hair *et al.*, 2014a). The results are presented in Table 2.

Table 3 presents the results of convergent and discriminant validity analysis, based on the factor loadings, CR and AVE estimates. Diagonal figures represent the square root of the AVE. They are higher than the figures below, which represent the between-constructs correlations, confirming that there were no validity issues. Having confirmed satisfactory reliability and validity results, we conducted the analysis of the measurement model in AMOS, using the χ^2 coefficient, root mean square error of approximation (RMSEA <0.07), comparative fit index (CFI >0.9) and chi-square statistics (CMIN) divided by degrees of freedom (DF). The results showed that $\chi^2(647) = 1,368.509$, CMIN/DF = 2.115, CFI = 0.969 and RMSEA = 0.046, which were above the acceptable values (Hair *et al.*, 2014a).

To ensure that common method variance did not affect the variables, we used the marker variable method (Podsakoff *et al.*, 2003), by including the theoretically unrelated construct measuring job engagement (Schaufeli *et al.*, 2006). The results showed that the common method variance was 33%, which is lower than the acceptable cut-off point (Eichhorn, 2014). That enabled us to conclude that common method bias was not an issue.

5.2 Path analysis

After ensuring that there were no reliability and validity issues with the measurements, the second step was the analysis of the structural model in Amos (Hair *et al.*, 2014a). We made sure that the structural model fit indices were satisfactory to proceed with path analysis as follows: $\chi^2(656) = 1,537.485$, CMIN/DF = 2.344, CFI = 0.962 and RMSEA = 0.050. The analysis of the relationships between variables showed that the model explains 78% of the variance in perceived well-being, 59% of the variance in productivity and 70% of the variance in intention to work from a smart home-office in the future. Out of 18 hypothesised paths, 14 were found to be significant, with two paths being negative (Table 4, Figure 2). That meant that 16 hypothesised relationships were supported. Specifically, the first hypothesis was partly supported by showing that task-technology fit (H1b) positively correlates with well-being. Path analysis confirmed the positive relationships between service relevance and the two dependent variables, thus supporting hypotheses 2a and 2b. The third set of hypotheses was not supported, as the relationships between control over environmental conditions, productivity and well-being were negative. Perceived usefulness positively correlated with the dependent variables, which supported hypotheses 4a and 4b. The fifth set of hypotheses was partly confirmed, as perceived ease of use showed a significant positive effect only in relation to well-being (H5b). Similarly, attitude towards smart homes positively correlated only with well-being, which means that hypothesis 6b is supported. Hypotheses 7a, 7b, 8a and 8b were confirmed, demonstrating a positive effect of individual factors, such as hedonic beliefs and innovativeness, on both productivity and well-being. Finally, future use intention correlated only with well-being, which made us support hypothesis 9b.

	1	2	3	4	5	6	7	8	9	10	11
1 Hedonic beliefs	0.888										
2 Task-technology fit	0.565	0.903									
3 Service relevance	0.560	0.748	0.889								
4 Control	0.511	0.864	0.727	0.896							
5 Perceived usefulness	0.599	0.843	0.780	0.855	0.938						
6 Perceived ease of use	0.582	0.770	0.618	0.812	0.792	0.903					
7 Attitude	0.684	0.640	0.589	0.638	0.660	0.674	0.882				
8 Future use intention	0.579	0.732	0.621	0.689	0.731	0.719	0.624	0.949			
9 Well-being	0.678	0.672	0.669	0.618	0.725	0.653	0.661	0.749	0.815		
10 Perceived productivity	0.580	0.561	0.648	0.473	0.648	0.474	0.512	0.555	0.762	0.882	
11 Individual innovativeness	0.465	0.425	0.394	0.402	0.400	0.422	0.494	0.479	0.484	0.412	0.870

Note(s): Diagonal figures represent the square root of the average variance extracted (AVE), and the values below represent between-construct correlations

