The current issue and full text archive of this journal is available on Emerald Insight at:
https://www.emerald.com/insight/1066-2243.htm

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

Davit Marikyan
Business School, University of Bristol, Bristol, UK
Savvas Papagiannidis
Newcastle University Business School, Newcastle Upon Tyne, UK
Omer F. Rana
School of Computer Science and Informatics, Cardiff University, Cardiff, UK, and
Rajiv Ranjan
School of Computing, Newcastle University, Newcastle Upon Tyne, UK

Received 27 December 2021
Revised 18 September 2022
11 January 2023
Accepted 11 January 2023

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

The authors would like to thank the reviewers and the editorial team for the constructive feedback and the opportunity to improve the manuscript. The earlier version of this research was presented at the conference - Marikyan *et al.* (2021), "Working in a smart home-office: exploring the impacts on productivity and wellbeing", in Domínguez-Mayo F.J., Marchiori M. and Filipe J. (Ed.s), *The 17th International Conference on Web Information Systems and Technologies 2021*, Science and Technology Publications, Setubal, Portugal, pp. 275–282.

Funding: This project was partly funded by the Engineering and Physical Sciences Research Council (EPSRC): PACE: Privacy-Aware Cloud Ecosystems (Project Reference: EP/R033293/1), and the work reported here was part-sponsored by Research England's Connecting Capability Fund award CCF18-7157 – Promoting the Internet of Things via Collaboration between HEIs and Industry (Pitch-In).

Internet Research

1066-2243
DOI 10.1108/INTR-12-2021-0931

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; Zanocco *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; Anıtsal, 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 (Ćulibrk *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 (Anıtsal, 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

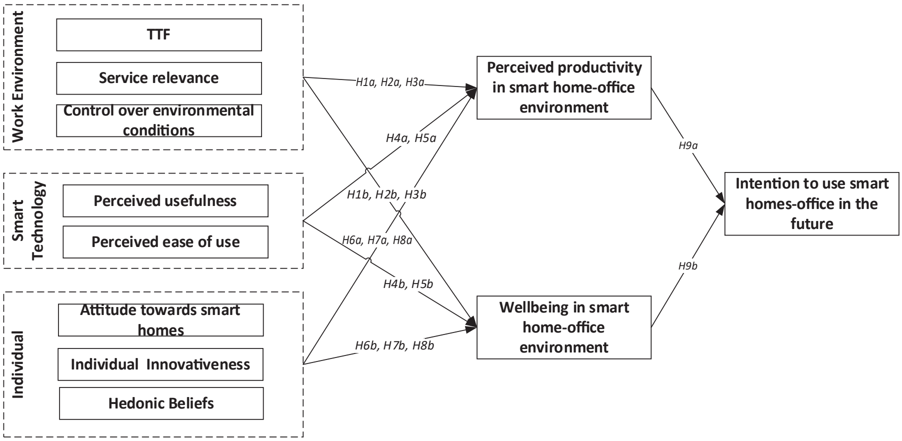


Figure 1.
Research model

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 (n = 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
	Other	1	0.2
Family size	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
	6 members or more	20	3.8
% of work done from home during the pandemic	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
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
	More than 6 years ago	19	3.6
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

Table 1. The profile of the respondents

Table 2.
Measurement items of constructs

Measurement items	Loading	Mean (SD)	α	CR	AVE
Task-technology fit (Yen *et al.*, 2010)		14.52 (4.34)	0.929	0.930	0.815
When it comes to my home-office environment, while working from home during the pandemic . . .					
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)			
Service relevance (Venkatesh and Bala, 2008)		12.71 (4.60)	0.918	0.919	0.790
For controlling my home-office environment while working from home during the pandemic, the usage of smart home technologies has been . . .					
important	0.889	4.20 (1.76)			
relevant	0.903	4.44 (1.66)			
pertinent	0.874	4.07 (1.57)			
Control (Venkatesh, 2000)		14.40 (4.56)	0.924	0.925	0.804
While working from my home-office during the pandemic . . .					
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)			
Perceived usefulness (Davis, 1989)		19.03 (5.82)	0.967	0.967	0.879
While working from my home-office during the pandemic, the usage of smart home technologies . . .					
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)			
Perceived ease of use (Davis, 1989)		15.52 (3.90)	0.929	0.930	0.815
While working from my home-office during the pandemic . . .					
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)			
Attitude towards smart homes (Elliott *et al.*, 2007)		22.20 (4.50)	0.933	0.934	0.779
My attitude towards smart homes has been . . .					
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)			
Individual innovativeness (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)			

(*continued*)

Measurement items	Loading	Mean (SD)	α	CR	AVE
I like to experiment with new information technologies	0.920	5.01 (1.47)			
Hedonic belief (Voss *et al.*, 2003)		19.66 (4.54)	0.937	0.937	0.789
While working from my home-office during the pandemic, the use of smart home technologies has been . . .					
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)			
Perceived productivity in a smart home-office (Tam and Oliveira, 2016; Oseland, 1999; Goodhue and Thompson, 1995)		20.64 (7.01)	0.946	0.946	0.778
During the pandemic, being able to control my home-office environment using smart home technologies has made it possible to . . .					
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	0.884	3.96 (1.52)			
Wellbeing (El Hedhli *et al.*, 2013)		14.15 (3.83)	0.852	0.855	0.664
During the pandemic, being able to control my home-office environment using smart home technologies has made it possible to . . .					
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)			
Future intention to use (Davis, 1989)		16.14 (4.01)	0.965	0.965	0.901
After the pandemic . . .					
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 χ^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: χ^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.

