Erasmus School of Social and Behavioural Sciences

Digital Literacy and Intrapreneurial Behaviour in a Digital Age Workplace

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Organisational Dynamics in the Digital Society

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Abstract

In today's rapidly evolving digital age, technologies are ubiquitous in organisational processes. In order for employees and organisations to remain competitive and future-proof, innovation is vital. Digital technology use fosters intrapreneurial behaviours (innovation, proactivity, risk-taking), rendering investigation into the digital literacy skills of employees relevant. This study aimed to empirically evaluate whether one's digital literacy positively related to employees' intrapreneurial behaviour, and how job characteristics of a digital age work environment (job autonomy and information overload) moderate this relationship. An online cross-sectional survey using pre-existing scales measured the levels of perceived digital literacy, intrapreneurial behaviour, job autonomy, and information overload of 113 full-time employees across occupations within Europe. The data was analysed using multiple linear regression analysis, followed by a moderation analysis of two independent moderators. The results of the multiple linear regression analysis indicated a significant positive relationship between digital literacy and intrapreneurial behaviour. Additionally, job autonomy was found to be positively associated with intrapreneurial behaviour, while information overload was negatively associated. The moderation effects of job autonomy and information overload were statistically insignificant. The findings provide novel empirical evidence between digital literacy and intrapreneurial behaviour, offering intervention strategies to enhance this positive effect, and contributing insights for the current development of various governmental-level digital competence initiatives. The findings also offer theoretical implications on personal resources within the JD-R theory.

Keywords: digital literacy, intrapreneurial behaviour, job autonomy, information overload, personal resources

Introduction

It is no secret that digital technologies have significantly impacted the daily lives of employees and organisations. With vast digital transformations, which have seen the emergence of the revolutionising personal computer in the 1980s and 90s, to the ubiquitous implementation of Information and Communication Technologies (ICTs) such as the Internet and online collaboration tools, technology is deeply embedded within organisations and restructures the ways of working (Townsend et al., 1998). These prevalent digital technologies have positively influenced the rate of innovations in contemporary organisations (Lokuge & Sedera, 2020). Driven by high competition that shapes the current market, innovation has become a key organisational characteristic of survival and success (Sedera & Lokuge, 2017).

Intrapreneurial behaviour plays a vital role in promoting innovation within organisations, enabling employees to behave as entrepreneurs within an organisation (Blanka, 2019). Intrapreneurial behaviour can be defined as the innovative, proactive, and risk-taking behaviours of employees (Preenen et al., 2016). Employees exhibiting these behaviours can lead to positive tangible organisational outcomes, such as product innovation, process improvement, new market expansion, enhanced customer experience, or social impact initiatives. Intrapreneurial behaviour's relevance to organisational competitiveness and survival in an age of rapid growth and digital transformation has made it a daily feature of organisational dynamics, spanning over geographical locations, workplace settings, and occupations (Elliroma 2021). Therefore, further understanding of intrapreneurial behaviour and its predictors is needed.

Digital technology use enhances intrapreneurial behaviour, as ICTs aid in speeding up information retrieval, reducing costs, and offering more data-backed analyses, as well as stimulating intrapreneurial behaviour through collaboration opportunities (Pinchot & Soltanifar, 2021). Because of the pervasive use of ICTs in organisations, it is imperative to investigate how these technologies are used by employees, and their impacts. Digital literacy is a skill that measures one's technical and cognitive competencies when finding, evaluating, creating, and communicating, using ICTs (Nikou et al., 2022). Despite being an essential skill in navigating the digital age (Bawden, 2008), there is a large scholarly gap in understanding how to measure, define, operationalise, and apply digital literacy skills within the organisational context. Moreover, although both intrapreneurial behaviour and digital literacy are becoming integral aspects of the workplace, particularly due to future-proofing efforts, the

possible effects of digital literacy on intrapreneurial behaviour have not been researched, creating a distinctly relevant scholarly gap.

Therefore, this study aims to conduct novel exploratory research on the relationship between digital literacy and intrapreneurial behaviour. The main research question is: *to empirically evaluate whether one's digital literacy positively relates to employees' intrapreneurial behaviour, and how a digital age work environment moderates this relationship*. Firstly, the research expects to find a positive relationship between digital literacy and intrapreneurial behaviour. Additionally, job characteristics common to a contemporary workplace are expected to moderate this relationship, with the job resource of autonomy strengthening, whereas the job demand of information overload weakening the main relationship.

By exploring these relationships, this study hopes to not only produce novel data on the relationship between digital literacy and intrapreneurial behaviour but also provide theoretical insights that have been called for further research on the foundational Job Demands-Resources theory by Bakker and Demerouti (2014). This includes an investigation into the direct effects of personal resources (digital literacy) on work engagement outcomes (intrapreneurial behaviour), treating personal resources as an independent third variable (Schaufeli & Taris, 2014), as well as how job resources and demands can act as moderators, particularly the under-researched interaction effects between job demands and personal resources (Bakker & Demerouti, 2017).

More importantly, this study hopes to offer practical implications on the importance of understanding and fostering digital literacy skills, underpinning the societal relevance of this study. The research aspires to offer intervention strategies, specifically organisational trainings and strengths-based interventions for employees, to continue developing essential digital literacy skills as a personal resource, in order for employees and organisations to remain future-proof. Finally, this study hopes to further inform the developing macro-level governmental initiatives, such as the Digital Competence Framework for Citizens (DigComp) by the European Union and UNESCO's Digital Literacy Global Framework, offering insights into how to measure digital literacy; the role that digital literacy skills play on intrapreneurial behaviour; and providing insights into interventions through said training and strengths-based initiatives. Understanding digital literacy skills is necessary for continuing future-proofing initiatives, and this research hopes to provide recent, relevant, and valuable insights within a digital age organisational context.

Next, the theoretical underpinnings of this research will be presented, along with the associated hypotheses, followed by an explanation of the methodology and the presentation of the results. Finally, the results are critically discussed and implications of the research are offered, to ultimately conclude whether one's digital literacy positively relates to employees' intrapreneurial behaviour, and how a digital age work environment moderates this relationship.

