International Entrepreneurship and Management Journal
https://doi.org/10.1007/s11365-024-00968-4

A technostress–entrepreneurship nexus in the developing world

Amon Simba[1] · Patient Rambe[2] · Samuel Ribeiro Navarrete[3,4] · Maria Teresa Palomo Vadillo[3]

Accepted: 12 March 2024

Abstract

Research indicates that entrepreneurs are relying on digital technology for their entrepreneurial endeavours, yet there is little knowledge on how to balance technology usage and wellbeing. Drawing on the concept of technostress and 643 observations of nascent South African entrepreneurs' interactions with digital technology, we advance knowledge at the technostress–entrepreneurship nexus. Partial least squares structural equation modelling (PLS-SEM) results reveal how digital self-efficacy moderates their behaviour and inability to balance digital technology usage with wellbeing. These results confirm entrepreneurship passion and perceived behavioural control as predictors of technostress amongst these entrepreneurs. They also suggest that the benefits of digital technology are not a predictor of technostress in African entrepreneurship; thus, extending a conceptual overlay of digital technology, digital self-efficacy, entrepreneurial passion (EP), and behaviour to define the mechanisms underlying a technostress–entrepreneurship nexus. The results show social, policy, and research implications in today's technology-driven environments characterised by a mixture of midrange to complete digital transformations.

Keywords African entrepreneurship · Technostress · Wellbeing · Digital self-efficacy · Passion · Behaviour

Introduction

The advent of digital technology has transformed many social and entrepreneurship environments (Audretsch & Belitski, 2017; Hill et al., 2015; Siddiqui et al., 2023). Existing scholarly works describe how individuals and organisations are increasingly relying on digital technology to get work accomplished (Ayyagari et al., 2011; De et al., 2020; Upadhyay, 2020; Zhao et al., 2020), create new business opportunities

Extended author information available on the last page of the article

Published online: 01 April 2024

(Bharadwaj et al., 2013), and solve societal issues (see Bardhan & Thouin, 2013). Elsewhere, research recognises that advanced technologies like artificial intelligence can be integrated into hybrid innovation to support innovative activities and new product development processes (Bouschery et al., 2023). This body of knowledge depicts the generative nature of ChatGPT as a catalyst for new ideas and concepts (Stevenson et al., 2022) essential for business development and innovation (Dwivedi et al., 2023; Redondo-Rodríguez et al., 2023). Whilst there is this notable and extensive application of digital technology (Haini & Pang, 2022), the scale and depth of its adverse impact on the wellbeing of many communities, particularly groups of nascent entrepreneurially minded individuals considering entrepreneurship, is yet to be substantiated (cf., Sedera et al., 2022).

Indeed, studies elsewhere acknowledge that whilst the 'upside' of digital technology in entrepreneurship is evident (Alaimo, 2022), knowledge about its 'dark side' for groups of individuals with entrepreneurial intentions remains underdeveloped (see Nambisan & Baron, 2021). Accordingly, this study uses South Africa—a developing country, as the research settings to explore the dark side of digital technology when used for entrepreneurship purposes (Tarafdar et al., 2020). South Africa's semi-developed digital technology ecosystem (Zikhali, 2018) provides suitable settings for undertaking quasi-experiments to gain insights into the interplay between digital technology, digital self-efficacy, EP, intentions, behaviour, and technostress. The aim is to figure out the underlying technostress–entrepreneurship mechanisms inherent in South Africa's digital technology/entrepreneurship space. This is worthy of investigation due to the cognitive dissonance that oftentimes arise from 'unevenly diffused digital infrastructure' in South Africa (Chetty, 2023, p. 5). Such a scenario intensifies technostress levels amongst technology users including South Africa's nascent entrepreneurs' communities using digital technology for their entrepreneurial endeavours. Empirical results generated from investigating South Africa's digital technology landscape can advance knowledge at the intersection of technostress (Brod, 1984) and entrepreneurial action (McMullen & Shepherd, 2006) in the form of EP, behaviour, and intentions (Ajzen, 2012; Nkwei et al., 2023).

Technostress is a concept we use in this study to describe the excessive use of digital technology and the associated health implications for users (cf., Ayyagari et al., 2011). We integrate technostress with the transactional theory of stress (Lazarus, 1966; Lazarus & Folkman, 1984a) to frame our research on how, and if, nascent African entrepreneurs can cope or deal with digital technology in a healthy manner (Pirkkalainen et al., 2019). We use a conceptual overlay of entrepreneurial intentions, passion, behaviour, and digital self-efficacy to motivate our theorisations. Based on our theoretical assumptions and motivations, we rely on the following research question to guide our inquiry:

Are there any mechanisms underlying a technostress–entrepreneurship nexus influencing African entrepreneurship?

Empirical insights derived from answers to this essential research question contribute to the field of entrepreneurship in the following way. First, our technostress–entrepreneurship analysis contributes to entrepreneurship research by integrating a psychology related concept—the transactional theory of stress (Bartels et al., 2023; Lazarus, 1966; Lazarus & Folkman, 1984a) to elaborate digital self-efficacy as a

moderator of perceived behavioural control and technostress in African entrepreneurship. Similarly, PLS-SEM results contribute new insights into how entrepreneurship passion and perceived behavioural control are predictors of technostress and entrepreneurial intentions in African entrepreneurship. Thus, extending a conceptual overlay of digital technology, digital self-efficacy, EP, and behaviour in such a way, contributes to the understanding of the mechanisms underlying a technostress–entrepreneurship nexus in African entrepreneurship.

Second, the study contributes contextualised entrepreneurship perspectives by spotlighting the dark side of digital technology (Tarafdar et al., 2020) in the form of technostress in African entrepreneurship. This is consistent with Welter (2011), who, like Zahra (2007), Bruton et al. (2022), Morris et al. (2023), and Simba et al. (2023) advocated for research in management and entrepreneurship to watch contextual variations in developing entrepreneurship theory. This contextualisation of theory development in entrepreneurship enables scholarly conversation with the context (cf., Hamann et al., 2020; Simba et al., 2024), and it illuminates facets of technostress in African entrepreneurship.

Third, our theorisations through a comprehensive technostress–entrepreneurship analysis, PLS-SEM results, and contextual insights have far-reaching social, policy, and theoretical implications. For example, the effects of technostress on business development may require policy intervention through reforms. Such policy-level intervention can help to ensure the availability of resources needed to sustain the mental and physical wellbeing of nascent entrepreneurs in many parts of the developing world (cf., Maleki et al., 2023; Zhao et al., 2020). For academics, the analysis and empirical results offer alternative theorisations for exploring technostress in nascent entrepreneurship.