Table 3. Convergent validity test

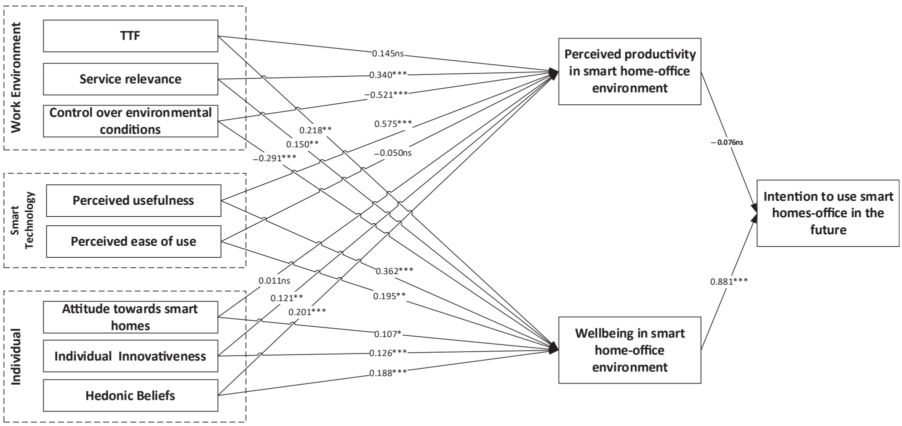
	1	2	3	4	5	6	7	8	9	10	11
1 Hedonic beliefs	*0.888*										
2 Task-technology fit	0.565	*0.903*									
3 Service relevance	0.560	0.748	*0.889*								
4 Control	0.511	0.864	0.727	*0.896*							
5 Perceived usefulness	0.599	0.843	0.780	0.855	*0.938*						
6 Perceived ease of use	0.582	0.770	0.618	0.812	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 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



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

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

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; Zanocco *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.

References

Abdallah, R., Xu, L. and Shi, W. (2017), "Lessons and experiences of a DIY smart home", *Paper Presented at SmartIoT@SEC 2017*, Silicon Valley, USA, 14 October, available at: https://dl.acm.org/doi/10.1145/3132479.3132488 (accessed 21 January 2022).

Abdullah, M.A. and Abdullah, M.A. (2021), "How COVID-19 has affected the internet of things (IoT) technology", *2021 IEEE International Conference on Service Operations and Logistics, and Informatics*, IEEE, New York, pp. 1-6.

Adesina, O.J., Raimi, S.O., Bolaji, O.A. and Adesina, A.E. (2016), "Teachers' attitude, years of teaching experience and self-efficacy as determinants of teachers' productivity in teachers' professional development programme in Ibadan Metropolis, Oyo State, Nigeria", *Journal of Emerging Trends in Educational Research and Policy Studies*, Vol. 7 No. 3, pp. 204-211.

Agarwal, R. and Prasad, J. (1998), "A conceptual and operational definition of personal innovativeness in the domain of information technology", *Information Systems Research*, Vol. 9 No. 2, pp. 204-215.

Agarwal, P. and Sajid, S. (2017), "A study of job satisfaction, organizational commitment and turnover intention among public and private sector employees", *Journal of Management Research*, Vol. 17 No. 3, pp. 123-136.

Al-Kuwari, M., Ramadan, A., Ismael, Y., Al-Sughair, L., Gastli, A. and Benammar, M. (2018), "Smart-home automation using IoT-based sensing and monitoring platform", *2018 IEEE 12th International Conference on Compatibility, Power Electronics and Power Engineering*, IEEE, New York, pp. 1-6.

Alam, M.R., Reaz, M.B.I. and Ali, M.A.M. (2012), "A review of smart homes— past, present and future", *IEEE Transactions on Systems, Man, and Cybernetics, C (Applications and Reviews)*, Vol. 42 No. 6, pp. 1190-1203.

Anıtsal, İ. (2005), "Technology-based self-service: from customer productivity toward customer value", The University of Tennessee, available at: https://bris.idm.oclc.org/login?url=https://www.

proquest.com/dissertations-theses/technology-based-self-service-customer/docview/305394264/se-2 (accessed 20 January 2022).

Atulkar, S. and Kesari, B. (2017), "Satisfaction, loyalty and repatronage intentions: role of hedonic shopping values", *Journal of Retailing and Consumer Services*, Vol. 39, pp. 23-34.

Babin, B.J., Darden, W.R. and Griffin, M. (1994), "Work and/or fun: measuring hedonic and utilitarian shopping value", *Journal of Consumer Research*, Vol. 20 No. 4, pp. 644-656.

Balta-Ozkan, N., Davidson, R., Bicket, M. and Whitmarsh, L. (2013), "Social barriers to the adoption of smart homes", *Energy Policy*, Vol. 63, pp. 363-374.

Balta-Ozkan, N., Amerighi, O. and Boteler, B. (2014a), "A comparison of consumer perceptions towards smart homes in the UK, Germany and Italy: reflections for policy and future research", *Technology Analysis and Strategic Management*, Vol. 26 No. 10, pp. 1176-1195.