Theory

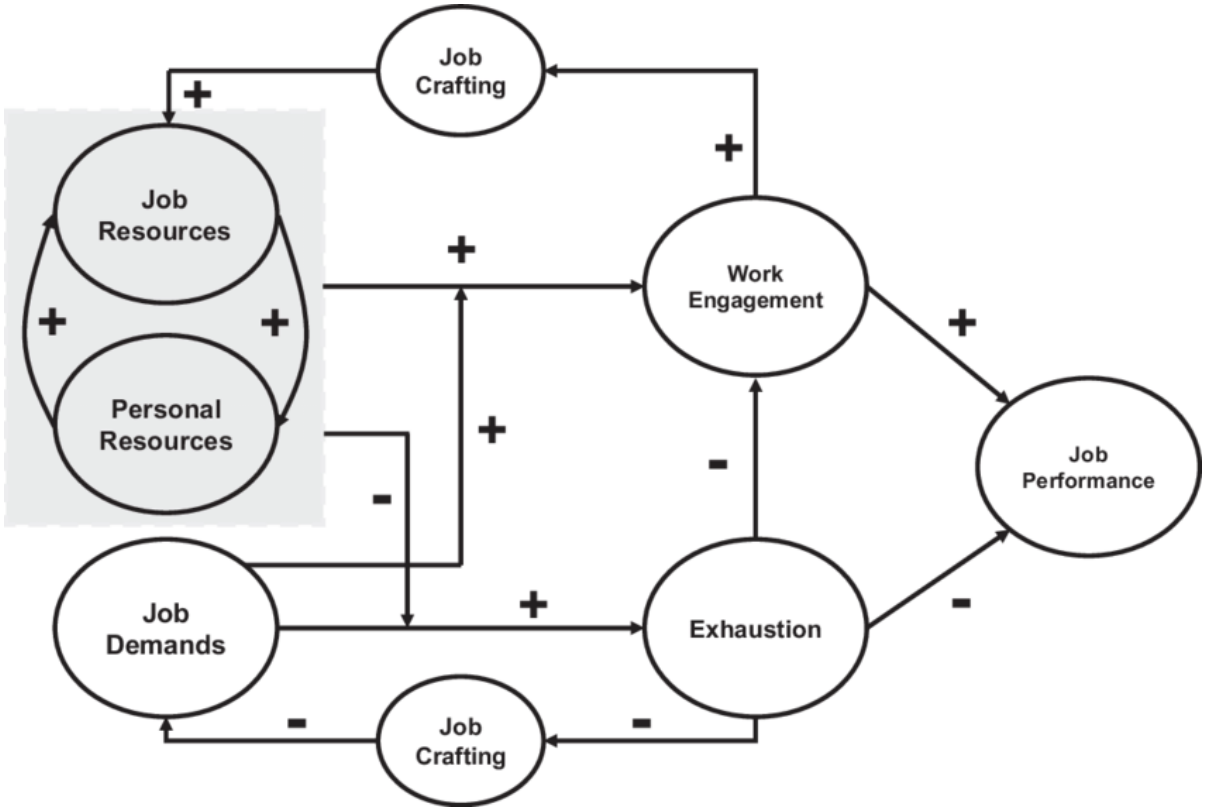
Job Demands-Resources Theory

The underpinning theoretical model for this study is the Job Demands-Resources (JD-R) model by Bakker and Demerouti (2014). Based on earlier and more simplified models of this combined stress and motivation model, the JD-R model stipulates that job demands are aspects of one's job that require prolonged physical or psychological efforts, resulting in costs such as increased strain and stress on employees (Bakker & Demerouti, 2007). Meanwhile, job resources aid employees in achieving work tasks and managing or buffering demands, as well as the demands' costs. A combination of job demands and resources is necessary to achieve positive outcomes, such as increased motivation, work engagement, and well-being, ultimately leading to better performance and organisational outcomes. As postulated by the JD-R model, when job demands and resources are both high, increased yet manageable levels of strain and high motivation are expected. Conversely, when job demands and resources are both low, a lack of strain and motivation is expected. When job demands are high but resources are low, a high level of strain and a low level of motivation is expected. Finally, when job demands are low but resources are high, a low level of strain and an increased (but not high) level of motivation is expected. It is important to note that the relationship between job resources and demands is highly nuanced and must be contextualised regarding the specific job demands and resources experienced. One reason why is because job demands can either be experienced as hindrance or challenge demands, which influences their relationship with job resources. When job resources are high yet demands are low, this can result in less engagement and bore-out due to limited strain. Whereas, when both job demands and resources are high, this can result in active work engagement when the demands experienced are not hindering the work, but rather challenging the employee in a positive way. Therefore, finding a suitable balance between job demands and resources can foster productive, engaged, and motivated employees..

As a response to various critiques regarding the earlier model (Bakker & Demerouti, 2007), a more advanced and nuanced theory has been developed (Bakker & Demerouti 2014) which this research applies (see Figure 1). A key addition to this improvement, and a focal point for this research, is the implementation of personal resources. Personal resources is an umbrella term which encompasses an individual's physical, psychological, and social resources that can facilitate their ability to cope with job demands and utilise job resources effectively. These personal resources can include, but are not limited to, self-efficacy, optimism, resilience, self-esteem, proactive personality, and social support (Bakker & Demerouti, 2014). The use of personal resources among employees has been found to positively increase an employee's self-concordance and resiliency, as employees felt more confident and capable whilst carrying out work tasks (Judge et al., 2005). This increased self-concordance from using personal resources has been found to further lead to higher job performance and job satisfaction through intrinsic motivation (Luthans & Youssef, 2007). By incorporating personal resources, the JD-R model recognises that individuals bring their unique set of strengths and capabilities to the workplace, influencing their response to job demands and the extent to which they can effectively utilise job resources. Not only has a direct relationship between personal resources and work engagement outcomes been found, but interventions such as training and strengths-based initiatives have been shown to also enhance the positive correlation (Peterson et al., 2011; Demerouti et al., 2011; Peterson & Seligman, 2004). Moreover, as with many aspects of the greater JD-R theory, there are reverse, causal, and interacting relationships among the different concepts. Xanthopoulou et al. (2009) found that job resources and personal resources engaged in a reciprocal relationship, as there was a predictive relationship between job resources and personal resources, as well as between personal resources and work engagement, which further predicted job resources. On the other hand, there is limited scholarly evidence on the interaction between personal resources and job demands (Xanthopoulou et al., 2007; Bakker & Demerouti, 2014), which will be further investigated through this research.

Figure 1

The Job Demands-Resources Model (Bakker & Demerouti, 2014)



Personal resources have been integrated into the JD-R model in various ways, highlighting its malleability. According to Schaufeli and Taris (2014), these include, but are not limited to: personal resources directly impacting well-being; personal resources moderating the relation between job characteristics and wellbeing; personal resources mediating the relation between job characteristics and well-being; personal resources influencing the perception of job characteristics; and personal resources acting as a "third variable". Schaufeli and Taris (2014) reflected on the many roles that personal resources play within the JD-R theory, but are critical of where exactly personal resources fit as more research needs to be conducted. Thus, this research will further explore the last conceptualisation of personal resources - personal resources as a "third variable" – to explore the direct relationship between personal resources and work engagement outcomes. This focus will be further contextualised and justified through the digital age working environment and new ways of working that organisations are increasingly expecting, hoping to further build upon the literature of personal resources in the JD-R theory.

The JD-R model explores multiple characteristics of organisational dynamics. This research will focus on four variables of the JD-R theory, namely personal resources, job

resources, job demands, and the work engagement outcome. As this research's primary focus is understanding how digital literacy relates to intrapreneurial behaviour, and how a digital age work environment's job characteristics may moderate this relationship, the following couplings are made: digital literacy is a personal resource, as it is a psychological skill; the job characteristic of job autonomy a job resources in the context of a contemporary work environment; the job characteristic of information overload is a job demand that may hinder one's work engagement, resulting from a digital age working environment; and finally intrapreneurial behaviour is the work engagement outcome.

Intrapreneurial Behaviour

Intrapreneurship, or intrapreneurial behaviour, is used and interpreted in a variety of ways in scholarly literature. Neessen et al. (2019) describe six major themes of intrapreneurship: innovativeness and new product/service/process creation; proactiveness; risk-taking; new business venturing; self-renewal of the organisation; and opportunity recognition and exploitation. Within the literature, these are mainly broken down into two main streams, grouping innovative, proactive, and risk-taking behaviours under intrapreneurial behaviour, which focuses more on an individual employee's behaviour with a bottom-up approach, and strategic renewal and new venture creation under Corporate Entrepreneurship, which focuses on organisational level new ventures from a top-down approach (Blanka, 2019). This study will focus on intrapreneurial behaviour from the perspective of innovative, proactive, and risk-taking behaviours (Preenen et al., 2016). This perspective is chosen because it focuses on employee behaviours and experiences, and behaviour is at the foundation of organisational-level intrapreneurship.

Due to the ubiquitous nature of ICT in the contemporary workplace, intrapreneurial employees make use of such technologies. Organisations have adopted technologies such as the Internet of Things, machine learning and artificial intelligence (AI), augmented reality, and in-memory computing (Cetindamar et al., 2021). As a response, "digital intrapreneur" encapsulates the organisational dynamic of using ICT, either as a final product or to enhance intrapreneurial processes, making technology a critical component of intrapreneurial behaviour today (Pinchot & Soltanifar, 2021). Focusing on the latter use of ICT for intrapreneurship, ICT has been found to help intrapreneurship by 1) speeding up the process through communication technologies and information retrieval, 2) being cheaper by using automation to fulfil certain tasks or conduct better product research, and 3) producing better outcomes using simulations

and better data analysis to stay competitive (Pinchot & Soltanifar, 2021). Moreover, ICTs have also recently been found to stimulate intrapreneurial behaviour. Rabl et al. (2022) explored whether various digital technologies as support tools in the workplace stimulate intrapreneurial behaviour. They found that social media, collaborative technologies, and intelligent decision systems as support tools all stimulated intrapreneurial behaviour, but the extent varied depending on the management support. Therefore, linking to the JD-R theory, this study will consider intrapreneurial behaviour as a work engagement outcome, rather than an organisational outcome.

Digital Literacy

The concept of digital literacy is very broad because the digital landscape is rapidly ever-changing (Bawden, 2008). Popularised by Gilster (1997) in his book *Digital Literacy*, digital literacy is explained to involve technical and cognitive skills needed to navigate technologies in the digital age, with a strong emphasis on the cognitive abilities one has to evaluate and communicate through ICT. This study will use Nikou et al.'s (2022) definition which expands on Gilster's (1997) conceptualisation, adding the cognitive and technical abilities of finding, evaluating, creating, and communicating information through using ICT.

Digital literacy has become increasingly important in today's digital age workplace as ICTs are ubiquitous. Digital literacy enables individuals to access a wealth of information and resources, connect with others, and participate in online communities, to develop skills to collaborate, create, and solve problems (Soliman et al., 2022; Nikou et al., 2022). Therefore, digital literacy can be viewed as essential for intrapreneurs to remain competitive and successful in the fast-paced, technology-driven business world.

Although there is no scholarly literature directly linking digital literacy to intrapreneurial behaviour, the need for adequate digital literacy skills is relevant to all employees of the contemporary workplace, but particularly to intrapreneurs. This is because of the benefits of speed, reduced costs, and better outcomes using digital technologies can bring to intrapreneurial behaviour, as outlined in the section above. Therefore, digital literacy skills could help employees navigate and leverage the benefits of ICTs to foster intrapreneurial behaviour, increase productivity, and achieve their innovative goals within their organisation. For example, at an individual employee level, an individual with low digital literacy may not be able to operate search engines effectively, or not possess the cognitive skills to evaluate the reliability of digital information found, resulting in poor quality work output. Similarly, if an

employee is innovative, but does not harness the digital literacy skills to successfully express themselves using ICTs, such as an e-mail or digital presentation to a manager, this can harm their possibility of being intrapreneurial. Alternatively, an employee with high levels of digital literacy may be more likely to produce up-to-date, quality suggestions through the help of digital technologies, therefore being able to participate in intrapreneurship in a contemporary workplace. Moreover, studies exploring the impact of digital literacy on entrepreneurship have found a significant positive relation, particularly in long-term business growth (Sariwulan et al., 2020; Fauzi et al., 2020). Using these insights within entrepreneurship onto intrapreneurship, we can learn that individuals with strong digital literacy skills are more likely to possess the knowledge, competence, and adaptability needed to drive innovation and entrepreneurial initiatives within established organisations. By leveraging digital tools and technologies effectively, intrapreneurs can identify new opportunities, create value, and foster a culture of innovation within their respective workplace environments, as entrepreneurs do.