After the introduction, the rest of the paper is structured as follows. We present the theoretical foundations underpinning our research. This is followed by our research hypotheses. In the methodology section, we explain our research approach, and we justify our chosen research methods. Thereafter, we present and discuss our findings. We highlight the key features of our research and implications of our findings to theory and practice in the conclusion. Finally, we present the limitations of our study and offer suggestions for future research.

Theoretical foundations

Since entrepreneurship is still evolving as a field of research (Kraus et al., 2020), its development lies in adopting theoretical constructs established in other domains (see Shepherd & Wiklund, 2020). Given the uniqueness of the context chosen as the research setting for this study, we needed to adopt an innovative approach to how we theorised the phenomenon under observation. Accordingly, we integrated the transactional theory of stress originating in psychology research (Lazarus & Folkman, 1984a) to advance new theorisations at the technostress (Brod, 1984) and entrepreneurship (Shane & Venkataraman, 2000) interface. This is consistent with recent research that used the transactional theory of stress to explore human behaviour and

coping mechanisms (see Herman et al., 2020; Schermuly et al., 2021; Sharma & Gupta, 2023).

Crucially and relevant to this study, the transactional theory of stress was used to provide the baseline enabling a comprehensive understanding of the influence of stress on entrepreneurial outcomes like expected financial wellbeing, life satisfaction, business growth, and exit intentions (see Bennett et al., 2021). Based on its utility within the field of entrepreneurship, by integrating the transactional theory of stress into technostress to account for the digital technology stressors (Hang et al., 2022; Zhao et al., 2020) that impact EP, behaviour, and intentions amongst aspiring entrepreneurs (Ajzen, 2012) in contexts characterised by semi-developed digital technology ecosystems, for example (see Zikhali, 2018), we could advance the theory further for application and understanding of entrepreneurship in this digital era.

Based on this theoretical understanding, we innovatively devised a contextualised technostress–entrepreneurship conceptual interface. Our approach aligns with Morris et al.'s (2023) perspectives on theory development using a developing or emerging market context. As much as we leverage the transactional theory of stress, we go beyond its average application by using local South African entrepreneurs to enable exploration of their specific social interactions to gain an understanding of phenomena unfolding in the country's digital space or ecosystem. We consider our technostress–entrepreneurship conceptual interface as a useful baseline for theorising to build knowledge at the technostress and entrepreneurship nexus (cf., Ayyagari et al., 2011) using rarely studied contexts. Most importantly and because of its emphasis on the psychology of individuals (Lazarus & Folkman, 1984a; Torkzadeh & Doll, 1999), interweaving stress into a technostress–entrepreneurship conceptual interface can help uncover the subtle effects of technostress on entrepreneurs in such contexts.

Hypothesis development

The hypotheses for this research centre on technostress and a conceptual overlay of entrepreneurial intentions, passion, behaviour, digital self-efficacy, and the benefits of digital technology. We draw upon the African context to foreground these hypotheses. In some way, we theorise an entrepreneurship phenomenon in a context whose unique social interactions in a given digital space have, until now, been undertheorised (cf., Thurik et al., 2023). As previously stated, such an approach aligns with recent research calls encouraging scholars to focus on developing theory using less-known contexts of the developing world (Morris et al., 2023). We take the view that scholars risk missing the unique features of African entrepreneurship by recycling overused theories with a Western perspective without regard to the context (cf., Simba et al., 2023).

Entrepreneurial intentions: an African entrepreneurship perspective

Since the concept of entrepreneurial intentions was first mentioned by Bird in 1988 to describe a person's rational or intuitive thinking, numerous studies have emerged. As an extension of this framework, Boyd and Vozikis (1994) added ideas around perceived ability and behavioural control to clarify further how these constructs, in

conjunction with how a person thinks (rational or intuitive thinking), influence or determine a person's level of intention. Further research has identified connections between one's behaviour and the desire to enter entrepreneurship (Ajzen, 2012), with some critical of the concept, arguing that it is misunderstood (see Tornikoski & Maalaoui, 2019).

Nonetheless, within this body of knowledge, there is some agreement that entrepreneurial behaviour (Zapkau et al., 2015), passion, and intentions (Biraglia & Kadile, 2017) as well as self-efficacy (Neneh, 2022) are the critical drivers for individuals with such an entrepreneurial mindset. Whilst this literature identifies entrepreneurial behaviour as one of the drivers behind new venture creation (Neneh, 2022), it mentions EP as the intense, positive feeling toward venture activities, suggesting that it develops as a reaction to a distant but desired state of the venture. Passion's strong motivational force derives from evaluating the future venture outcome as highly significant for the entrepreneur's wellbeing (Cardon et al., 2005).

To that end, we contend that entrepreneurial behaviour and passion in varied contexts like South Africa spur nascent or aspiring entrepreneurs to consider entrepreneurship (see Adusei, 2016; Leke et al., 2018; Ngoasong, 2018). This is consistent with prior research which indicates that passion—a strong inclination toward certain activities—plays an important role in behaviour across a wide variety of disciplines (Murnieks et al., 2014). In entrepreneurship research, EP exerts an influence on one's behaviour to engage in entrepreneurial activity (see Kyriakopoulos et al., 2024; Murnieks et al., 2020; Scheu & Kuckertz, 2023). From that perspective, we suggest the following hypotheses:

H1 *A positive relationship exists between perceived behavioural control and entrepreneurial intentions in African entrepreneurship.*

H2 *Entrepreneurial passion positively affects entrepreneurial intentions in African entrepreneurship.*

With the first two hypotheses, we have argued that there is a positive relationship between entrepreneurial behaviour and passion in African entrepreneurship. For the third hypothesis, we advance that even if South Africa has semi-developed digital ecosystems (Zikhali, 2018), there are notable benefits inherent in using digital technology amongst South Africa's group of aspiring entrepreneurs. Indeed, and although digital technology induces stress (Berger et al., 2021; Nambisan & Baron, 2021)—as we will elaborate with our other hypotheses thereafter, it also comes with some benefits. As previously mentioned, it can help individuals and organisations to get work accomplished faster and more efficiently (De et al., 2020; Zhao et al., 2020). A recent World Bank Group report on digital Africa showed how digital transformation is creating self-employment and reducing poverty (Begazo et al., 2023). Thus, and given its ability to stimulate such social transformation, it is conceivable that nascent entrepreneurially minded individuals will be attracted to use digital technology.