Balta-Ozkan, N., Boteler, B. and Amerighi, O. (2014b), "European smart home market development: public views on technical and economic aspects across the United Kingdom, Germany and Italy", *Energy Research and Social Science*, Vol. 3, pp. 65-77.

Banbury, S.P. and Berry, D.C. (2005), "Office noise and employee concentration: identifying causes of disruption and potential improvements", *Ergonomics*, Vol. 48 No. 1, pp. 25-37.

Barnes, S.J. (2020), "Information management research and practice in the post-COVID-19 world", *International Journal of Information Management*, Vol. 55, 102175.

Beaunoyer, E., Dupéré, S. and Guitton, M.J. (2020), "COVID-19 and digital inequalities: reciprocal impacts and mitigation strategies", *Computers in Human Behavior*, Vol. 111, 106424.

Bogdan, R., Tatu, A., Crisan-Vida, M.M., Popa, M. and Stoicu-Tivadar, L. (2021), "A practical experience on the Amazon Alexa integration in smart offices", *Sensors*, Vol. 21 No. 3, p. 734.

Boyce, P.R. (2014), *Human Factors in Lighting*, CRC Press, London.

Brennan, A., Chugh, J.S. and Kline, T. (2002), "Traditional versus open office design: a longitudinal field study", *Environment and Behavior*, Vol. 34 No. 3, pp. 279-299.

Brich, J., Walch, M., Rietzler, M., Weber, M. and Schaub, F. (2017), "Exploring end user programming needs in home automation", *ACM Transactions on Computer-Human Interaction*, Vol. 24 No. 2, pp. 1-35.

Buil, I., Catalán, S. and Martínez, E. (2020), "Understanding applicants' reactions to gamified recruitment", *Journal of Business Research*, Vol. 110, pp. 41-50.

Carroll, N. and Conboy, K. (2020), "Normalising the 'new normal': changing tech-driven work practices under pandemic time pressure", *International Journal of Information Management*, Vol. 55, 102186.

Chang, I.-C., Liu, C.-C. and Chen, K. (2014), "The effects of hedonic/utilitarian expectations and social influence on continuance intention to play online games", *Internet Research*, Vol. 24 No. 1, pp. 21-45.

Chatterjee, S., Chakraborty, S., Fulk, H.K. and Sarker, S. (2021), "Building a compassionate workplace using information technology: considerations for information systems research", *International Journal of Information Management*, Vol. 56, 102261.

Choi, O.-K. and Cho, E. (2019), "The mechanism of trust affecting collaboration in virtual teams and the moderating roles of the culture of autonomy and task complexity", *Computers in Human Behavior*, Vol. 91, pp. 305-315.

Corbett, J. (2013), "Using information systems to improve energy efficiency: do smart meters make a difference?", *Information Systems Frontiers*, Vol. 15 No. 5, pp. 747-760.

Ćulibrk, J., Delić, M., Mitrović, S. and Ćulibrk, D. (2018), "Job satisfaction, organizational commitment and job involvement: the mediating role of job involvement", *Frontiers in Psychology*, Vol. 9, p. 132.

Davis, F.D. (1989), "Perceived usefulness, perceived ease of use, and user acceptance of information technology", *MIS Quarterly*, Vol. 13 No. 3, pp. 319-340.

Davis, F.D., Bagozzi, R.P. and Warshaw, P.R. (1992), "Extrinsic and intrinsic motivation to use computers in the workplace", *Journal of Applied Social Psychology*, Vol. 22 No. 14, pp. 1111-1132.

Dawkins, C.E. and Frass, J.W. (2005), "Decision of union workers to participate in employee involvement: an application of the theory of planned behaviour", *Employee Relations*, Vol. 27 No. 5, pp. 511-531.

Deci, E.L. and Ryan, R.M. (1985), "Conceptualizations of intrinsic motivation and self-determination", in *Intrinsic Motivation and Self-Determination in Human Behavior*, Springer, Boston, pp. 11-40.

Deloitte (2021), "Internet of Things (IoT) the rise of the connected world", available at: https://www2.deloitte.com/content/dam/Deloitte/in/Documents/technology-media-telecommunications/in-tmt-IoT_Theriseoftheconnectedworld-28aug-noexp.pdf (accessed 20 January 2022).

Dhir, A., Sadiq, M., Talwar, S., Sakashita, M. and Kaur, P. (2021), "Why do retail consumers buy green apparel? A knowledge-attitude-behaviour-context perspective", *Journal of Retailing and Consumer Services*, Vol. 59, 102398.

Drumea, C. (2020), "Work-related stress and subsequent productivity in a teleworking environment induced by pandemic-related confinement. evidence from the public organizations", *Ovidius University Annals, Economic Sciences Series*, Vol. 20 No. 1, pp. 337-341.

Edwards, J.R. and Rothbard, N.P. (2000), "Mechanisms linking work and family: clarifying the relationship between work and family constructs", *Academy of Management Review*, Vol. 25 No. 1, pp. 178-199.

Eichhorn, B.R. (2014), "Common method variance techniques", Working Paper, Department of Operations and Supply Chain Management, Cleveland State University, Cleveland, 5 October.