Hence, in reference to the JD-R model, digital literacy can be interpreted to be a personal resource for the digitally permeated intrapreneurial behaviour. With the above theoretical relationship of digital literacy on intrapreneurial behaviour, this study hypothesises that:

> *Hypothesis 1 (H1): The digital literacy of individuals positively relates to the intrapreneurial behaviour of employees.*

Job Autonomy

Job autonomy is a job characteristic that is widely accepted to be viewed as a job resource, due to the benefits that it brings to work satisfaction and behaviours (Breaugh, 1985). Job autonomy is defined as comprising of three facets of autonomy, namely method (discretion over the procedures of work), scheduling (feeling of control over the timing and sequencing of their work), and criteria (discretion is applied to make changes in one's indicators and standard to evaluate their own performance) (Breaugh, 1985). Having adequate job autonomy is viewed as a job resource and a beneficial workplace characteristic, as it is used to fulfil job-related tasks using an employee's individual skills and planning (Lin & Ping, 2016).

Job autonomy is positively associated with intrapreneurial behaviour, indicating that higher levels of job autonomy foster and encourage employees to engage in proactive, risk-taking, and innovative actions. Job autonomy is regarded as a factor that enables an

"intrapreneurship-friendly environment" within organisations (Blanka, 2019, p. 937). When job autonomy is provided to employees, employees' perceived capabilities increase, leading to employees being more willing to act intrapreneurially (De Jong et al., 2015). Moreover, Elert et al. (2019) not only found that higher job autonomy did lead to more intrapreneurship in the workplace, but that job autonomy was mandatory for employees to have the space and time to be intrapreneurial. Elert et al. (2019) further investigated that the increase in job autonomy was positively associated with trust from the manager to the employee, which led to more proactive and risk-taking behaviours, as well as a space to take risks. Interestingly, a lack of job autonomy was found to be the main predicting factor for employees to resign and become independent entrepreneurs (Van Gelderen & Jansen, 2006), whereas employees with job autonomy were more likely to remain and engage in intrapreneurship (Elert et al., 2019). Therefore, employees with the job characteristic of autonomy as a resource not only feel capable to take risks and participate in proactive and innovative behaviours, but also have the space and time through scheduling, method, and criteria autonomy to be intrapreneurial in the workplace. As job autonomy has previously been found to positively interact with intrapreneurial behaviours, the following hypothesis is formulated:

> *Hypothesis 2 (H2): Job autonomy positively relates to the intrapreneurial behaviour of employees.*

The interaction between job autonomy, digital literacy, and intrapreneurial behaviour is a key aspect to consider in understanding the dynamics of intrapreneurship in the digital age. By examining how job autonomy moderates the relationship between digital literacy and intrapreneurial behaviour, we can gain valuable insights into the unique role of job autonomy as a job characteristic and resource within organisations. To understand how job autonomy and digital literacy interact, we can turn to the Conservation of Resources (COR) theory (Hobfoll, 1989). Hobfoll's (1989) COR theory posits that individuals strive to protect, maintain, and accumulate resources, which can include material, social, and psychological resources. The potential or actual loss of these resources is seen as a significant threat, leading to psychological distress, and prompting individuals to invest in additional resources. Moreover, the COR theory highlights the importance of resource gain, whereby the acquisition of valuable resources and the positive emotions associated with them become increasingly valuable, particularly in the face of mitigating resource loss. This emphasis on resource gain serves as an emotional respite and enables individuals to pursue their goals effectively.

Applying the COR theory to this study, job autonomy and digital literacy are both considered psychological resources. As both job autonomy and digital literacy are resources, the former being a job resource and the latter a personal resource, according to the COR theory, these two resources interact by strengthening each other to maintain and acquire resources. The maintenance and strengthening of job autonomy and digital literacy resources can subsequently strengthen the main direct relationship between digital literacy and intrapreneurial behaviour. It is important to note that there is no pre-existing literature specifically looking at the moderation effects of job autonomy on digital literacy and intrapreneurial behaviour, or on the interaction between digital literacy and job autonomy. However, by referencing the COR theory, theoretical premises can be hypothesised, which will be tested. For example, when an employee with digital literacy skills is provided job autonomy, they are motivated to protect and maintain their psychological skills and resources. An employee with increased job autonomy has the time and space to better apply and utilise their digital literacy skills, such as using ICTs to obtain large amounts of information faster, evaluating digital information, and presenting their information coherently. Additionally, they can develop and enhance their digital literacy skills, resulting in them being better able to participate in intrapreneurial behaviours. On the other hand, an employee who does not have job autonomy as a resource will therefore not be able to interact with their digital literacy resource and could even suffer from psychological distress as a result. With low or no job autonomy, an employee will not have the time or space to be able to use, or struggles to maintain, their personal resource of digital literacy skills for them to be intrapreneurial at work. This is due to a lack of freedom or space to use their digital literacy skills to take risks, be proactive, and innovative in a digital age workplace. Through the COR theory, job autonomy as a job resource can positively interact with digital literacy as a personal resource, which ultimately leads to increased intrapreneurial behaviours, thus formulating the following hypothesis:

> *Hypothesis 2a (H2a): Job autonomy strengthens the relationship between digital literacy and intrapreneurial behaviour.*

Information Overload

The job characteristic information overload is a job demand that can cause negative psychological consequences and hinder work outcomes. Information overload refers to the experienced psychological stress that results from being burdened by vast quantities of

information at rapid speeds, leading to inefficient and ineffective information processing (Eppler & Mengis, 2008). Information overload can arise from two primary spaces; cyber-based, which refers to the overwhelming amount of digital information that individuals encounter through various online channels such as emails, social media, news websites, and online platforms, and place-based, which refers to the overwhelming amount of information present in physical workplace environments stemming from factors including information displays, signage, documents, interactions, or visual stimuli (Misra & Stokols, 2012). Information overload is a job demand of the contemporary workplace, which leads to negative outcomes such as increased perceived stress, impacting one's productivity and decision-making when an employee's capacity to absorb and utilise information effectively has been exceeded (Misra et al., 2020).

Information overload negatively influences intrapreneurial behaviour as it is a job demand that hinders individuals' capacity to engage in proactive and innovative actions. There is no existing scholarly literature looking at the direct effects of information overload on intrapreneurial behaviour. However, this direct relationship can be explored by looking at the constituent behaviours of intrapreneurial behaviour, most relevantly innovation and its related creativity, as well as proactivity. Innovation arises from knowledge and information about a specific topic, and in today's digital age, information is readily accessible with ubiquitous ICTs (Van Knippenberg et al., 2015). However, when the abundance of information becomes overwhelming, leading to information overload, it hinders the effective absorption and utilisation of information, thereby hindering the potential for subsequent innovations. Moreover, as we are in the digital age, also referred to as the information age, "infomania" is a root cause of information overload. First coined by Ferrarini (1984), "infomania" is characterised by an excessive compulsion or need to monitor emails, texts, social media, online news, and other digital platforms. This frequently results in being unable to concentrate uninterruptedly, consequently hindering the acquisition of essential life management skills which include decision-making, problem-solving, creativity, and critical thinking (Borkovich & Middle, 2018). With constant distractions and the stress of information overload, knowledge workers have been found to experience superficial thinking and low idea generation, resulting in reduced output despite investing increased time in tasks (Hallowell, 2005). These adverse cognitive consequences have a direct impact on one's ability to act intrapreneurially, as not only is innovation crucial to intrapreneurship, but so is effective decision-making. Effective decision-making enables employees to exhibit proactive, risk-taking, and innovative behaviours by recognising opportunities, assessing risks, allocating resources, and aligning

with strategic goals, to name a few (Blanka, 2019). As stress experienced from information overload hinders one's ability to exhibit intrapreneurial behaviours, the following hypothesis is formulated:

> *Hypothesis 3 (H3): Information overload negatively relates to the intrapreneurial behaviour of employees.*