Recent studies have shown that digital technology creates value and business opportunities for small businesses/competitors in Africa (see Friederici et al., 2020; Ngoasong, 2018). Similarly, a study on digital entrepreneurship in South Africa and

its indigenous value systems by Abubakre et al. (2021) concluded that the use of digital technology allowed South African entrepreneurs to be agile and transcend space and time constraints when collaborating and supporting each other's endeavours. These entrepreneurs leveraged digital technologies to create an environment that enabled forms of innovation to thrive (Yoo et al., 2010). In some way, their digital platforms allowed new forms of business and human connectedness, becoming a basis for interactions that have both social and economic value. From that perspective, digital technologies in Africa act as enablers of positive change in business and society—in other words, across all facets of their entrepreneurial ecosystem (Adusei, 2016; Madichie et al., 2019), including digital platform-based ecosystems (see Nambisan & Baron, 2021). To that end, we propose the following hypothesis:

H3 *There is a positive relationship between the benefits of digital technology and entrepreneurial intentions in African entrepreneurship.*

The impact of technostress on entrepreneurs

In today's global environment in which technology seems to have infiltrated every aspect of our social space (Ayyagari et al., 2011), it can inevitably bring some benefits, as we have shown with our third hypothesis. As we will demonstrate below, it can also have its challenges, especially for individuals in, or considering entrepreneurship (Thurik et al., 2023). Given that EP and obsession (behaviour) are the key characteristics of entrepreneurially minded individuals (Neneh, 2022), the desire to use digital technology excessively without noticing can manifest itself into stress—technostress to use Brod's (1984) felicitous term. Research elsewhere describes this excessive use of technology as techno overload (Karr-Wisniewski & Lu, 2010). Studies that elaborate on this optimum use of technology suggest a negative relationship between techno overload with wellbeing outcomes (Chandra et al., 2019; Choi & Lim, 2016; Hang et al., 2022).

Indeed, although digital technology has benefits in entrepreneurship (Soluk et al., 2021), it is likely that it can also influence entrepreneurial behaviours, passion, and intentions in some way (see Elia et al., 2020). Research, for example, Nambisan and Baron (2021), has shown that entrepreneurs involved in digital platform-based ecosystems tend to suffer from role conflict and high levels of stress caused by demanding digital ecosystem tasks they must perform. Likewise, Berger et al. (2021) reported high levels of stress amongst entrepreneurs who aspire to enhance their innovations and market performance by tapping into digital technology.

Based on this body of research evidence, it is to be expected that in developing countries like South Africa, characterised by semi-developed entrepreneurial ecosystems (Abubakre et al., 2021; Zikhali, 2018), the effects of technostress on entrepreneurs, especially amongst nascent or aspiring entrepreneurs, is magnified. Indeed, and in addition to the limited understanding of when and how to use technology for general and business purposes, a lack of support mechanisms to help with using new technological systems, including underdeveloped IT infrastructure often associated with ecosystems in developing economies like South Africa (Mariscal, 2005;

Smidt & Jokonya, 2022), entrepreneurially minded individuals will likely experience some form of technostress. Thus, and based on this assessment, we hypothesise the following:

H4 *A positive relationship exists between perceived behavioural control and technostress in African entrepreneurship.*

H5 *In the context of Africa, EP negatively affects technostress amongst African entrepreneurs.*

Entrepreneurial intentions, self-efficacy, and digital technology in Africa

Research on entrepreneurial intentions and self-efficacy identifies how individuals with confidence in their abilities channel such confidence into new venture creation (Boyd & Vozikis, 1994; Stroe et al., 2018). As a concept, self-efficacy emerged in social psychology (Bandura, 1982; Gecas, 1989) and has been adopted in entrepreneurship research to explain how entrepreneurially minded individuals develop a perception of control when they are threatened in their environment (Brehm, 1966; McClelland, 1975). From that perspective, it can be argued that the theory of self-efficacy can help to explain the actions of entrepreneurs in the face of technology-induced stress (technostress) (cf., Zhao et al., 2020).

Indeed, prior research suggests that self-efficacy specific to a given activity domain is instrumental in predicting performance in that domain (Bandura, 1997). Reflecting on the situation created by today's advancements in technology, it can be argued that its ability to modify the cognitive processes of individuals (Baron, 2008) as they seek freedom from their constraints (Gecas, 1989; Renko et al., 2021) can advance our understanding of how technostress manifests itself in African entrepreneurship. Admittedly, for those entrepreneurial individuals with high digital self-efficacy, their confidence is enhanced in such a way that helps them to adapt to their stressful environment (Caprara et al., 2013). How this plays out in the African context amongst nascent entrepreneurs is yet to be substantiated in research.

Elsewhere existing scholarly research (e.g., Qi, 2019) suggests that self-efficacy negatively affects technostress. Indeed, individuals with higher computer self-efficacy will more easily adapt to the changes and developments in computer technology and IT than those with lower computer self-efficacy (Shu et al., 2011). Contrarily, research elsewhere identifies individuals with lower computer self-efficacy as more resistant to technology change than those with higher self-efficacy (Ellen et al., 1991). In addition, positive self-efficacy may encourage learning new skills, whereas negative self-efficacy may create resistance in operative capabilities (Zhang & Espinoza, 1998).

From that perspective, it is plausible to suggest that self-efficacy can help mitigate technostress's effects and, as a result, enhance the likelihood of using digital technology even in contexts such as South Africa characterised by semi-developed digital technology ecosystems. Following that argument, we reason that digital self-efficacy has the potential to build confidence amongst entrepreneurially minded individuals in

South Africa in such a way that attenuates their anxiety or technology-induced stress (cf., McDonald & Siegall, 1992; Yener et al., 2021).

That argument is consistent with research elsewhere that suggests digital self-efficacy reduces the negative impacts of role conflict and technostress (Abd Aziz et al., 2023). Thus, digital self-efficacy helps to exert some form of control on a situation that is likely to have a detrimental effect on one's wellbeing (see McClelland, 1975). Considering that, one can expect that individuals with high digital self-efficacy may not postpone adopting technology but will likely opt for an approach behaviour over avoidance or resistance behaviour (Kumari & Kumar, 2023). Accordingly, we draw upon this implied theoretical meaning of self-efficacy to argue that:

H6 *Digital self-efficacy mediates the relationship between perceived behavioural control and technostress in African entrepreneurship.*

H7 *Digital self-efficacy mediates the relationship between the benefits of digital technology and technostress in African entrepreneurship.*

Figure 1 illustrates the connectivity of our key constructs using our hypotheses elaborated above to indicate the direction of purported linkages.