El Hedhli, K., Chebat, J.-C. and Sirgy, M.J. (2013), "Shopping well-being at the mall: construct, antecedents, and consequences", *Journal of Business Research*, Vol. 66 No. 7, pp. 856-863.

Elkhorchani, H. and Grayaa, K. (2016), "Novel home energy management system using wireless communication technologies for carbon emission reduction within a smart grid", *Journal of Cleaner Production*, Vol. 135, pp. 950-962.

Elliott, M.A., Armitage, C.J. and Baughan, C.J. (2007), "Using the theory of planned behaviour to predict observed driving behaviour", *British Journal of Social Psychology*, Vol. 46 No. 1, pp. 69-90.

Fishbein, M. and Ajzen, I. (1981), "Attitudes and voting behavior: an application of the theory of reasoned action", *Progress in Applied Social Psychology*, Vol. 1, pp. 253-313.

Fleishman, E.A. (1965), "Attitude versus skill factors in work group productivity", *Personnel Psychology*, Vol. 18 No. 3, pp. 253-266.

Fonner, K.L. and Stache, L.C. (2012), "All in a day's work, at home: teleworkers' management of micro role transitions and the work–home boundary", *New Technology, Work and Employment*, Vol. 27 No. 3, pp. 242-257.

Ford, R., Pritoni, M., Sanguinetti, A. and Karlin, B. (2017), "Categories and functionality of smart home technology for energy management", *Building and Environment*, Vol. 123, pp. 543-554.

Gadeyne, N., Verbruggen, M., Delanoeije, J. and De Cooman, R. (2018), "All wired, all tired? Work-related ICT-use outside work hours and work-to-home conflict: the role of integration preference, integration norms and work demands", *Journal of Vocational Behavior*, Vol. 107, pp. 86-99.

Goodhue, D.L. and Thompson, R. (1995), "Task-technology fit and individual performance", *MIS Quarterly*, Vol. 19 No. 2, pp. 213-236.

Hafermalz, E. and Riemer, K. (2021), "Productive and connected while working from home: what client-facing remote workers can learn from telenurses about 'belonging through technology'", *European Journal of Information Systems*, Vol. 30 No. 1, pp. 89-99.

Hair, J.F., Black, W.C., Babin, B.J. and Anderson, R.E. (2014a), *Multivariate Data Analysis*, Pearson New International Edition, Pearson Education, Essex.

Hair, J.F., Gabriel, M. and Patel, V. (2014b), "AMOS covariance-based structural equation modeling (CB-SEM): guidelines on its application as a marketing research tool", *Brazilian Journal of Marketing*, Vol. 13 No. 2.

Han, D.-m. and Lim, J.-h. (2010), "Smart home energy management system using IEEE 802.15.4 and Zigbee", *IEEE Transactions on Consumer Electronics*, Vol. 56 No. 3, pp. 1403-1410.

Han, S.-L., An, M., Han, J.J. and Lee, J. (2020), "Telepresence, time distortion, and consumer traits of virtual reality shopping", *Journal of Business Research*, Vol. 118, pp. 311-320.

Handrich, M. and Heidenreich, S. (2013), "The willingness of a customer to co-create innovative, technology-based services: conceptualisation and measurement", *International Journal of Innovation Management*, Vol. 17 No. 04, 1350011.

Hu, P.J.-H., Clark, T.H. and Ma, W.W. (2003), "Examining technology acceptance by school teachers: a longitudinal study", *Information and Management*, Vol. 41 No. 2, pp. 227-241.

Huang, L., Zhu, Y., Ouyang, Q. and Cao, B. (2012), "A study on the effects of thermal, luminous, and acoustic environments on indoor environmental comfort in offices", *Building and Environment*, Vol. 49, pp. 304-309.

Hubert, M., Blut, M., Brock, C., Zhang, R.W., Koch, V. and Riedl, R. (2019), "The influence of acceptance and adoption drivers on smart home usage", *European Journal of Marketing*, Vol. 53 No. 6, pp. 1073-1098.

Hussein, R.S., Mohamed, H. and Kais, A. (2021), "Antecedents of level of social media use: exploring the mediating effect of usefulness, attitude and satisfaction", *Journal of Marketing Communications*, Vol. 28, pp. 1-22.

Iyer, R. and Muncy, J.A. (2016), "Attitude toward consumption and subjective well-being", *Journal of Consumer Affairs*, Vol. 50 No. 1, pp. 48-67.

Kang, S., Ou, D. and Mak, C.M. (2017), "The impact of indoor environmental quality on work productivity in university open-plan research offices", *Building and Environment*, Vol. 124, pp. 78-89.

Khanna, P. and Jha, S. (2021), "Can IoT boost organizational productivity? A study of employees' perceptions using a mixed method approach", *South Asian Journal of Management*, Vol. 28 No. 2, pp. 137-163.

Kim, S.H. (2008), "Moderating effects of job relevance and experience on mobile wireless technology acceptance: adoption of a smartphone by individuals", *Information and Management*, Vol. 45 No. 6, pp. 387-393.

Kim, S. and Garrison, G. (2009), "Investigating mobile wireless technology adoption: an extension of the technology acceptance model", *Information Systems Frontiers*, Vol. 11 No. 3, pp. 323-333.