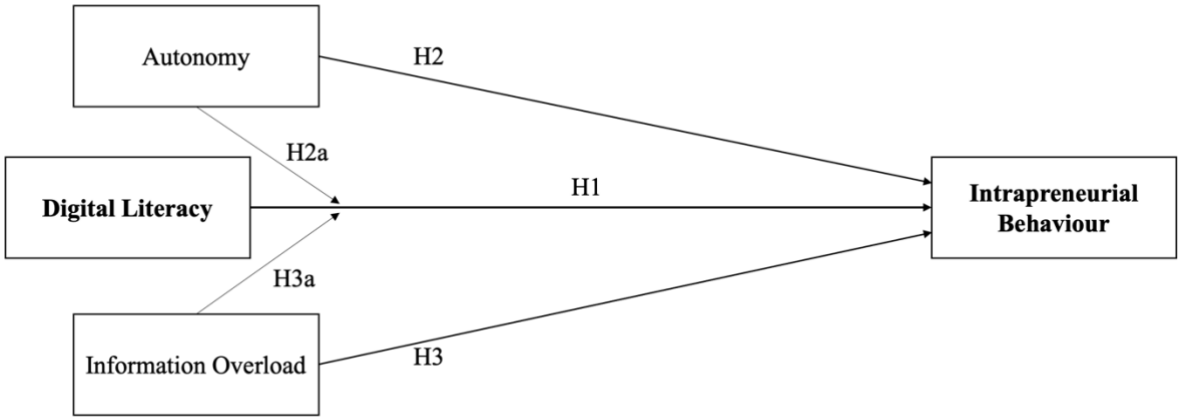
Information overload as a hindrance job demand can also moderate the relationship between digital literacy and intrapreneurial behaviour. The interaction between job demands and personal resources is under-researched and has been called to be researched by Bakker and Demerouti themselves (2017). This study aims to address the research gap between job demands and personal resources by investigating the interaction. According to the JD-R theory, job demands can lead to increased strain, which can therefore reduce work engagement outcomes (Bakker & Demerouti, 2014). An excessive amount of hindrance job demands can also hinder the positive effects of personal resources on work engagement outcomes, becoming a burden and overshadowing the potential benefits of personal resources on work engagement outcomes during unsuccessful and ineffective balancing of resources and demands. Therefore, higher perceived information overload is a hindrance demand (Koltay, 2011), and can negatively affect the relationship between digital literacy and intrapreneurial behaviour, because the job demand hinders the processes between the personal resource and work engagement outcome. An employee with high information overload can experience hindrances in their ability to effectively utilise their digital literacy skills and the benefits of technology use for their intrapreneurial activities, as this requires time, space, and attention that one does not have when perceiving stress from information overload demands. On the other hand, an employee with low information overload will not negatively affect their ability to effectively apply digital literacy skills to increase intrapreneurial behaviour, because they do not perceive high information overload and its subsequent negative cognitive effects and stressors. Therefore, they are not experiencing limitations or hindrances in their capacity to apply their digital literacy skills for intrapreneurial behaviours and can continue to reap the benefits of digital literacy on intrapreneurship. Therefore, because information overload is expected to hinder one's ability to use their personal resource of digital literacy for intrapreneurial behaviours in the workplace, the following hypothesis is formulated:

Hypothesis 3a (H3a): Information overload weakens the relationship between digital literacy and intrapreneurial behaviour.

These hypotheses derived from the above theory and literature are presented in the conceptual model below (Figure 2).

Figure 2

Conceptual model



Research Method

Research design and data collection

The primary purpose of this research is to empirically evaluate whether one's digital literacy positively relates with intrapreneurial behaviours in working individuals, and how a digital age work environment's job characteristics may moderate this relationship. A cross-sectional online survey method was used to collect data, as it beneficially reaches a large sample in a cost-effective manner, as well as allows for increased reliability through the application of pre-existing scales. This online survey was created on Qualtrics and shared on work-related platforms, such as LinkedIn, or alumni work-related groups on Facebook (see Appendix A for full survey). Participants could access a direct link to the survey, and were greeted with an explanation of the study, followed by what the survey entails, including the average time that it will take to fill in this survey. After reading the ethical dimensions of the

survey, such as anonymity, participants gave their informed consent with a checkmark. Once checked, they could continue to fill out the online survey. The survey consisted of demographic control variable questions regarding age, gender, level of education, and profession, followed by the survey scales measuring intrapreneurial behaviour, digital literacy, job autonomy, and information overload. Finally, participants were thanked for their participation.

Sample

The sample for this survey research remained broad, consisting of all types of working individuals. Therefore, the sampling design was multistage, as the sample is not from a specific organisation or known group of individuals (Creswell & Creswell, 2018). Inclusion criteria for this survey was that the participant must be at least 18-years old and a full-time employee at the current moment, as well as meeting typical requirements within surveys, such as providing consent and answering the questions.

Convenience sampling was used as participants taking part in this survey were not mandated to participate, and only did so out of convenient availability. Although this is considered less desirable (Creswell & Creswell, 2018), because the purpose of this research is to explore intrapreneurial behaviour and digital literacy outside of a specific case or organisation, this sampling strategy provided an open and more broad interpretation. Stratification was not used, as the general demographic questions asked act as control variables.

A formal power analysis was first used to calculate the target sample size using the software G*Power. The two-tailed alpha value (α) was at the commonly accepted value of 0.05 and the beta value (β) at the commonly accepted value of 0.20 (Creswell & Creswell, 2018). An estimate of the size of correlation (*r*) was not possible using previous studies. Therefore, a value of 0.3, which was recommended by G*Power, was used. The output target sample size was 84 participants.

The survey received a total of 153 responses. From this total, 40 responses were discarded due to: no consent given; only consent was given but no other answers to questions; only demographic information was provided; or straight-lining was used. This resulted on a non-response rate of 26.14%. Thus, the total responses of individual full-time employees, and subsequent sample for this survey is *N=113* (see Table 1 for sample characteristics). Each of these final responses provided entirely complete answers, except for two responses missing age (which is a demographic control). Due to the limited demographic controls, it is not possible to identify if a specific group was not targeted, as it was not possible to trace exactly to who

the survey link was accessible. However, there was a prominent population of pilots in the sample (15%), which is a limitation for generalisability.

Table 1

Sample characteristics

		Full sample (*N=113*)	
		N	%
Variable	Category		
Gender	Male	72	63.7
	Female	40	35.4
	Prefer not to say	1	0.9
Level of Education	Less than high school	0	
	High school diploma	10	8.8
	Vocational Education	12	10.6
	Higher vocational education	5	4.4
	Bachelor's	45	49.8
	Master's	36	31.9
	Doctorate	1	0.9
	Other	4	3.5

	Range	*M*	*SD*
Age (n=111, 2 missing)	20 - 64	39.01	14.30

Measurements

The concepts of this study are 1) intrapreneurial behaviour, acting as the dependent variable, 2) digital literacy, acting as the independent or predictor variable, 3) job autonomy, which is a predictor and moderator variable, and 4) information overload, which is a predictor and the second moderator variable. Each variable was measured using existing scales, explained below.

Firstly, demographic information was asked, measuring for control variables. These were age, gender, level of education, and profession. Next, the specific concepts relating to the research questions and hypotheses were asked using pre-existing scales as measures (see

Appendix A for survey questions). A principal component analysis was conducted for each scale, followed by a factor reliability test to identify the Cronbach's alpha (α) item reliability value, using the SPSS statistical data analysis software.

Intrapreneurial behaviour was measured using the Intrapreneurial Behaviour Scale (Preenen et al., 2016). This consisted of eight items derived from extant intrapreneurial behaviour measures by the authors. Participants indicated their agreement with the items on a 7-point Likert scale ranging from 1 (strongly disagree) to 7 (strongly agree). The Cronbach's α reliability was .741, indicating a good level of item reliability.

Digital literacy was measured using the Digital Literacy sub-scale (Nikou et al., 2022). This scale consisted of 10 items. All items were be measured on a 7-point Likert scale from 1 (strongly disagree) to 7 (strongly agree). The Cronbach's α reliability was .885, indicating a strong level of item reliability. It is important to note here that finding a pre-existing scale for digital literacy was difficult, and this is the only publicly available scale. This further highlights the gap in scholarly research regarding concepts of digital literacy, tech savviness or technological competence.

Job autonomy was measured using the Work Autonomy Scale (Breaugh, (1999), as a development of their previous Work Autonomy Scale (1985)). This consists of nine items, measuring three different "facets" that make up job autonomy, measured on a 7-point Likert scale from 1 (strongly disagree) to 7 (strongly agree). These three facets are method autonomy, scheduling autonomy, and criteria autonomy. These were treated as one scale, which had a Cronbach's α reliability of .903, indicating a very strong level of item reliability.

Information overload was measured using the Perceived Information Overload Scale (Misra & Stokols, 2012). This scale consists of two sub-scales: cyber-based information overload consisting of nine items; place-based information overload consisting of seven items. Both sub-scales were measured on a 5-point Likert-scale (where 0 = never and 4 = very often). The total Cronbach's α reliability for both scales were .884, indicating a strong level of item reliability, whereas the individual sub-scales had a weaker Cronbach's α reliability of .879 (for cyber-based), and .749 (for place-based). For the subsequent data analysis, information overload was decided to be considered as one all-encompassing scale, with this decision being made through theoretical considerations of job characteristics of the digital age.

Statistical analysis and assumptions for data

The collected data was analysed using the SPSS version 29 software. It was speculated that multiple linear regression would be used to analyse the collected statistical data. Thus, before testing the hypotheses, the assumptions of normality, homoscedasticity, linearity, independent observations, and multicollinearity were checked to ensure there were no violations and that a hierarchical multiple linear regression analysis could be successfully conducted (see Appendix B). It is important to note that during this analysis, two outliers were identified, one which was excluded due to a note from the participant that they were not a full-time employee, and another which had the lowest intrapreneurial behaviour score which was not excluded from the analyses. Confirmatory sensitivity testing of the latter data point did not show significant impact on the results, so this data point was included in the analyses. Starting with normality, the normal distribution histogram of the raw data visually looked promising, however the Q-Q plot showed some outliers. Thus, the normality of the residuals was tested. Statistically, the residuals are normally distributed with a Kolmogorov-Smirnov value of .200, and a Shapiro-Wilk value of .309. These values support the null hypothesis; thus the residuals are normally distributed and the data does not violate the assumption of normality needed for linear regression. The P-P plot also supported this, with minor deviations from the line, but is accepted. Next, the homoscedasticity assumption was checked, and excluding the one recognised outlier, the data points are generally rectangular, are dispersed, and do not show a clear pattern. Therefore, the data can be considered homoscedastic excluding the one outlier. With this data passing the assumptions for normality, as the points are normally distributed, fall along the P-P line, as well as the overall data being homoscedastic, linearity is also therefore assumed to not be violated. For testing independent observations, the Durbin-Watson statistic value was 1.998, which does not violate this assumption as this value is close to 2.0, and the data can thus be considered independent. Finally, multicollinearity was tested using both the Variance Inflation Factor (VIF) and Tolerance values. The VIF values are only slightly above 1, which shows some degree of multicollinearity, but this is accepted as values between 5-10 are considered to violate the multicollinearity assumption. The tolerance values are between 0.653 and 0.865, which are above the multicollinearity value boundary of 0.2.