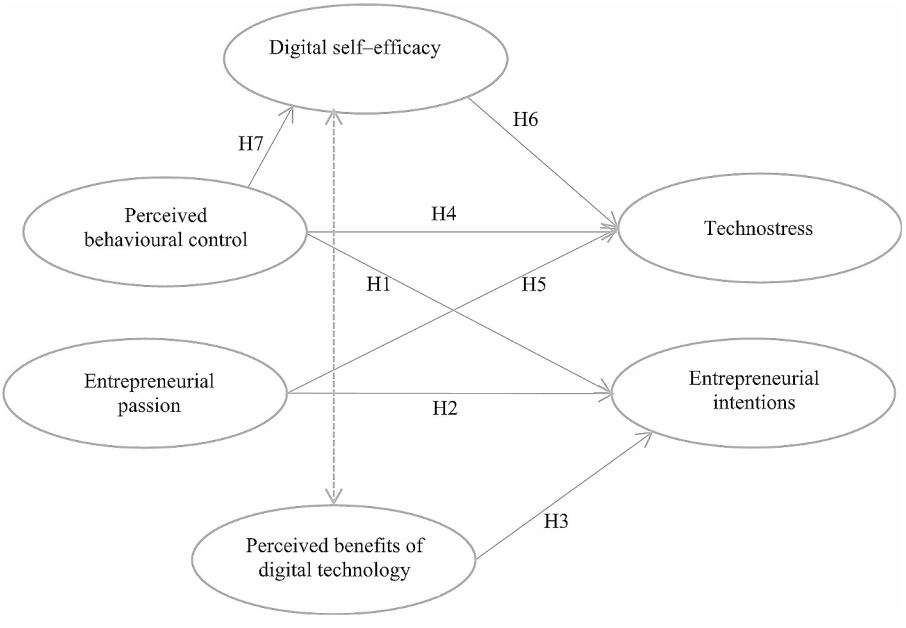

Fig. 1 Conceptual model

Methodology

Research methods

The nature of this inquiry lends itself to a quantitative research approach because its main focus is to explore associative and predictive relationships (Shmueli et al., 2016). Specifically, we used PLS-SEM methodological tools to bridge exploration with an explanation of technostress and its effects on nascent African entrepreneurs in South Africa's complex semi-developed digital technology ecosystem (Zikhali, 2018). In some way, PLS-SEM readily facilitated the analyses of mediators and moderators of technostress in entrepreneurship more than traditional methods, including multiple regression (Kline, 2016).

We used second-generation statistical techniques such as SEM in this study because it gave us the capacity to simultaneously model and estimate complex relationships amongst multiple dependent and independent variables (Hair et al., 2022), technostresses, and entrepreneurial intentions. Unlike first-generation statistical techniques (e.g., regression type methods) that are restricted to processing observable variables (e.g., age or sales in dollars), using SEM allowed us to consider theoretical constructs of technostress and entrepreneurial intentions after prior stand-alone validation (e.g. through confirmatory factor analysis), thereby limiting the ex post inclusion of measures of these theoretical constructs (Kline, 2016).

Moreover, first-generation statistical techniques (e.g., multiple regression, logistic regression, analysis of variance) share two other limitations that are overcome by SEM, namely, (1) the postulation of a single model structure, and (2) the conjecture that all variables are measured without error (Haenlein & Kaplan, 2004). Regarding the first limitation, multiple regression and its extensions postulate a simple model structure involving one layer of independent and dependent variables. Therefore, causal chains or complex nomological networks involving many intervening variables can only be estimated pairwise, rather than simultaneously, which can have severe consequences for the quality of results (Sarstedt et al., 2020). In contrast, PLS introduces a causal-predictive approach to SEM (Jöreskog & Wold, 1982), which focuses on explaining variance in the model's dependent variables (Chin et al., 2020) by simultaneously computing all variables.

Thus, PLS-SEM allowed us to incorporate our theoretically justified model (see Fig. 1) into associative and predictive relationships deduced from a conceptual overlay of digital technology, digital self-efficacy, EP, intentions, and behaviour. Being able to generate empirical casewise out-of-sample predictions from our model and to evaluate the predictive power of explanatory models was vital in building and evaluating a technostress–entrepreneurship nexus. Crucially, PLS-SEM's self-diagnostic capabilities enabled us to generate predictions around the technostress–entrepreneurship nexus related to nascent South African entrepreneurs. That permitted us to use prediction matrices to figure out the mechanisms underlying a technostress–entrepreneurship nexus in African entrepreneurship.

Regarding the second limitation of first-generation statistical techniques, it is critical to remember that each observation of the real world is accompanied by a certain measurement error (whether systematic or random) and these techniques are only

applicable when neither of these errors exist, strictly speaking. This condition of the absence of errors rarely exists, especially when estimating relationships amongst measures of theoretical constructs such as perceptions, attitudes, and intentions (Hair et al., 2022). To the extent that the concepts under consideration (i.e., entrepreneurial intentions, perceived behavioural control, perceived benefits of technology, and technostress) are typically unobservable and measured indirectly by multiple indicator variables, when estimating these variables, PLS-SEM accounts for measurement error in observed variables (Hair et al., 2022).

Research sample

The sample for this study comprises graduate entrepreneurship students. These students were identified through their alumni affiliations in universities geographically located in 10 provinces of South Africa. Despite the higher concentration of universities in Gauteng, KwaZulu-Natal, Eastern Cape, Western Cape, and Limpopo, targeting various other universities was deemed appropriate because it provided a complete picture of graduate entrepreneurship students representative of the leading provinces in South Africa. Moreover, and since our methodology was consistent with the principles of PLS-SEM, targeting universities in various provinces helped us to build a complete picture of what is possible with the predictions in PLS-SEM (cf., Shmueli et al., 2016).

A report commissioned by Universities South Africa in 2020 featured a baseline study focusing on the level of entrepreneurial activity in South Africa's universities. This pilot study concluded that 26 public universities engaged in entrepreneurial activities of one form or another (Universities South Africa, 2020). Most South African universities expect students who enrol to start their first-year university programme to study an entrepreneurial module/course. An alternative would be to take an entrepreneurship subject in one of their academic years prior to exiting the university.

Given this focus on entrepreneurship in higher education in South Africa, we were interested in alumni who had attended entrepreneurship programmes for a period ranging from 12 h to two years. Selecting alumni based on their exposure to entrepreneurship education is consistent with research elsewhere. For example, Ndofirepi (2020) explained how access to entrepreneurship education influences the entrepreneurial disposition of students to actively engage in entrepreneurship in the future (entrepreneurship intentions). Likewise, do Paço et al. (2011) suggested a positive link between education and entrepreneurship. Similarly, Raposo et al. (2008a, b) found that education had the most crucial effect on students' propensity to start up a firm. Thus, our sampling approach aligns with other studies.