Kim, D.J. and Hwang, Y. (2012), "A study of mobile internet user's service quality perceptions from a user's utilitarian and hedonic value tendency perspectives", *Information Systems Frontiers*, Vol. 14 No. 2, pp. 409-421.

Kim, M. and Qu, H. (2014), "Travelers' behavioral intention toward hotel self-service kiosks usage", *International Journal of Contemporary Hospitality Management*, Vol. 26 No. 2, pp. 225-245.

Kim, Y.J., Chun, J.U. and Song, J. (2009), "Investigating the role of attitude in technology acceptance from an attitude strength perspective", *International Journal of Information Management*, Vol. 29 No. 1, pp. 67-77.

Kim, T., Kim, M.C., Moon, G. and Chang, K. (2014a), "Technology-based self-service and its impact on customer productivity", *Services Marketing Quarterly*, Vol. 35 No. 3, pp. 255-269.

Kim, T., Seo, H., Kim, M.C. and Chang, K. (2014b), "Customer productivity in technology-based self-service of virtual golf simulators", *International Journal of Sports Marketing and Sponsorship*, Vol. 16 No. 1, pp. 19-34.

Kim, Y., Park, Y. and Choi, J. (2017), "A study on the adoption of IoT smart home service: using value-based adoption model", *Total Quality Management and Business Excellence*, Vol. 28 Nos 9-10, pp. 1149-1165.

Lee, J. (2004), "Discriminant analysis of technology adoption behavior: a case of internet technologies in small businesses", *Journal of Computer Information Systems*, Vol. 44 No. 4, pp. 57-66.

Lee, Y.-K., Park, J.-H., Chung, N. and Blakeney, A. (2012), "A unified perspective on the factors influencing usage intention toward mobile financial services", *Journal of Business Research*, Vol. 65 No. 11, pp. 1590-1599.

Liébana-Cabanillas, F., Ramos de Luna, I. and Montoro-Ríos, F.J. (2015), "User behaviour in QR mobile payment system: the QR Payment Acceptance Model", *Technology Analysis and Strategic Management*, Vol. 27 No. 9, pp. 1031-1049.

Ling, H.-C., Chen, H.-R., Ho, K.K. and Hsiao, K.-L. (2021), "Exploring the factors affecting customers' intention to purchase a smart speaker", *Journal of Retailing and Consumer Services*, Vol. 59, 102331.

Maalsen, S. and Dowling, R. (2020), "Covid-19 and the accelerating smart home", *Big Data and Society*, Vol. 7 No. 2, 2053951720938073.

Mak, C.M. and Lui, Y. (2012), "The effect of sound on office productivity", *Building Services Engineering Research and Technology*, Vol. 33 No. 3, pp. 339-345.

Mallawaarachchi, H., De Silva, L. and Rameezdeen, R. (2017), "Modelling the relationship between green built environment and occupants' productivity", *Facilities*, Vol. 35 Nos 3/4, pp. 170-187.

Manis, K.T. and Choi, D. (2019), "The virtual reality hardware acceptance model (VR-HAM): extending and individuating the technology acceptance model (TAM) for virtual reality hardware", *Journal of Business Research*, Vol. 100, pp. 503-513.

Marikyan, D., Papagiannidis, S. and Alamanos, E. (2019), "A systematic review of the smart home literature: a user perspective", *Technological Forecasting and Social Change*, Vol. 138, pp. 139-154.

Marikyan, D., Papagiannidis, S. and Alamanos, E. (2020), "Cognitive dissonance in technology adoption: a study of smart home users", *Information Systems Frontiers*. doi: 10.1007/s10796-020-10042-3.

Marikyan, D., Papagiannidis, S. and Alamanos, E. (2021), "'Smart home sweet smart home': an examination of smart home acceptance", *International Journal of E-Business Research*, Vol. 17 No. 2, pp. 1-23.

Marikyan, D., Papagiannidis, S., Rana, O.F., Ranjan, R. and Morgan, G. (2022), "'Alexa, let's talk about my productivity': the impact of digital assistants on work productivity", *Journal of Business Research*, Vol. 142, pp. 572-584.

Maula, H., Hongisto, V., Östman, L., Haapakangas, A., Koskela, H. and Hyönä, J. (2016), "The effect of slightly warm temperature on work performance and comfort in open-plan offices–a laboratory study", *Indoor Air*, Vol. 26 No. 2, pp. 286-297.

McCartney, K. and Humphreys, M. (2002), "Thermal comfort and productivity", *Indoor Air*, Vol. 1, pp. 822-827.

Minton, E.A., Spielmann, N., Kahle, L.R. and Kim, C.-H. (2018), "The subjective norms of sustainable consumption: a cross-cultural exploration", *Journal of Business Research*, Vol. 82, pp. 400-408.

Mishra, D., Akman, I. and Mishra, A. (2014), "Theory of reasoned action application for green information technology acceptance", *Computers in Human Behavior*, Vol. 36, pp. 29-40.

Molino, M., Ingusci, E., Signore, F., Manuti, A., Giancaspro, M.L., Russo, V., Zito, M. and Cortese, C.G. (2020), "Wellbeing costs of technology use during Covid-19 remote working: an investigation using the Italian translation of the technostress creators scale", *Sustainability*, Vol. 12 No. 15, p. 5911.