With the data not violating the assumptions for linear regression analyses, a hierarchical multiple linear regression analysis was conducted to test Hypotheses 1, 2, and 3, to explore the direct relationships of digital literacy, job autonomy, and information overload on intrapreneurial behaviour respectively. Subsequently, a hierarchical moderation regression

analysis was used to test Hypotheses 2a and 3a, using Model 2 of the Hayes PROCESS macro software extension in SPSS, testing the moderation effects of job autonomy and information overload on the main effect of Hypothesis 1. These analyses and results are presented next.

Results

Descriptive statistics

Descriptive statistics and bi-variate correlations were carried out to understand the various variables and their relationships (see Table 2). To look at correlations, Pearson's Product Correlation Coefficient values were used. All correlations fall in the expected directions. The average level of digital literacy skills was good, as the mean was 5.45 out of 7. Additionally, average level of intrapreneurial behaviour was also good, as the mean was 5.62 out of 7.

Firstly, it is important to note that there is a moderately positive statistically significant correlation between digital literacy and intrapreneurial behaviour (r =.421, p < .001). This relationship is particularly important as it supports for Hypothesis 1, but will be further explored using regression analyses below.

Moreover, job autonomy has a moderate positive statistically significant correlation with both intrapreneurial behaviour (r =.403, p < .001) and digital literacy (r =.435, p < .001). Although the correlation between independent variables job autonomy and digital literacy is moderate (below a strength of .6), data analysis continued as usual because prior multicollinearity checks were verified, but this correlation was kept in mind in case of confounding or suppressing effects were identified later. Cyber-based information overload and place-based information overload are strongly correlated with each other (r =.588, p < .001) and very strongly with total information overload (r =.931, p <.001, r =.843, p <.001 respectively), therefore confirming that these two sub-scales will be treated as one for the following data analysis. Interestingly, the control variable of age had a statistically significant moderate negative correlation with digital literacy (r = -.388, p <.001).

The variables job autonomy and information overload that also act as moderators for Hypotheses 2a and 3a were not correlated with one another (r = -.002, p <.982). Information overload was also not correlated with the other variables.

For each of the subsequent analyses, all variables except the dependent variable of intrapreneurial behaviour were centred in order to better interpret the intercepts and interactions between variables.

Table 2

Summary statistics and Pearson's correlation matrix

Variables	*M*	*SD*	1	2	3	4	4a	4b	5	6	7
Study variables											
1. Intrapreneurial Behaviour	5.62	.70	-								
2. Digital Literacy	5.45	.99	.421**	-							
3. Job Autonomy	3.45	.93	.403**	.435**	-						
4. Information Overload (Total)	2.59	.68	-.148	.189*	-.002	-					
4a. Cyber-based	2.59	.80	-.146	.158	-.006	.931**	-				
4b. Place-based	2.59	.70	-.111	.185	.003	.843**	.588**	-			
Control variables											
5. Age	39.2	14.28	-.077	-.388**	-.144	-.098	-.029	-.174	-		
6. Gender	1.38	.54	-.072	.048	.012	.300**	.279**	.252**	-.283**	-	
7. Level of Education	4.91	1.40	.144	.251**	.259**	.149	.110	.169	-.131	.272**	-

Note:2-tailed correlations. Correlation is significant at the (**) .01 or (*) .05 level.

Hypothesis testing: Direct effects

To examine the direct effects of digital literacy, job autonomy, and information overload on intrapreneurial behaviour, a hierarchical multiple regression analysis was conducted. This analysis aimed to determine the unique contributions of digital literacy, job

autonomy, and information overload on predicting intrapreneurial behaviour, after accounting for the effects of the control variables.

The hierarchical multiple regression analysis consisted for two steps. In the first step, the control variables age, gender, and level of education were entered into the model. The results showed that the control variables did not significantly predict intrapreneurial behaviour (R^2 = .045, p <.177). In the second step, all of the predictor variables were included, namely digital literacy, job autonomy, and information overload. The overall model was found to be statistically significant (F(6, 103) = 7.014, p <.001), indicating that the set of predictors, including the control variables, collectively explained a significant proportion of the variance in intrapreneurial behaviour. The overall model at step two demonstrated a significant improvement in the prediction of intrapreneurial behaviour compared to step one. The change in R^2 value between steps was found to be significant (ΔR^2 = .245, p <.001) with a significant R^2 value (R^2 = .290, p <.001), indicating that digital literacy, job autonomy, and information overload accounted for a significant additional proportion of 24.5% of the variance in intrapreneurial behaviour beyond the control variables. Next, the individual variables' unique effects on intrapreneurial behaviour will be explored, testing the direct effect Hypotheses 1, 2, and 3.

Digital literacy

The relationship between digital literacy and intrapreneurial behaviour was tested, in order to answer Hypothesis 1 (*digital literacy of individuals positively relates to the intrapreneurial behaviour of employees*). The standardised regression coefficient (β) shows that digital literacy made a unique statistically significant moderate positive contribution to the prediction of intrapreneurial behaviour (β = .388, p <.001). Each standard deviation increase in digital literacy was associated with a .446 standard deviation increase in intrapreneurial behaviour. Therefore, the hierarchical multiple regression analysis revealed that digital literacy did have a statistically significant positive relationship with intrapreneurial behaviour. Thus, Hypothesis 1 is accepted.

Job autonomy

The relationship between job autonomy and intrapreneurial behaviour was tested, in order to answer Hypothesis 2 (*job autonomy positively relates to the intrapreneurial behaviour of employees*). The standardised regression coefficient (β = .238, p =.013) shows that job autonomy made a unique statistically significant albeit weak positive contribution to the

prediction of intrapreneurial behaviour. Each standard deviation increase in job autonomy was associated with a .238 standard deviation increase in intrapreneurial behaviour. Therefore, job autonomy did have a statistically significant positive relationship with intrapreneurial behaviour. Thus, Hypothesis 2 is accepted.

Information overload

The relationship between information overload and intrapreneurial behaviour was tested, in order to answer Hypothesis 3 (*information overload negatively relates to the intrapreneurial behaviour of employees.*). The standardised regression coefficient (β = -.200, p =.027) shows that information overload also made a unique statistically significant albeit weak negative contribution to the prediction of intrapreneurial behaviour. Each standard deviation increase in information overload was associated with a -.200 standard deviation decrease in intrapreneurial behaviour. Therefore, information overload did have a statistically significant negative relationship with intrapreneurial behaviour. Thus, Hypothesis 3 is accepted.

Hypothesis testing: Moderation effects of job demands and resources

To gain a more comprehensive understanding of the relationship between digital literacy and intrapreneurial behaviour, a moderation analysis was conducted to test Hypotheses 2a and 3a (*job autonomy strengthens the relationship between digital literacy and intrapreneurial behaviour; information overload weakens the relationship between digital literacy and intrapreneurial behaviour*). The Hayes PROCESS macro tool in SPSS was used to conduct a Model 2 moderation analysis of two independent moderators. The analysis aimed to explore the moderating effects of job autonomy and information overload on the relationship between digital literacy and intrapreneurial behaviour. In addition to the two moderator variables, the independent variable of digital literacy and the dependent variable of intrapreneurial behaviour, the model incorporated control variables of age, gender, and level of education.

The overall moderation model with two independent moderators showed an F-value of 5.967 (p < .001), indicating that the model was a good fit for the data. Furthermore, the R^2-value of .3209 indicated that 32% of the variance in intrapreneurial behaviour could be explained by this moderation model, at a significant level.

The analysis revealed that the interaction between digital literacy and job autonomy was not statistically significant (β = .1155, p = .0813). The regression graph also displayed no

significant moderation effects between the job autonomy and digital literacy on intrapreneurial behaviour (see Appendix B). This finding suggests that job autonomy does not play a moderating role in the relationship between digital literacy and intrapreneurial behaviour within this sample, and we do not accept Hypothesis 2a.

Similarly, the analysis revealed that the interaction between digital literacy and information overload was not statistically significant ($\beta = .1298$, $p = .1500$). This finding suggests that information overload also does not moderate the relationship between digital literacy and intrapreneurial behaviour, therefore rejecting Hypothesis 3a.

Discussion

As both society and the workplace become increasingly digitalised, personal resources such as digital literacy are important to consider and understand. Intrapreneurial behaviours are becoming ever-more pertinent work engagement outcomes for organisations, in hopes to sustain relevance and competition in the fast-paced digital world and its accompanied New Ways of Working. This research set out to empirically evaluate whether one's digital literacy positively relates to the intrapreneurial behaviour of employees, and how a digital age work environment's job characteristics (job autonomy and information overload) moderate this relationship. First, the direct effects of digital literacy, job autonomy, and information overload on intrapreneurial behaviour were examined using multiple linear regression analysis, which were found to be significant. Subsequently, the moderation effects of job autonomy and information overload were tested, which were found to be not significant. The following section will discuss each hypotheses' result, to further explore the researched processes.