Sampling techniques

We used an online Raosoft sample size calculator to sample our alumni. We set a significance level of 95%, a margin of error of 5%, a sample distribution of 50%, and a total population enrolled at public higher education institutions of 1,112,439 generating a sample size of 385. To increase the response rate, we almost doubled the

sample size by distributing 700 questionnaires. Of the questionnaires distributed, 651 were returned, and 643 were found to be usable, representing a response rate of 93%. Of the retained questionnaires, a sizeable number came from Gauteng (494 = 76.8%), KwaZulu-Natal (83 = 12.9%), Eastern Cape (20 = 3.1%), Limpopo (18 = 2.8%), Mpumalanga (10 = 1.6%) and Western Cape (9 = 1.4%).

Pilot study

Before engaging in a full-scale data collection exercise, we carried out a preliminary study to check the robustness of our data collection instrument (see Bell et al., 2022). As part of this piloting phase, 20 questionnaires were administered to students enrolled in a university programme in South Africa in which they were studying an entrepreneurship module. At this pilot phase, participants were selected in a way that closely reflected the sampled elements' characteristics and aligned with selected universities. Whilst the face validity of the questionnaire distributed to participants was assessed based on inputs from these pilot studies, no significant amendments were made to the original questionnaire following the pilot study.

Variables

Entrepreneurial intentions We measured our variables using scales adapted from contemporary literature. The entrepreneurial intentions concept was measured using four items adapted from the literature (Asimakopoulos et al., 2019; Youssef et al., 2021).

On a Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree), respondents were asked to indicate the extent to which they agreed with the given statements. Sample items under entrepreneurial intentions included 'I intend to create a firm in the future' and 'I have thought very seriously of starting a firm at some point'.

Perceived behavioural control The perceived behavioural control concept has six items adapted from literature (Youssef et al., 2021). Sample items under perceived behavioural control included statements such as 'I know the necessary practical details to start a firm' and 'I know how to develop an entrepreneurial project'.

Entrepreneurial passion The EP concept had five items developed from literature (Feng & Chen, 2020). The sample items under this concept included statements such as 'entrepreneurship is my passion' and 'I can devote myself to entrepreneurial activities'.

Entrepreneurship anxiety The entrepreneurship anxiety (EA) concept had five items developed from literature. The sample items included statements such as 'the possibility to fail in business is a concern to me' and 'I am afraid to start a business and lose it for whatever reason'.

Perceived benefits of digital technology The perceived benefits of digital technology concept had seven items drawn from literature (Perrotta, 2013). The sample items

included statements such as 'digital technology is a great source of information for me' and 'digital technology presents business opportunities for me'.

Technostress dimensions The technostress construct was measured using four dimensions: overload, invasion, complexity, and uncertainty (Karr-Wisniewski & Lu, 2010; Marchiori et al., 2018). The overload concept comprised four items. The sample items included statements such as 'my workload has increased with the use of online learning technology' and 'I am forced to change my study habits to adapt to online learning technology'. The invasion concept has four items: 'I spend less time with my family because of online learning' and 'I feel that my personal life is being invaded by online learning'.

The complexity concept had five items. The sample items included statements such as 'I need a long time to understand and use new features of the online learning technology' and 'I do not find enough time to study because I need to catch up with the new features of the online learning platforms'. Uncertainty concepts comprised three items. These included statements like 'the technologies used for online learning keeps evolving' and 'there are always new features to learn on the online learning platforms'.

Measurement of the outer model

To assess the adequacy of the measurement model, we examined the model's convergent validity (the extent to which indicators of one latent construct are related) and discriminant validity (the extent to which indicators of one latent construct are different from indicators of another construct). To measure the adequacy of the outer (measurement) and inner model, SEM methodology, which includes confirmatory factor analysis (CFA) and structural modelling analysis, was conducted (Gallagher & Brown, 2013). The CFA assesses the validity of the measurements, whilst the structural model analysis tests the research hypotheses specified in the conceptual models. CFA is the step of SEM that deals with the validity of the measurements used in the models, meaning the relationships between the indicators and their respective latent variables and the relationship between latent variables (Brown, 2015). This validity assessment includes composite reliability, convergent and discriminant validity.

Composite reliability Reliability concerns the extent to which the measurement of a phenomenon provides stable and consistent results (Carmines & Zeller, 1979; Taherdoost, 2016). The scale's reliability in SEM studies is generally assessed with Cronbach's alpha and composite reliability (CR) (Peterson & Kim, 2012). The required cut-off value for Cronbach's alpha and CR is 0.7, although 0.6 is sometimes permissible. Results in Table 1 show that Cronbach's alpha ranges from 0.812 to 0.907, indicating an overall acceptable internal consistency of all six latent variables considered in the model. Therefore, based on these results, all constructs involved in this study are considered reliable.

Table 1 Results of composite reliability and convergent validity of study concepts

Constructs	Items	Factor loadings	Cronbach's alpha	Composite reliability	Average variance extracted (AVE)
Digital self–efficacy	DSE1:	0.733	0.847	0.849	0.621
	DSE2	0.807			
	DSE3	0.812			
	DSE4	0.793			
	DSE5	0.792			
Entrepreneurship anxiety	EA1	0.768	0.907	0.909	0.730
	EA2	0.893			
	EA3	0.875			
	EA4	0.869			
	EA5	0.860			
Entrepreneurial intentions	EI1	0.810	0.812	0.812	0.639
	EI2	0.802			
	EI3	0.816			
	EI4	0.769			
Entrepreneurial passion	EP1	0.729	0.857	0.858	0.637
	EP2	0.843			
	EP3	0.801			
	EP4	0.833			
	EP5	0.779			
Technostress	COMa	0.926	0.861	0.883	0.708
	IVa	0.910			
	UNCa	0.794			
	OVa	0.718			
Perceived behavioural control	PBC1	0.685	0.852	0.854	0.576
	PBC2	0.814			
	PBC3	0.762			
	PBC4	0.763			
	PBC5	0.766			
	PBC6	0.756			

Convergent validity Convergent validity is the extent to which a set of items only measures one latent variable in the same direction. It establishes the extent to which indicators of one latent construct are related (Rambe & Khaola, 2023). The results support the convergent validity because all the factor loadings are above or equal to 0.5. In addition, the average variance extracted (AVEs) estimates are above 0.5.

Table 1 statistically supports the reliability and the convergent validity of the items retained in the final model. This demonstrates that the items, included in the final model are suitable measures of their respective constructs. Furthermore, Table 1 shows the results of CR and convergent validity for the concepts examined in the study.