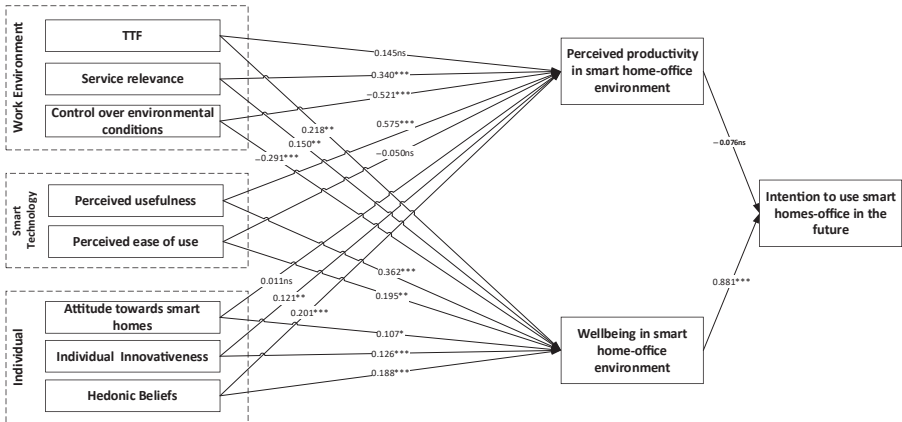
Table 3.
Convergent
validity test

Table 4.
The results of the tests
of hypotheses

H	Path	Coef	t-test, sig
H1a	Task- technology fit → perceived productivity	0.145	(1.676 ns)
H1b	Task- technology fit → well-being	0.218	(2.975**)
H2a	Service relevance → perceived productivity	0.340	(5.417***)
H2b	Service relevance → well-being	0.150	(2.855**)
H3a	Control over environmental conditions → perceived productivity	−0.521	(−5.195***)
H3b	Control over environmental conditions → well-being	−0.291	(−3.463***)
H4a	Perceived usefulness → perceived productivity	0.575	(6.616***)
H4b	Perceived usefulness → well-being	0.362	(4.963***)
H5a	Perceived ease of use → perceived productivity	−0.050	(−0.707 ns)
H5b	Perceived ease of use → well-being	0.195	(3.216**)
H6a	Attitude towards smart home → perceived productivity	0.011	(0.195 ns)
H6b	Attitude towards smart home → well-being	0.107	(2.247*)
H7a	Individual innovativeness → perceived productivity	0.121	(3.069**)
H7b	Individual innovativeness → well-being	0.126	(3.765***)
H8a	Hedonic beliefs → perceived productivity	0.201	(3.882***)
H8b	Hedonic beliefs → well-being	0.188	(4.273***)
H9a	Perceived Productivity → future use intention	−0.076	(−1.826 ns)
H9b	Well-being → future use intention	0.881	(17.415***)

Note(s): Significance: ns ≥ 0.05; * <0.05; **<0.01; ***<0.001

Figure 2.
The results of the
analysis of the
structural model



Note(s): Significance: ns ≥ 0.05; * < 0.05; ** < 0.01; *** < 0.001

6. Discussion

Data analysis showed that work environment factors correlate with perceived productivity and well-being in a smart home-office, except for perceived task-technology fit, which is important only in relation to well-being. The positive effect of service relevance on productivity and well-being is consistent with prior research (Khanna and Jha, 2021), suggesting that smart home technologies can create comfortable conditions whilst working at home. The negative path between control over environmental conditions, perceived productivity and well-being did not support the study hypotheses. This finding is surprising considering that the deployment of connected devices is favoured by employees, due to technology functions regulating light and thermal conditions in the office (Papagiannidis and Marikyan, 2019; Bogdan et al., 2021). Because smart home integration into the work context

had a temporary nature, controlling the work environment specifically, which is often inseparable from the rest of the house, may have been a challenge. In addition, controlling conditions in spaces for which technology was repurposed may be more difficult than expected. This may be due to the need to change default settings or add new devices to the smart home system, which could undermine technology efficiency in delivering tailored services (Abdallah *et al.*, 2017; Brich *et al.*, 2017). As such, difficulties in setting up devices to control the work environment may have a negative impact on user experience. The significant path between task-technology fit and well-being is consistent with prior literature arguing that the match between service and tasks results in satisfaction, which relates to the personal state (Marikyan *et al.*, 2020). This result shows that the perceived suitability of smart home technologies for the management of micro-tasks, e.g. switching lights on and off, adjusting temperature, regulating airflow, whilst working from home is related to an individual's well-being. The non-significant role of task-technology fit on productivity could be due to the design of smart homes. Smart homes aim to make routine house-management tasks more comfortable in order to improve the quality of life, rather than improve the productivity of work-related tasks (Balta-Ozkan *et al.*, 2014b). Whilst smart home services may make workers feel more comfortable whilst working from home, they may not be perceived as directly affecting productivity.

The analysis of smart home-related factors showed that perceived usefulness is the strongest determinant of productivity and well-being. This finding is in line with technology acceptance research, postulating that perceived usefulness facilitates technology adoption behaviour (Davis, 1989). The finding also corroborates prior evidence about the usefulness of technology for employees in remote control and micro-task management (Khanna and Jha, 2021; Bogdan *et al.*, 2021). As such, smart home technologies can enhance the home-office environment. The analysis showed a significant and positive relationship between perceived ease of use and well-being. However, the correlation between ease of use and productivity was not significant. The path analysis suggests that the operational attributes of smart homes are not a primary concern when it comes to personal productivity assessment. This may be due to the usability feature being directly associated with automation and comfort, which are the main factors contributing to well-being (Sequeiros *et al.*, 2021), rather than productivity.