The results of this study suggest that there is a direct and positive linear relationship between digital literacy and intrapreneurial behaviour, highlighting the importance of investigating digitalisation within the organisational context. The linear relationship indicates that individuals with higher digital literacy skills positively influences one's intrapreneurial behaviour as they tend to exhibit more innovative, proactive, and risk-taking behaviours within the organisational context. A theoretical reasoning for this relationship can be explained through intrinsic motivation. Luthans & Youssef (2007) explain that an individual's feelings of positive self-evaluations relating to a skill (e.g., digital literacy), fostering intrinsic motivation, can lead to higher work engagement and job performance outcomes (e.g., intrapreneurial behaviour). Although there is no existing scholarly literature that investigates or addresses the exact relationship of digital literacy and intrapreneurial behaviour, the

hypothesis was derived from previous research investigating the relevance of ICTs in intrapreneurship (Pinchot & Soltanifar, 2021). By focusing this research on digital literacy, which is measured in reference to today's consensus and societal standards of technology use, this research delves deeper than showing that ICT use is inherent to intrapreneurship, by specifically presenting that *how* one uses ICTs can predict and influence intrapreneurial behaviours. The found relationship highlights the importance of being able to use the ubiquitous technologies around us, and how integrated ICTs are within organisational dynamics, as the skilful and effective use of digital technologies can excel organisations to stay innovative and competitive through their employees' behaviours in a rapidly changing landscape.

This study found that job autonomy positively related to intrapreneurial behaviour. Although the relationship was weak, it was significant. Therefore, the more job autonomy one has, the more likely they are to exhibit intrapreneurial behaviour. This linear relationship is in line with previous studies. Job autonomy is recognised as a key factor that fosters an environment conducive to intrapreneurship in organisations (Blanka, 2019). De Jong et al. (2015) also found that granting job autonomy as a job resource to employees increased their perceived capabilities, leading to employees engaging in intrapreneurial behaviours more. Elert et al. (2019) not only confirmed the positive association between job autonomy and intrapreneurship but also emphasised that job autonomy is essential for providing employees with the necessary freedom and flexibility to act intrapreneurially.

Although employees with job autonomy as a resource may feel capable to take risks, be proactive, and innovative through individually crafted time and space for tasks, the positive relationship between job autonomy and intrapreneurship found in this study was not as strong as expected. This could be because the mean autonomy of participants was only 3.45, out of 7 (see Table 2), indicating only a moderate level of autonomy. Autonomy has been an organisational and psychological buzzword for decades, particularly with Ryan and Deci's (1985) Self-Determination Theory (SDT). Autonomy in SDT is one of three innate psychological needs, the other two being competence and relatedness (Ryan & Deci, 2000). When these psychological needs are satisfied, individuals experience increased self-motivation and improved mental health. However, if these needs are hindered or unmet, individuals may experience reduced motivation and diminished well-being. By granting employees increased autonomy, self-determination is promoted, which is expected to generate higher levels of job satisfaction, fulfilment, and engagement. This is because employees are likely to perceive their achievements as the direct outcome of their own inherent abilities. Moreover, autonomy acts

as an intrinsic motivator, stimulating enhanced performance. Therefore, job autonomy has long been regarded as an important job resource to offer employees. This study sample's moderate level of autonomy can either signify that job autonomy is generally not being offered or utilised frequently despite its positive effects on work outcomes and well-being. Alternatively, and more probable, is that the sample did not represent the population accurately, and an over-represented group of occupations inconducive to job autonomy skewed the results. As there was a significant portion of pilots on the sample (15%), a lack of job autonomy is salient in commercial pilot occupations, which could partially justify the experienced moderate job autonomy mean (Cooper & Sloan, 1985). Because not more is known about the demographics of the sample, it is unfortunately not possible to precisely trace why this previously established relationship between job autonomy intrapreneurial behaviour is found to be weak in this study. Therefore, any applications of the found weak positive relationship between job autonomy and intrapreneurial behaviour to wider contexts must be handled with cautious discretion.

As the final direct effect, this study found that information overload had a negative relationship with intrapreneurial behaviour. The linear relationship was weak, yet significant. Hence, the more information overload one perceives, the less they exhibit intrapreneurial behaviour. This specific direct relationship does not have existing scholarly research, however, the result of this effect can be understood through the three behaviours that constitute intrapreneurial behaviour. Information overload has been found to result in reduced cognitive abilities, including creativity, innovation, and decision-making (Borkovich & Middle, 2018). These cognitive abilities are the constituent behaviours of intrapreneurial behaviour. The found negative relationship between information overload and intrapreneurial behaviour is therefore backed by, and supporting, previous findings. However, as information overload is a still-evolving construct due to the fast-paced advancements in ICT use, the established scholarly findings on information overload and innovation and creativity are few, and not particularly strong either. Even more pressingly, there is no published research on information overload and intrapreneurial behaviour. Therefore, the weak relationship can arise from under-researched measures, relationships, and theories of the two constructs, that can be an aim for future research.

Despite the ubiquity of ICTs and their accompanied distractions and stressors, the mean level of information overload was moderate (2.59 out of 5, see Table 2). This result could be supported by studies that have found that Generation Y (born around 1981 to 1996) are more normalised and at ease with using ICTs and handling the vast amounts of rapidly incoming information, due to exposure throughout their lives (Bolton et al., 2013; Reisenwitz & Iyer,

2009). The mean age of this study's sample was 39 years, which belongs to Generation Y. However, the correlation between age and information overload was not significant (see Table 2). Another possible reason for the moderate mean level of information overload could be the increase in boundary-setting efforts and approaches regarding digital technologies and the acknowledging of the harmful effects of information overload, both in personal and work contexts (Arnold et al., 2023). Consequently, if the information overload effects are moderate, they would in turn not greatly react with the intrapreneurial behaviours. Nonetheless, the significant negative, albeit weak, relationship between information overload and intrapreneurship can be a starting point for future endeavours into the effects of the digital age working environment on favourable organisational and individual work engagement outcomes.

Finally, the moderation effects of job characteristics job autonomy and information overload on the main effect of digital literacy and intrapreneurial behaviour were not significant. This suggests that other variables or factors not considered in this study model may play a more influential role in moderating the relationship between digital literacy and intrapreneurial behaviour. Both moderation effects investigated were characterised by their novelty. The interactions between job autonomy and information overload with digital literacy have not been previously explored. Therefore, the findings of to the moderation effects contribute to existing knowledge, by introducing a new perspective or starting point to expand understanding of the complex dynamics between these concepts present in the digital age organisational context. As explained above, both job autonomy and information overload were perceived on average at only a moderate level. Therefore, their influence on the main effect may be less pronounced, restricting the extent of variation and influence on intrapreneurial behaviour, thereby reducing the likelihood of identifying a significant moderation effect and resulting in an insignificant finding. The non-significant moderation effects suggests that job autonomy and information overload may not be significant factors in strengthening or mitigating intrapreneurial behaviours for individuals with different levels of digital literacy. Moreover, information overload may not be as strong of a hindrance demand as expected. Therefore, it is important to explore other potential moderators or factors, such as the availability of resources, organisational support, or individual characteristics, that may independently contribute to intrapreneurial behaviour or possibly dilute the potential moderating effect of job autonomy and information overload.

It is also possible that the independent variable of digital literacy should have been the moderator, and the job resource of autonomy and the job demand of information overload should have been the predictors instead. Having the personal resource (digital literacy)

moderate the main effect between a job resources or demands on a work engagement outcome is a common way of applying the Job Demands-Resources theory (Schaufeli & Taris, 2014). This may have resulted in employees' personal resources bringing greater control, adaptability, and lasting impact that are transferable across job contexts and provide consistent support and resilience. In contrast, job resources may be limited, and job demands can increase, both fluctuating over time, and are provided by the organisation. By understanding personal resources as the moderator can empower employees to shape their work outcomes more effectively, leading to sustainable and favourable results through their own directive. With that being said, selecting the job resources and demands as the moderators between personal resources and work outcomes was intentional for this research because it extends the impact to the organisational level by shedding light on the importance of fostering a supportive environment for employees to develop and utilise their personal strengths. Additionally, job resources help overcome systemic barriers, ensuring that individuals can fully utilise their personal resources. Simultaneously, the role of job demands as a moderator emphasises the importance of balancing or managing the demands individuals face in their work environment with their personal resources. It highlights the need for supportive organisational practices and resources that can help individuals effectively cope with challenging job demands, reduce strain, and foster positive work outcomes. The formulated amalgamation of variables was chosen for the moderation effect because of the integration of organisational support, leveraging strengths, and addressing systemic factors. It remains to be seen whether a stronger effect size can validate these theoretical hypotheses, or whether job autonomy and information overload are simply not notable factors for intrapreneurial behaviours in today's digital age.