Table 2 Fornell and Larker criterion results

	Digital self–efficacy	Entrepreneurial passion	Entrepreneurship anxiety	Entrepreneurial intentions	Perceived behavioural control	Technostress
Digital Self–efficacy	**0.788**					
Entrepreneurial passion	0.585	**0.798**				
Entrepreneurship anxiety	0.378	0.286	**0.854**			
Entrepreneurial intention	0.559	0.642	0.239	**0.799**		
Perceived behavioural control	0.575	0.686	0.249	0.710	**0.759**	
Technostress	0.379	0.235	0.573	0.309	0.384	**0.841**

Table 3 HTMT results

	Digital Self–efficacy	Entrepreneurial passion	Entrepreneurship anxiety	Entrepreneurial intentions	Perceived behavioral control
Entrepreneurial passion	0.686				
Entrepreneurship anxiety	0.430	0.326			
Entrepreneurial intentions	0.672	0.768	0.280		
Perceived behavioral control	0.672	0.803	0.283	0.849	
Technostress	0.440	0.279	0.630	0.382	0.464

Discriminant validity Discriminant validity denotes how a latent variable or construct discriminates from other latent variables (Taherdoost, 2016). It measures the extent to which indicators of one latent construct differ from indicators of another construct (Rambe & Khaola, 2023) According to Fornell and Larcker (1981), the square root of the AVE is expected to be above the interconstruct correlation coefficient. Discriminant validity was assessed by comparing correlations between all pairs of constructs with the square root of the AVE of each construct (Malhotra et al., 2017).

Correlations greater than the square root of AVE indicate poor discriminant validity between the constructs involved. Table 2 below illustrates no discriminant validity concern between the constructs. The result is further strengthened by the heterotrait-monotrait (HTMT) results in Table 3, which does not present a discriminant validity issue. The HTMT test generates ratios assessing how any two constructs share a common variance. The ratios should not exceed 0.9 (Henseler et al., 2015, p. 115).

Results

Inner model measurement outcomes

The structural model examined the path coefficient (β), coefficient of determination (R^2), effect size (f^2), and predictive relevance (Q^2). The model was developed and tested to appraise the significance of the constructs. Figure 2 illustrates PLS results

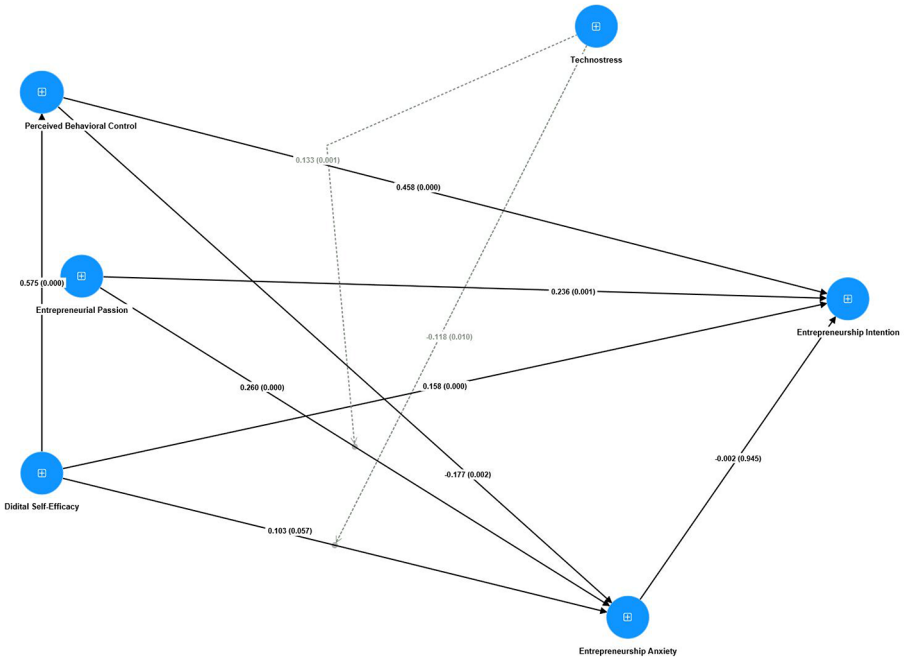

Fig. 2 Structural modelling results

generated through testing our hypotheses. According to the results, the empirical model explains 39% (R^2) of EA, and entrepreneurial intentions explain 56.4% (R^2) of the variance. Moreover, the model accounts for 33.1% (R^2) of perceived behavioural control.

Standardised regression outcomes

Table 4 illustrates the predictive effects of our independent variables on dependent variables. The beta values indicate the direction and strength of the relationships, whilst the p values (sig.) estimate the significance of the predictive effect (Pallant, 2010). The significance of the relationship is supported if the p value is below 0.05. An $f^2 \leq 0.14$ indicates a small effect size. Whilst an f^2 between 0.15 and 0.34 (inclusive) is a medium effect, and an $f^2 \geq 0.35$ is considered a large effect size.

The results demonstrate that digital self-efficacy has a positive ($\beta = 0.575$) and significant effect ($p < 0.05$; $f^2 \geq 0.35$) on perceived behavioural control. Moreover, perceived behavioural control has a positive ($\beta = 0.458$), but medium (f^2 between 0.15 and 0.34 [inclusive]) significant ($p < 0.05$) effect on entrepreneurial intentions. The findings further demonstrate that EP has a positive ($\beta = 0.260$), but small ($f^2 \leq 0.14$) significant ($p < 0.05$) effect on EA. Entrepreneurial passion has a positive ($\beta = 0.236$), but small ($f^2 \leq 0.14$) significant ($p < 0.05$) effect on entrepreneurial intention. Digital self-efficacy has a positive ($\beta = 0.158$), but small ($f^2 \leq 0.14$) significant ($p < 0.05$) effect on entrepreneurial intentions. Digital self-efficacy has a positive ($\beta = 0.158$), but small ($f^2 \leq 0.14$) significant ($p < 0.05$) effect on entrepreneurial intentions. How-