Individual factors include the attitude towards smart homes, personal innovativeness and hedonic beliefs. The analysis showed that productivity in a smart home-office is not determined by the individual's attitude towards smart homes. However, when it came to well-being, the importance of attitude was confirmed. The divergent findings can be explained by the salience of the belief that smart homes are instrumental in creating comfortable living conditions (Sequeiros *et al.*, 2021; Marikyan *et al.*, 2019; Al-Kuwari *et al.*, 2018) and are not typically associated with work. Positive relationships between innovativeness, productivity and perceived well-being are consistent with literature suggesting that individuals with a high innovativeness trait tend to be early adopters of new applications (Agarwal and Prasad, 1998). Innovative individuals tend to have higher involvement in the co-creation of new experiences, services and results (Handrich and Heidenreich, 2013). Remote workers with a more salient innovativeness trait tend to experiment with new technologies and adapt them to a new context, such as working from a smart home-office. Positive relationships between perceived hedonic benefit, job productivity and well-being mean that the enjoyment that individuals experience whilst using smart home devices for controlling their work environment increases employees' perceptions of productivity at work and their well-being. The finding is consistent with prior research, which found that hedonic benefit enhances the perception of the fit between technology services and tasks, subsequent technology adoption and satisfaction (Ozturk *et al.*, 2016; Marikyan *et al.*, 2021).

Finally, despite the growing usage of smart home devices after the shift to remote working post-pandemic (Umair *et al.*, 2021; Deloitte, 2021; Maalsen and Dowling, 2020; Zanicco *et al.*, 2021),

individuals do not care much about technology implications for productivity purposes. The analysis of the predictors of intention to work from a smart home-office showed that only well-being correlates with intentions. Smart homes' ability to enhance well-being could potentially underpin willingness to work from a smart home-office in the future. Similar findings have also been confirmed in prior research, postulating that the perception of well-being correlates with the perceived usefulness of technology, inducing the intention to use it in the future (Verma and Sinha, 2018).

6.1 Theoretical and practical contributions

This study makes two important theoretical contributions. First, the paper contributes to the literature on remote workers' behaviour by testing the role of the factors related to the work environment, smart technology and individual factors in well-being and productivity. The findings complement research which has mostly examined technologies that are designed for the delivery of work tasks distantly and collaborations between employees (Pérez Pérez *et al.*, 2004; Drumea, 2020; Hafermalz and Riemer, 2021). The findings of this study focus on how technology can help manage the environment in which employees work and transform individuals' experiences. By exploring the interaction of people with smart home technologies, this study provides an understanding as to how usage relates to the perception of productivity and especially well-being, which is much needed given the rapid shift to the use of technology in private life (Beaunoyer *et al.*, 2020). This knowledge is important against the backdrop of the prolonged effect of COVID-19, unequal access to innovative technologies and the growing research on the implications of technologies in crisis (Molino *et al.*, 2020; Spagnoli *et al.*, 2020; Drumea, 2020; Beaunoyer *et al.*, 2020). Secondly, the paper contributes to the smart home literature by bringing a novel insight into the role that technology can have in the workplaces, which has not been explored before. The analysis of the predictors of perceived productivity and well-being gives insights into the aspects of technology use that facilitate technology application in personalising workspaces. Such findings provide evidence with regards to whether office spaces, potentially equipped with capabilities similar to those of smart homes, can help individuals control their environment, improving their comfort and productivity. This could be important when it comes to company policies and support for employees that aim to enhance well-being whilst working remotely.

This research also has practical implications for organisations. Specifically, the findings of the effects of task-technology fit, service relevance, perceived usefulness, perceived ease of use and hedonic beliefs provide implications for managerial practices in two ways. First, it could be important to equip office spaces with smart systems monitoring temperature and light and enabling employees to intelligently control these conditions. The use of smart homes integrated into workspaces needs to be efficient, convenient, easy and playful to facilitate productivity. Secondly, companies could offer smart home devices for employees working from home so they can enjoy the benefit of ambient control whilst working remotely.

7. Conclusion

Against the backdrop of the increasing utilisation of smart home technologies after the COVID-19 pandemic outbreak (Umair *et al.*, 2021; Abdullah and Abdullah, 2021; Zanocco *et al.*, 2021), this study aimed to address the gap in the literature, which lacked evidence about the implications of smart home technology usage in a work environment. To address the gap, the first objective of the study was to explore the impact of the use of smart home devices on job productivity and well-being by focussing on the potential role that work environment factors, smart home use factors and individual beliefs and characteristics can play. These findings have implications for the literature on remote workers' behaviour by

suggesting the sets of conditions that can facilitate perceived well-being and better job productivity. The second objective of the paper was to investigate how the evaluation of technology implications for job productivity and well-being translates into the long-term utilisation of smart homes in a work environment in the future. The confirmed positive effect of well-being brings evidence about the driver of the adoption of smart homes for work settings.

7.1 Limitations and future research suggestions

There are limitations in this study, which future research could address. First, the non-confirmed effects of some antecedents on productivity suggest that there is a possibility that they indirectly relate to productivity via well-being. To empirically test whether this assumption holds true, future research could test the mediating role of well-being. Secondly, the sample was based on users located in the United Kingdom. Given that in other countries, especially in emerging markets, the technological infrastructure is different, the perception and experience of individuals in relation to smart home-offices could be different. Similarly given that workers in different countries experienced the pandemic effect in different ways, remote working may have had a different impact. Whilst this paper touched upon individuals' preferences to work from a smart home-office, future research could investigate whether the findings could be transferred into the workplace, creating a "smarter" office environment. Another limitation is that we focussed on a wide scope of smart technologies, which made it impossible to evaluate which technology plays the most important role in enhancing productivity in a smart home-office and individuals' well-being.

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