Moore, G.C. and Benbasat, I. (1996), "Integrating diffusion of innovations and theory of reasoned action models to predict utilization of information technology by end-users", in Kautz, K. and

Pries-Heje, J. (Eds), *Diffusion and Adoption of Information Technology*, Springer, Oslo, pp. 132-146.

Mulcahy, R., Letheren, K., McAndrew, R., Glavas, C. and Russell-Bennett, R. (2019), "Are households ready to engage with smart home technology?", *Journal of Marketing Management*, Vol. 35 Nos 15-16, pp. 1370-1400.

Mullins, J.K. and Cronan, T.P. (2021), "Enterprise systems knowledge, beliefs, and attitude: a model of informed technology acceptance", *International Journal of Information Management*, Vol. 59, 102348.

Mun, Y.Y., Jackson, J.D., Park, J.S. and Probst, J.C. (2006), "Understanding information technology acceptance by individual professionals: toward an integrative view", *Information and Management*, Vol. 43 No. 3, pp. 350-363.

Niemelä, R., Hannula, M., Rautio, S., Reijula, K. and Railio, J. (2002), "The effect of air temperature on labour productivity in call centres—a case study", *Energy and Buildings*, Vol. 34 No. 8, pp. 759-764.

Oseland, N. (1999), *Environmental Factors Affecting Office Worker Performance: A Review of Evidence*, Chartered Institution of Building Services Engineers, London.

Osmonbekov, T. (2010), "Reseller adoption of manufacturers' e-business tools: the impact of social enforcement, technology–relationship fit and the mediating role of reseller benefits", *Journal of Business Research*, Vol. 63 No. 3, pp. 217-223.

Overby, J.W. and Lee, E.-J. (2006), "The effects of utilitarian and hedonic online shopping value on consumer preference and intentions", *Journal of Business Research*, Vol. 59 Nos 10-11, pp. 1160-1166.

Ozturk, A.B., Nusair, K., Okumus, F. and Hua, N. (2016), "The role of utilitarian and hedonic values on users' continued usage intention in a mobile hotel booking environment", *International Journal of Hospitality Management*, Vol. 57, pp. 106-115.

Papagiannidis, S. and Marikyan, D. (2019), "Smart offices: a productivity and well-being perspective", *International Journal of Information Management*, Vol. 51, 102027.

Papagiannidis, S., Harris, J. and Morton, D. (2020), "WHO led the digital transformation of your company? A reflection of IT related challenges during the pandemic", *International Journal of Information Management*, Vol. 55, 102166.

Pérez Pérez, M., Martínez Sánchez, A., de Luis Carnicer, P. and José Vela Jiménez, M. (2004), "A technology acceptance model of innovation adoption: the case of teleworking", *European Journal of Innovation Management*, Vol. 7 No. 4, pp. 280-291.

Podsakoff, P.M., MacKenzie, S.B., Lee, J.-Y. and Podsakoff, N.P. (2003), "Common method biases in behavioral research: a critical review of the literature and recommended remedies", *Journal of Applied Psychology*, Vol. 88 No. 5, p. 879.

Ramos-de-Luna, I., Montoro-Ríos, F. and Liébana-Cabanillas, F. (2016), "Determinants of the intention to use NFC technology as a payment system: an acceptance model approach", *Information Systems and E-Business Management*, Vol. 14 No. 2, pp. 293-314.

Rocchi, M. and Bernacchio, C. (2022), "The virtues of COVID-19 pandemic: how working from home can make us the best (or the worst) version of ourselves", *Business and Society Review*, Vol. 127 No. 3, pp. 685-700.

Ryan, R.M. and Deci, E.L. (2000), "Intrinsic and extrinsic motivations: classic definitions and new directions", *Contemporary Educational Psychology*, Vol. 25 No. 1, pp. 54-67.

Saade, R.G., Vahidov, R., Tsoukas, G.M. and Tsoukas, A. (2014), "Informing physicians using a situated decision support system: disease management for the smart city", *Knowledge Management and E-Learning*, Vol. 6 No. 4, pp. 472-492.

Saari, A., Tissari, T., Valkama, E. and Seppänen, O. (2006), "The effect of a redesigned floor plan, occupant density and the quality of indoor climate on the cost of space, productivity and sick leave in an office building–A case study", *Building and Environment*, Vol. 41 No. 12, pp. 1961-1972.

Schaufeli, W.B., Bakker, A.B. and Salanova, M. (2006), "The measurement of work engagement with a short questionnaire: a cross-national study", *Educational and Psychological Measurement*, Vol. 66 No. 4, pp. 701-716.

Schill, M., Godefroit-Winkel, D., Diallo, M.F. and Barbarossa, C. (2019), "Consumers' intentions to purchase smart home objects: do environmental issues matter?", *Ecological Economics*, Vol. 161, pp. 176-185.

Schuster, H.G. (2008), "Daylight in office buildings—the users' response", *Journal of Green Building*, Vol. 3 No. 1, pp. 102-111.

Scott, J. (2000), "Rational choice theory", in Browning, G., Halcli, A. and Webster, F. (Eds), *Understanding Contemporary Society: Theories of the Present*, Sage Publications, London, pp. 126-138.

Seppanen, O. and Fisk, W.J. (2004), "A model to estimate the cost effectiveness of the indoor environment improvements in office work", *ASHRAE Transactions*, Vol. 111 LBNL-55447.