Table 4 Standardized regression weights and hypotheses outcomes

Path Co–efficient	Beta value (0)	f^2	*P* Value	Outcomes
Digital self–efficacy – > Entrepreneurship anxiety	0.103	0.007	0.057	Digital self–efficacy has a non–significant effect ($P>0.05$) on entrepreneurship anxiety. Therefore, this hypothesis is rejected.
Digital self–efficacy – > Entrepreneurial intentions	0.158	0.032	0.000	Digital self–efficacy has a positive ($\beta=0.158$), but small ($f^2\leq0.14$) significant ($P<0.05$) effect on entrepreneurial intentions. Therefore, this hypothesis is accepted.
Digital self–efficacy – > Perceived behavioral control	0.575	0.495	0.000	Digital self–efficacy has a positive ($\beta=0.575$), and significant effect ($P<0.05$; $f^2\geq0.35$) on perceived behavioral control. Therefore, this hypothesis is accepted.
Entrepreneurial passion – >Entrepreneurship anxiety	0.260	0.042	0.000	Entrepreneurial passion has a positive ($\beta=0.260$), but small ($f^2\leq0.14$) significant ($P<0.05$) effect on entrepreneurship anxiety. Therefore, this hypothesis is accepted.
Entrepreneurial passion – > Entrepreneurial intention	0.236	0.060	0.001	Entrepreneurial passion has a positive ($\beta=0.236$), but small ($f^2\leq0.14$) significant ($P<0.05$) on entrepreneurial intentions. Therefore, this hypothesis is accepted.
Entrepreneurship anxiety – >Entrepreneurial intention	–0.002	0.000	0.945	Entrepreneurship anxiety has a non–significant effect ($P>0.05$) on entrepreneurship intentions. Therefore, this hypothesis is rejected.
Perceived behavioral control – > Entrepreneurship anxiety	–0.177	0.023	0.002	Perceived behavioral control has a negative ($\beta=-0.177$), but small ($f^2\leq0.14$) significant effect ($P<0.05$) on entrepreneurship anxiety. Therefore, this hypothesis is accepted.
Perceived behavioral control – > Entrepreneurial intentions	0.458	0.232	0.000	Perceived behavioral control has a positive ($\beta=0.458$), but medium (f^2 between 0.15 and 0.34 (inclusive)) significant ($P<0.05$) effect on entrepreneurship intentions. Therefore, this hypothesis is accepted.

ever, digital self-efficacy has a non-significant effect ($p > 0.05$) on entrepreneurial anxiety. Entrepreneurship anxiety has a non-significant effect ($p > 0.05$) on entrepreneurial intentions.

Impact of technostress

The results ($\beta = 0.133$, $p < 0.05$) indicate that technostress positively moderates the influence of EP on EA. The results ($\beta = -0.118$, $p < 0.05$) indicate that technostress negatively moderates the influence of digital self-efficacy on EA.

The moderation results in Table 5 indicate that technostress positively moderates ($\beta = 0.133$; $p < 0.05$) the influence of EP on EA. Hence the green slope is more oblique than the blue slope (Graph 1); meaning that the effect of EP on EA is weaker amongst individuals with low technostress compared to those with high technostress. In conclusion, the effects of EP on EA depend on the level of technostress.

Graph 2 shows results confirming that technostress negatively moderates (B = −0.118; $p < 0.05$) the influence of digital self-efficacy on EA. The graph illustrates a positive red slope and a negative green slope. This implies that digital self-efficacy positively affects EA amongst nascent entrepreneurially minded individuals with low technostress. However, digital self-efficacy negatively affects EA amongst technostressed individuals. In other words, for people with low technostress, high self-efficacy is associated with high anxiety whilst high EA correlates with lower self-efficacy amongst individuals with high technostress.

Mediation outcomes

Table 6 illustrates that perceived behavioural control mediates the effect of digital self-efficacy on EA because indirect effects of digital self-efficacy are significant ($p < 0.05$). However, the direct effect is non-significant ($p > 0.05$). Therefore, this mediation is complete. Perceived behavioural control mediates the effect of digital self-efficacy on entrepreneurial intentions because both the direct and indirect effects of digital self-efficacy are significant ($p < 0.05$). Therefore, this mediation is partial. However, the rest of the hypotheses tested were negative.

Entrepreneurship anxiety does not mediate the effect of EP on entrepreneurial intentions because the indirect effects of EP are non-significant ($p > 0.05$). Entrepreneurship anxiety does not mediate the effect of perceived behavioural control on entrepreneurial intentions because the indirect effects of perceived behavioural control are non-significant ($p > 0.05$). Entrepreneurship anxiety does not mediate the effect of digital self-efficacy on entrepreneurial intentions because the indirect effects of digital self-efficacy are non-significant ($p > 0.05$).

Discussion

Research suggests that the benefits of digital technology to entrepreneurship, including faster information processing, ease of establishing technology-inspired ventures, and access to markets, etc. (Nambisan & Baron, 2021; von Briel et al., 2018), make

Table 5 The moderating effects of technostress

	Moderators/ interaction effects	P–value	Hypotheses testing outcomes
Technostress x entrepreneurial passion – > entrepreneurship anxiety	0.133	0.001	The results ($\beta = 0.133$, $P < 0.05$) indicate that Technostress positively moderates the influence of Entrepreneurial Passion on Entrepreneurship Anxiety. Therefore, this hypothesis is accepted.
Technostress x digital self–efficacy – > entrepreneurship anxiety	–0.118	0.010	The results ($\beta = -0.118$, $P < 0.05$) indicate that technostress negatively moderates the influence of digital self–efficacy on entrepreneurship anxiety. Therefore, this hypothesis is accepted.

Table 6 Mediation outcomes

Independent variables	Dependent variable	Direct effects		Indirect effects		Findings
Mediator = Entrepreneurship Anxiety		Co–eff	p–value	Co–eff	p–value	
Entrepreneurial passion	Entrepreneurial intention	0.236	0.001	–0.001	0.946	Entrepreneurship anxiety does not mediate the effect of entrepreneurial passion on entrepreneurial intentions because the indirect effects of entrepreneurial passion are non–significant ($p > 0.05$). **Therefore, this hypothesis is rejected.**
Perceived behavioural control		0.458	0.000	0.000	0.947	Entrepreneurship anxiety does not mediate the effect of perceived behavioural control on entrepreneurship intention because the indirect effects of perceived behavioural control are non–significant ($p > 0.05$). **Therefore, this hypothesis is rejected**
Digital self–efficacy		0.158	0.000	–0.000	0.952	Entrepreneurship anxiety does not mediate the effect of digital self–efficacy on entrepreneurship intention because both the indirect effects of digital self–efficacy are non–significant ($p > 0.05$). **Therefore, this hypothesis is rejected**
Mediator: Perceived behavioural control		***Co–eff***	***p–value***	***Co–eff***	***p–value***	**Findings**
Digital self–efficacy	Entrepreneurship Anxiety	0.103	0.057	-0.102	0.004	Perceived behavioural control mediates the effect of digital self–efficacy on Entrepreneurship Anxiety because indirect effects of digital self–efficacy are significant ($p < 0.05$). however, the direct effect is non–significant ($p > 0.05$). Therefore, this mediation is full. **This hypothesis is accepted**
Digital self–efficacy	Entrepreneurial intention	0.158	0.000	0.263	0.000	Perceived behavioural control mediates the effect of digital self–efficacy on entrepreneurial intentions because both the direct and indirect effects of digital self–efficacy are significant ($p < 0.05$). Therefore, this mediation is partial. **This hypothesis is accepted**

it more appealing to entrepreneurial individuals (Dy et al., 2017). Notwithstanding the benefits of using technology in entrepreneurship (Soluk et al., 2021), this research elaborates on its impact on the wellbeing of entrepreneurial individuals (see Zhao et al., 2020). It focused on developing an understanding of how entrepreneurial individuals in South Africa cope or deal with technostress (Ayyagari, 2013) triggered by their excessive subconscious use of technology, in other words, techno overload (Karr-Wisniewski & Lu, 2010). Developing such an understanding in African entrepreneurship is important because a large proportion of African entrepreneurs are still trying to figure out what technology entails (Soluk et al., 2021) and how or when to use or stop using it (Tarafdar et al., 2011, 2020). Moreover, its effects on mental wellbeing are yet to be fully understood (Zhao et al., 2020). Taking that into consideration, the findings of this study advance entrepreneurship research in several ways.