An additional interesting finding that did not pertain to the hypotheses was the correlation between digital literacy and the control variable age. The data showed that the older someone is, the less digitally literate they are. Adding to the previous effects that Generation Y potentially have on digital technology use, this relationship can be understood though the generational difference between "digital immigrants" and "digital natives". "Digital immigrants" are individuals that were born before 1980 and have had to learn how to use digital technologies (Kivunja, 2014). Whereas "digital natives" are individuals that were born after 1980, into the world of ubiquitous daily technology, rendering their use of technology less of a learnt skill, but a second, or even first-nature behaviour (Prensky, 2001). With age being a factor on digital literacy skills, it makes this relationship's relevance to the organisational context ever-more important, as it shows that some individuals inhibit an implicit disadvantage regarding digital literacy skills, because they are "digital immigrants". Furthermore, due to the

linear relationship between digital literacy and intrapreneurial behaviour, it could also indirectly negatively impact these immigrants' opportunities to exhibit intrapreneurial behaviours in the workplace, and consequently complicating remaining competitive with their younger colleagues. Age has been found to have a negative direct effect on intrapreneurial behaviour, however this can be mediated through intra-personal social capital and personal social capital (Klein & Hador, 2019). However, there was no significant correlation between age and intrapreneurial behaviour found in this study, so this influence may not be as stark or direct, but it can remain a possibility.

Implications

This study offers theoretical implications on the study variables and constructs, as well as the underpinning theoretical framework of the Job Demands-Resources (JD-R) theory (Bakker & Demerouti, 2014). Firstly, ICT use is examined from the perspective of a psychological skill and resource, focusing on *how* ICTs are used. This is a development from previous studies that merely look at technology presence or the frequency of ICT use in intrapreneurship (Rabl et al., 2022; Pinchot & Soltanifar, 2021). Not only does this further develop much-needed research on digital literacy as a construct, but it also expands upon existing streams of intrapreneurial behaviour research. Intrapreneurship studies frequently focus on the organisation as a whole, leaving the individual-level factors and psychological processes of intrapreneurial behaviours understudied (Blanka, 2019). This study emphasises the importance of considering the individual's psychological skills and resources in understanding intrapreneurial behaviour, providing insights into how ICT usage can facilitate or hinder intrapreneurial tendencies at the individual level.

Moreover, by applying the (JD-R) theory by Bakker and Demerouti (2014) to a contemporary digital age workplace context, this study contributes to the growing evidence supporting the theory's strength and adaptability. The findings underscore the theory's continued relevance in explaining work-related outcomes in the context of evolving technological advancements and changing work environments. Additionally, this research extends the theoretical understanding by highlighting the role of personal resources as a "third variable" that can directly relate to work engagement outcomes (Schaufeli & Taris, 2014). By recognising the significance of personal resources, in this case digital literacy, in shaping work engagement outcomes, this study emphasises the importance of considering individual factors alongside job and organisational characteristics. These theoretical implications contribute to a more comprehensive understanding of the complex dynamics between resources, demands, and

work engagement, paving the way for future research and practical applications in promoting favourable organisational behaviours and outcomes in the digital workplace.

The findings of this research also offer practical implications. Bakker and Demerouti's (2014) JD-R theory expands on intervention possibilities to develop personal resources to further facilitate work engagement outcomes. Regarding this research's focus on personal resources on work engagement outcomes, the JD-R theory's interventions most suited for this research are trainings and strengths-based interventions. As the JD-R theory places focus on the individual's capabilities, outcomes, and experiences, Bakker and Demerouti (2014) recommend that organisations could decide to invest in training employees to better cope with job demands and improve themselves and their work outcomes during work. The findings of this research consequently highly recommend organisations to take the initiative in enhancing the personal resource of digital literacy of their employees, as it can lead to increased intrapreneurial behaviours, which ultimately benefit the organisation's competitiveness in the digital age. Organisations may not feel responsible to train their employees' personal resources, however, it is recommended that internal training initiatives be provided by the organisation for employees, particularly for older employees, because of the potential for increased intrapreneurship. Moreover, this research's findings also suggest that individuals themselves can develop and leverage their own digital literacy skills, through strengths-based interventions, for them to feel more equipped and self-efficacious at work and beyond (Peterson & Seligman, 2004), in hopes of resulting in increased intrapreneurial behaviours and positive work engagement outcomes.

Finally, the results of this study can further inform macro-level governmental initiatives and policies dedicated to researching and providing insights into the importance of digital literacy in the contemporary digital age. The European Union commissioned Digital Competence Framework for Citizens (DigComp) initiative aims to provide competence assessment tools, provide training opportunities, and help citizens and employees engage confidently, critically, and safely with digital technologies. However, so far, this has only materialised for the education sector, and its organisational implementations are still under development. Moreover, UNESCO's Digital Literacy Global Framework is another initiative under development, which aims to target Sustainable Development Goal 4.4, which focuses on increasing the percentage of youth and adults with proficient digital literacy skills. As both initiatives are still under-development, this research and its above implications and interventions hope to provide further guidance, input, and support on the development of these initiatives, particularly stressing the role that organisations can play in training digital literacy,

additional insight into how digital literacy can be measured, as well as the linear relationship digital literacy has with the positive, future-proofing work engagement outcome of intrapreneurial behaviour. It is imperative to share resources and establish interventions for improving digital literacy, not only for employees but anyone operating in today's digital age.

Limitations and future research

The findings of this study should be interpreted within the context of several limitations, for which future research can aim to address. Firstly, the sample of this study possesses several limitations that warrant careful consideration and potential implications for generalisability. The sample size consisted of 113 participants, which may limit the generalisability of findings due to its smaller size. Moreover, the characteristics of this specific sample may further restrict the generalisability. There was a notably high number of pilots in the sample (15%). The overrepresentation of pilots may result in findings that are specific to this particular professional group and may not be applicable to the broader population or other occupational contexts that this study aimed to research. Consequently, caution should be exercised when extrapolating the study's results to populations with different occupational backgrounds or professions, impacting the generalisability and external validity of the results. Finally, the sample consisted of workers only within Europe, excluding findings from the rest of the world in which organisational dynamics may be significantly different.

To address the limitations of the sample, future research can focus on a larger sample size, as a larger sample size can enhance the statistical power and increase the confidence in the results. A focus on diversifying the sample is also important for future research, both in terms of occupational contexts, but also geographical and cultural contexts. Occupationally, this study assumes that intrapreneurship is inherent within today's digital working climate, thus the level of intrapreneurial behaviour was measured. However, how intrapreneurial employees are expected to be was not measured. This is significant because not all occupations need or are able to participate in intrapreneurship, thus it is crucial to not overgeneralise the applicability of intrapreneurship, and future research should consider the diversity of occupational requirements and delve deeper into these discrepancies. Moreover, culturally, European contexts emphasise individualism and autonomy, which could possibly the measured intrapreneurial behaviour and perceived job autonomy. In contrast, Eastern or collectivistic contexts prioritise collective goals, group harmony, and social relationships, which may influence organisational dynamics and use of resources, resulting in different conclusions. Understanding these cultural nuances is vital for comprehending the study's constructs across

diverse contexts. Future research should also focus on expanding scholarly literature beyond the western perspective.

Secondly, this research applied a quantitative research design, which may not capture the full complexity of the phenomenon under investigation. To gain a more comprehensive understanding of the relationships between digital literacy and intrapreneurial behaviours, and any moderating variables, future research could consider incorporating qualitative or mixed-methods approaches. Over-relying on just the statistics of the direct and moderation effects only paints a single layered picture, whereas perhaps the job characteristics may significantly interact in a way that is not captured through statistical analyses. Furthermore, a longitudinal study on digital literacy and intrapreneurship could allow for long-term observations on patterns, how variables interact and influence each other, the stability of variables, and the impacts of interventions over time. A future longitudinal study can contribute to a more comprehensive understanding of the dynamic relationship between digital literacy and intrapreneurial behaviours.

Finally, the study measures used in this research have limitations that may impact data quality and applicability. The use of self-report measures by using scales are subject to biases, such as social desirability bias and response bias, as participants may provide answers perceived as more socially acceptable or desirable. This can introduce inaccuracies or distortions, which is important to consider when interpreting the results. Additionally, although only pre-existing measurement scales with established validity were used in the study, the digital literacy scale was the only available scale that measured or assessed constructs related to technological proficiency, such as tech savviness, that encompassed both practical technological competence as well as cognitive evaluations regarding digital information. Not only was this scale very difficult to find and access, needing to search under countless possible construct name variations, but the use of Nikou et al.'s (2022) digital literacy scale is a limitation for this study as it is only very recent and has not been validated as much as the other scales used in this study have.

Future research should focus on the need for establishing valid and reliable scales on constructs that are ubiquitous and imperative to not only organisational environments in today's digital age, but also to the daily life of the 21st century. In addition, future research should focus on clarifying and standardising these constructs, making them easier to identify, define, operationalise, and apply in research. This will help address challenges related to poor quality, incomplete, or excessive use of constructs and measurement scales. Moreover, the dynamic nature of technology and its influence on the organisational sphere necessitates

continuous exploration. Academic literature often lags behind the rapid pace of technological advancements; thus it is imperative to not only approach scholarly work critically but also to recognise the necessity for continuous inquiry and scholarly research.