Seppanen, O., Fisk, W.J. and Faulkner, D. (2004), "Control of temperature for health and productivity in offices", *ASHRAE Transactions*, Vol. 111 LBNL-55448.

Seppanen, O., Fisk, W.J. and Lei, Q. (2006a), "Effect of temperature on task performance in office environment", *paper presented at the 5th International Conference on Cold Climate Heating, Ventilating and Air Conditioning*, Moscow, Russia, 21-24 May, available at: https://eta-publications.lbl.gov/sites/default/files/lbnl-60946.pdf (accessed 21 January 2022).

Seppanen, O., Fisk, W.J. and Lei, Q. (2006b), "Room temperature and productivity in office work", in de Oliveira Fernandes, E., Pinto, J.R. and Gameiro da Silva, M. (Eds), *The 8th International Conference and Exhibition on Healthy Buildings 2006*, Curran Associates, New York, pp. 243-248.

Sequeiros, H., Oliveira, T. and Thomas, M.A. (2021), "The impact of IoT smart home services on psychological well-being", *Information Systems Frontiers*, Vol. 24, pp. 1009-1026.

Shin, J., Park, Y. and Lee, D. (2018), "Who will be smart home users? An analysis of adoption and diffusion of smart homes", *Technological Forecasting and Social Change*, Vol. 134, pp. 246-253.

Shuhaiber, A. and Mashal, I. (2019), "Understanding users' acceptance of smart homes", *Technology in Society*, Vol. 58, 101110.

Silva, M.F., Maas, S., de Souza, H.A. and Gomes, A.P. (2017), "Post-occupancy evaluation of residential buildings in Luxembourg with centralized and decentralized ventilation systems, focusing on indoor air quality (IAQ). Assessment by questionnaires and physical measurements", *Energy and Buildings*, Vol. 148, pp. 119-127.

Spagnoli, P., Molino, M., Molinaro, D., Giancaspro, M.L., Manuti, A. and Ghislieri, C. (2020), "Workaholism and technostress during the Covid-19 emergency: the crucial role of the leaders on remote working", *Frontiers in Psychology*, Vol. 11, p. 3714.

Statista (2022), "Smart home - United Kingdom", *Digital Markets*, available at: https://www.statista.com/outlook/dmo/smart-home/united-kingdom (accessed 22 January 2022).

Stolojescu-Crisan, C., Crisan, C. and Butunoi, B.-P. (2021), "An IoT-based smart home automation system", *Sensors*, Vol. 21 No. 11, p. 3784.

Strengers, Y., Hazas, M., Nicholls, L., Kjeldskov, J. and Skov, M.B. (2020), "Pursuing pleasance: interrogating energy-intensive visions for the smart home", *International Journal of Human-Computer Studies*, Vol. 136, 102379.

Talal, M., Zaidan, A., Zaidan, B., Albahri, A., Alamoodi, A., Albahri, O., Alsalem, M., Lim, C., Tan, K.L. and Shir, W. (2019), "Smart home-based IoT for real-time and secure remote health monitoring of triage and priority system using body sensors: multi-driven systematic review", *Journal of Medical Systems*, Vol. 43 No. 3, p. 42.

Tam, C. and Oliveira, T. (2016), "Performance impact of mobile banking: using the task-technology fit (TTF) approach", *International Journal of Bank Marketing*, Vol. 34 No. 4, pp. 434-457.

Tam, C., Santos, D. and Oliveira, T. (2020), "Exploring the influential factors of continuance intention to use mobile apps: extending the expectation confirmation model", *Information Systems Frontiers*, Vol. 22 No. 1, pp. 243-257.

Teslyuk, V., Beregovskyi, V., Denysyuk, P., Teslyuk, T. and Lozynskyi, A. (2018), "Development and implementation of the technical accident prevention subsystem for the smart home system", *International Journal of Intelligent Systems and Applications*, Vol. 10 No. 1, p. 1.

Umair, M., Cheema, M.A., Cheema, O., Li, H. and Lu, H. (2021), "Impact of COVID-19 on IoT adoption in healthcare, smart homes, smart buildings, smart cities, transportation and industrial IoT", *Sensors*, Vol. 21 No. 11, p. 3838.

Van der Heijden, H. (2004), "User acceptance of hedonic information systems", *MIS Quarterly*, Vol. 28 No. 4, pp. 695-704.

Venkatesh, V. (2000), "Determinants of perceived ease of use: integrating control, intrinsic motivation, and emotion into the technology acceptance model", *Information Systems Research*, Vol. 11 No. 4, pp. 342-365.

Venkatesh, V. (2020), "Impacts of COVID-19: a research agenda to support people in their fight", *International Journal of Information Management*, Vol. 55, 102197.

Venkatesh, V. and Bala, H. (2008), "Technology acceptance model 3 and a research agenda on interventions", *Decision Sciences*, Vol. 39 No. 2, pp. 273-315.

Venkatesh, V. and Davis, F.D. (2000), "A theoretical extension of the technology acceptance model: four longitudinal field studies", *Management Science*, Vol. 46 No. 2, pp. 186-204.