Theoretical contributions

Building on the transactional theory of stress (Brod, 1984), our study offers a technostress–entrepreneurship conceptual interface to account for African entrepreneurship in a semi-developed digital technology ecosystem (Zikhali, 2018). This technostress–entrepreneurship nexus contributes to knowledge by articulating both the benefits and effects of digital technology in Africa. Arguably, the theoretical baseline comprising an overlay of digital technology, digital self-efficacy, EP, and behaviour (Ajzen, 2012), presented in this study, led to empirical outcomes that contribute new perspectives elaborating on the mechanisms underlying a technostress–entrepreneurship nexus in African entrepreneurship.

Its implied theoretical assumptions and the empirical outcomes provide incisive knowledge into how technostress manifests itself in Africa (cf., Soluk et al., 2021).

Thus, using an overlay of constructs derived from a technostress–entrepreneurship nexus, the findings of this research contribute to the understanding of how digital self-efficacy acts as a moderator of the behaviours of African entrepreneurs and their inability to cope/deal with digital technology in a healthy manner (technostress) (cf., Ayyagari et al., 2011). Its empirical results extend research on entrepreneurial intentions (Ajzen, 2012) by showcasing how entrepreneurship passion and perceived behavioural control act as predictors of technostress. Moreover, digital technology's benefits do not help predict technostress in the context of African entrepreneurship. In some way, these empirical results combined with the technostress–entrepreneurship analysis enrich entrepreneurship (Shane & Venkataraman, 2000) and psychology literature (Gecas, 1989). For entrepreneurship research, the analysis provides new perspectives to account for the dark side of entrepreneurship using an African context. Psychology research is enriched through insights into a form of stress triggered by the excessive use of technology in the workplace for those at the threshold of creating their own venture.

Research implications

The technostress–entrepreneurship nexus and the empirical evidence presented in this research holds social, policy, and theoretical implications. As an example, the effects

of technostress on business development described in this research should encourage debate on policy and structural reforms in the developing world, not least in Africa, especially with its perceived impact on entrepreneurship. Such a policy-level intervention can help to consider investing in resources needed to sustain nascent entrepreneurs' mental and physical wellbeing in many parts of the developing world (cf., Maleki et al., 2023; Zhao et al., 2020). This is important because entrepreneurship can catalyse job creation, inclusive development, and a way out of poverty. For academics, the analysis and empirical results offer alternative theorisations for exploring technostress and entrepreneurship as well as the impact of technostress on entrepreneurial behaviour, passion, and intentions in variable contexts.

Conclusion

This study developed new insights at the technostress–entrepreneurship nexus. Its uniqueness lies in the research settings it uses to explore the factors mediating and moderating technostress in African entrepreneurship. Using an overlay of a conceptual arsenal of digital technology, digital self-efficacy, EP, and behaviour, the study defined the mechanisms underlying a technostress–entrepreneurship nexus in Africa. It confirmed that entrepreneurship passion and perceived behavioural control are predictors of technostress.

Contrarily the study revealed that the benefits of digital technology are not a predictor of technostress in African entrepreneurship. It argued that such understanding holds academic, policy, and social implications. Theoretically, academics are presented with alternative theorisation and policy institutions that must consider policies and reforms to support entrepreneurship in Africa. Doing so will improve lives as it helps deal with technostress's effects on entrepreneurs known to play a critical economic role through employment creation and poverty reduction in Africa.

The notable rise in mental health issues driven by digital technology addictions transcends the developing world context used for the purpose of this study (Scott et al., 2017). From that perspective, it can be argued that the theorisations and subsequent conceptual model developed here can be applied in other contexts (see Orrensalo et al., 2022; Thurik et al., 2023). Extrapolating these results to other domains including education can help to transform the lives of young people who can be vulnerable to technology overload.

Limitations and suggestions for future research

Like any other research, our study has limitations. For example, critics of PLS-SEM research techniques (e.g., Rönkkö et al., 2016) often cite its lack of rigour as its main shortcoming. Elsewhere, editors of a journal focusing on operations management research categorically stated that any papers using PLS-SEM as a research method received by their journal would be rejected (see Guide & Ketokivi, 2015). However, we believe that PLS-SEM in this research more readily facilitated the analyses of mediators and moderators of technostress in entrepreneurship than traditional methods including multiple regression (Hair et al., 2022; Kline, 2016). This is essential,

especially for contexts in which the technology environment is at the midpoint in its evolution with limited understanding of the mechanisms underlying technostress.

In such situations, we contend that using PLS-SEM techniques can provide an opportunity for future research. Indeed, and given that technology adoption and its use in Africa is at different points of adoption due to IT infrastructure issues, limited digital technology skills, and a general lack of when to use or not to use technology the mediating and moderating factors of technostress may vary widely. Aspects of technostress may not be easily identifiable. Therefore, the use of PLS-SEM techniques in researching such contexts may help to uncover subtle but related factors interacting within a particular environment, for example, a digital technology ecosystem, in such a way that aids the understanding of their link to technostress.

Supplementary Information The online version contains supplementary material available at https://doi.org/10.1007/s11365-024-00968-4.

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Authors and Affiliations

Amon Simba[1] · Patient Rambe[2] · Samuel Ribeiro Navarrete[3,4] · Maria Teresa Palomo Vadillo[3]

✉ Amon Simba
amon.simba@ntu.ac.uk

Patient Rambe
prambe@cut.ac.za

Samuel Ribeiro Navarrete
samuelribeironavarrete@gmail.com

Maria Teresa Palomo Vadillo
maite.palomo@esic.university

[1] Nottingham Business School, Nottingham NG1 4FQ, UK

[2] Central University of Technology, Bloemfontein, Free State, South Africa

[3] ESIC University, Madrid, Spain

[4] University of Economics and Human Sciences, Warsaw, Poland