Verma, P. and Sinha, N. (2018), "Integrating perceived economic wellbeing to technology acceptance model: the case of mobile based agricultural extension service", *Technological Forecasting and Social Change*, Vol. 126, pp. 207-216.

Voss, K.E., Spangenberg, E.R. and Grohmann, B. (2003), "Measuring the hedonic and utilitarian dimensions of consumer attitude", *Journal of Marketing Research*, Vol. 40 No. 3, pp. 310-320.

Wang, J., Spicher, N., Warnecke, J.M., Haghi, M., Schwartze, J. and Deserno, T.M. (2021), "Unobtrusive health monitoring in private spaces: the smart home", *Sensors*, Vol. 21 No. 3, p. 864.

Wu, B. and Chen, X. (2017), "Continuance intention to use MOOCs: integrating the technology acceptance model (TAM) and task technology fit (TTF) model", *Computers in Human Behavior*, Vol. 67, pp. 221-232.

Xu, K., Wang, X., Wei, Song, H. and Mao, B. (2016), "Toward software defined smart home", *IEEE Communications Magazine*, Vol. 54 No. 5, pp. 116-122.

Yang, K. and Cho, S.B. (2016), "Towards sustainable smart homes by a hierarchical hybrid architecture of an intelligent agent", *Sustainability*, Vol. 8 No. 10.

Yang, H.-d. and Yoo, Y. (2004), "It's all about attitude: revisiting the technology acceptance model", *Decision Support Systems*, Vol. 38 No. 1, pp. 19-31.

Yang, H., Lee, W. and Lee, H. (2018), "IoT smart home adoption: the importance of proper level automation", *Journal of Sensors*, Vol. 2018, pp. 1-11.

Yen, D.C., Wu, C.-S., Cheng, F.-F. and Huang, Y.-W. (2010), "Determinants of users' intention to adopt wireless technology: an empirical study by integrating TTF with TAM", *Computers in Human Behavior*, Vol. 26 No. 5, pp. 906-915.

Zanocco, C., Flora, J., Rajagopal, R. and Boudet, H. (2021), "Exploring the effects of California's COVID-19 shelter-in-place order on household energy practices and intention to adopt smart home technologies", *Renewable and Sustainable Energy Reviews*, Vol. 139, 110578.

Zhang, F., Haddad, S., Nakisa, B., Rastgoo, M.N., Candido, C., Tjondronegoro, D. and de Dear, R. (2017), "The effects of higher temperature setpoints during summer on office workers' cognitive load and thermal comfort", *Building and Environment*, Vol. 123, pp. 176-188.

About the authors

Davit Marikyan is Lecturer in Marketing at the University of Bristol Business School (UK). He holds a PhD degree in Marketing and Innovation Management from Newcastle University and a Master's degree in Marketing and Strategy from Warwick Business School, the University of Warwick (UK). Also, Davit holds a Bachelor's degree in Business Management from Westminster Business School, Westminster University (UK). His research has appeared in several academic journals and has been presented at international conferences. Davit's research interests embrace the role of e-business technologies in organisational and consumer settings. More specifically, his research revolves around consumer behaviour in the context of innovative technology utilisation. Through his research, Davit aims to understand the psychological and cognitive underpinnings of technology acceptance and adoption in public and private settings. He also focusses on the implications of digital transformation for organisations. Currently, Davit is working on multiple projects that aim to investigate consumption through the lenses of nostalgic experiences. Davit Marikyan is the corresponding author and can be contacted at: Davit.marikyan@bristol.ac.uk

Professor Savvas Papagiannidis is the David Goldman Professor of Innovation and Enterprise in the Newcastle University Business School, UK. His work has been published in several academic journals and presented at international conferences. His research interests mainly revolve around electronic business and its various sub-domains. More specifically, his research aims to inform our understanding of how e-business technologies affect the social and business environment, organisational strategies and business models and how these are implemented in terms of functional innovations. His work puts strong emphasis on innovation, new value creation and the exploitation of entrepreneurial opportunities, within the context of different industries.

Omer F. Rana received the B Engineering degree in information systems engineering from Imperial College of Science, Technology and Medicine, London, UK, an MSc in microelectronics systems design from the University of Southampton, UK and a PhD in neural computing and parallel architectures from the Imperial College of Science, Technology and Medicine. He is Professor of performance engineering with Cardiff University, Cardiff, UK. His research interests include high performance distributed computing, data analytics/mining and scalable systems.

Professor Rajiv Ranjan was awarded an integrated Masters and PhD (2003–2008) by the Department of Computer Science and Software Engineering, the University of Melbourne. He is Australian-British computer scientist, of Indian origin, known for his research in Distributed Systems (Cloud Computing, Big Data and the Internet of Things). He is University Chair Professor for the internet of Things research in the School of Computing of Newcastle University, United Kingdom. He is the director of Networked and Ubiquitous Systems Engineering (NUSE) Group. He is also the Academic Director of School of Computing and the Research Director of Newcastle Urban Observatory. He is an internationally established scientist in the area of Distributed Systems (having published over 250 scientific papers). Professor Ranjan is ranked by Microsoft Academic as one of the top authors in Cloud Computing, Big Data, Quality of Service, Resource Management and Services Computing. According to recent (2020) bibliometric study by the Stanford University (https://bit.ly/3ndOXlN), and he is one of the highly cited authors in distributed computing field.