Conclusion

In the digital organisational landscape, the effects of digital literacy skills on intrapreneurial behaviour is particularly important to understand. Through multiple linear regression analysis, this research confirmed a positive relationship between digital literacy and intrapreneurial behaviours. However, common job characteristics of the digital age workplace, namely job autonomy and information overload, did not moderate the direct main effect. Given the nascent linear relationship between digital literacy and intrapreneurial behaviour, future endeavours need to be carried out to delve deeper into this pertinent relationship of today's digital and organisational climate. Hopefully, the value of digital literacy will continue to be appreciated through investigations, as well as efforts to provide support on this vital skill for all humans of the digital age, as we will all have to endure the rapidly transforming future ahead of us.

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Appendix A

Online Survey

Dear participant,

Thank you very much for your interest in this study. This research is conducted for the final graduate thesis of the Master's programme Organisation Dynamics in the Digital Society at the Erasmus School of Social and Behavioural Sciences of the Erasmus University of Rotterdam. With the help of your responses, I will be able to conduct research about Intrapreneurial Behaviour through the resources of Digital Literacy and Autonomy and the demand of Information Overload in the workplace.

There will be several blocks of questions with various statements for which you will need to rate the extent to which you agree. This survey will take approximately 7 minutes to complete.

Your participation in this survey is entirely voluntary, and you may discontinue at any point. Your answers will be anonymous throughout your participation, and your anonymity will be safeguarded upon submission of this survey. By participating in this interview, you will not experience any appreciable risks or discomfort.

By selecting "Yes, I consent" below, you agree to the following:
- I give consent to participating in this research
- I understand that participation is entirely voluntary
- I understand that participation is anonymous
If you do not consent to the above points, please kindly exit this survey.

Please note the following: You have the right to withdraw your consent to use the personal data that you have provided at any time. This will have no consequences and you do not need to justify your decision. If you would like to evoke this right or have any questions about this study, please do not hesitate to contact me at 654166ih@eur.nl.

Thank you in advance for participating in this survey - enjoy!

Inka Hyttinen

- ◯ Yes, I consent
- ◯ No, I do not consent

Thank you very much for choosing to participate!

To begin, please provide some demographic information below. This will remain entirely anonymous and is only collected for representational purposes.

In what year were you born?

What is your gender?

- ○ Male
- ○ Female
- ○ Non-binary
- ○ Prefer not to say

What is your highest level of education?

- ○ Less than high school
- ○ High school diploma
- ○ Vocational Education (MBO, etc.)
- ○ Higher Vocational Education (HBO, etc.)
- ○ Bachelor's (BSc, etc.)
- ○ Master's (MSc, etc.)
- ○ Doctorate (PhD, etc.)
- ○ Other

What is your profession?

(Feel free to add as much or as little information as you like)

Next, you will be asked various questions based on the following four topics:

1. Intrapreneurial Behaviour
2. Digital Literacy
3. Job Autonomy
4. Information Overload

Please answer each of these questions to the best of your ability.

Intrapreneurial Behaviour 1/2

People display different behaviours at work.

Using the scale below, please indicate to what extent you agree with the following statements about your work behaviour.

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
I think of solutions to problems in my work	○	○	○	○	○	○	○
I try to convince my managers to support my ideas	○	○	○	○	○	○	○
In my work, I translate new ideas into workable applications	○	○	○	○	○	○	○
In my work I always try to learn new things	○	○	○	○	○	○	○

Intrapreneurial Behaviour 2/2

These statements are also about Intrapreneurial Behaviour. Please indicate to what extent you agree with the following statements about your work behaviour.

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
I am always thinking about how I can do my job as well as possible in the future	○	○	○	○	○	○	○
In my work, I search for people that I can learn from	○	○	○	○	○	○	○
I dare to take risks in my work	○	○	○	○	○	○	○
I take initiative, even if the outcome is uncertain	○	○	○	○	○	○	○

Digital Literacy 1/2

The following statements aim to measure how comfortable people feel about their ability to use Information and Communication Technologies (ICT). ICT can be used to find, evaluate, create and communicate information.

Using the scale below, please indicate how comfortable you feel with using ICT by responding to what extent you agree with the following statements.

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
I know how to solve my own technical (ICT related) problems	○	○	○	○	○	○	○
I can learn new digital technologies easily	○	○	○	○	○	○	○
I keep up with important new digital technologies	○	○	○	○	○	○	○
I know about a lot of different digital technologies	○	○	○	○	○	○	○
I have the technical skills I need to use digital technologies for working/learning and to create artefacts (e.g. presentations) that demonstrate my understanding of what I have learnt	○	○	○	○	○	○	○

Digital Literacy 2/2

These statements are also about Digital Literacy. Please indicate how comfortable you feel with using ICT by responding to what extent you agree with the following statements.

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
I am confident with my search and evaluation skills to obtain information from the Web	○	○	○	○	○	○	○
I am familiar with issues related to web-based activities e.g. cyber safety, search issues, plagiarism	○	○	○	○	○	○	○
Digital technology enables me to collaborate better with my colleagues on project work and other working/learning activities	○	○	○	○	○	○	○
I frequently obtain help with my work tasks from my colleagues over the Internet e.g. through Skype, Microsoft teams	○	○	○	○	○	○	○
I have good digital technology skills	○	○	○	○	○	○	○

Job Autonomy 1/2

The following statements explore how much autonomy people have in the workplace.

Please indicate how much autonomy you have by responding to what extent you agree with the following statements.

	Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree
I am allowed to decide how to go about getting my job done (the methods I use)	○	○	○	○	○
I have control over the scheduling of my work	○	○	○	○	○
I am free to choose the method(s) to use in carrying out my work	○	○	○	○	○
I am able to choose the way to go about my job (the procedures to utilise)	○	○	○	○	○

Job Autonomy 2/2

The following statements are also about Job Autonomy. Please indicate how much autonomy you have by responding to what extent you agree with the following statements.

	Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree
I have some control over the sequencing of my work activities (when I do what)	○	○	○	○	○
My job is such that I can decide when to do particular work activities	○	○	○	○	○
My job allows me to modify the normal way we are evaluated so that I can emphasise some aspects of my job and play down others	○	○	○	○	○
I am able to modify what my job objectives are (what I am supposed to accomplish)	○	○	○	○	○
I have some control over what I am supposed to accomplish (what my supervisor sees as my job objective)	○	○	○	○	○

You're almost at the end! Only one more topic to go - hang in there!

Information Overload 1/3

The following statements explore levels and types of Information Overload from the workplace. This is the experience of stress or feeling overwhelmed, due to multiple communication and information inputs from either technology or the working environment, which is perceived as too much to cope with or be utilised efficiently.

Please indicate your experience of Information Overload by responding to what extent you agree with the following statements.

	Never	Almost never	Sometimes	Fairly often	Very often
In the last month, how often have you felt overwhelmed with the digital messages you received at work? (e.g., email, work-related channels, and chats)	○	○	○	○	○
In the last month, how often have you forgotten to respond to important digital messages?	○	○	○	○	○
In the last month, how often have you felt pressured to respond to digital messages quickly?	○	○	○	○	○
In the last month, how often have you received more cell phone calls than you can handle?	○	○	○	○	○
In the last month, how often have you felt that you receive more digital attachments than you can handle?	○	○	○	○	○

Information Overload 2/3

The following statements are also about Information Overload. Please indicate your experience of Information Overload by responding to what extent you agree with the following statements.

	Never	Almost never	Sometimes	Fairly often	Very often
In the last month, how often have you felt that you have had to spend too much time maintaining the various information and communication devices you own (e.g., laptops, desktop computers, personal digital assistants)?	○	○	○	○	○
In the last month, how often have you felt pressured to manage several information and communication inputs at the same time?	○	○	○	○	○
In the last month, how often have you felt that you have too many messages (e.g., wall postings, event notifications, personal messages, status updates, and applications) on your social media page to deal with?	○	○	○	○	○
In the last month, how often have you felt that you receive more instant messages than you can handle?	○	○	○	○	○
In the last month, how often have you felt hassled by your commute to work?	○	○	○	○	○

Last one!

Information Overload 3/3

The following statements are also about Information Overload. Please indicate your experience of Information Overload by responding to what extent you agree with the following statements.

	Never	Almost never	Sometimes	Fairly often	Very often
In the last month, how often have you felt that your work activities leave you too little time for recreational activities?	○	○	○	○	○
In the last month, how often have you felt that your work demands make you less sensitive to the needs of others?	○	○	○	○	○
In the last month, how often have you felt that you have too many demands in your home to be able to handle comfortably?	○	○	○	○	○
In the last month, how often have you felt that the demands on you in your workplace exceed your capacity to deal with them?	○	○	○	○	○
In the last month, how often have you felt that your home environment is too noisy?	○	○	○	○	○
In the last month, how often have you felt that your work environment is too noisy?	○	○	○	○	○

You have reached the end of the survey! I greatly appreciate your participation.

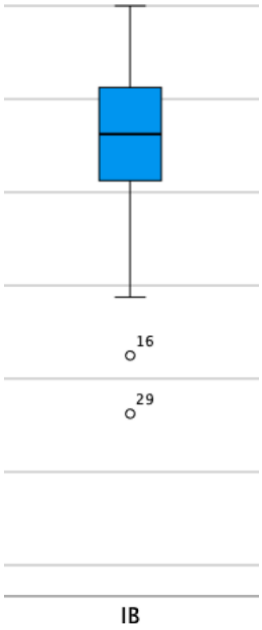
Please press next to submit your responses.

If you have any further questions or comments about this survey or graduate research thesis, please feel free to respond below or contact me at 654166ih@eur.nl.

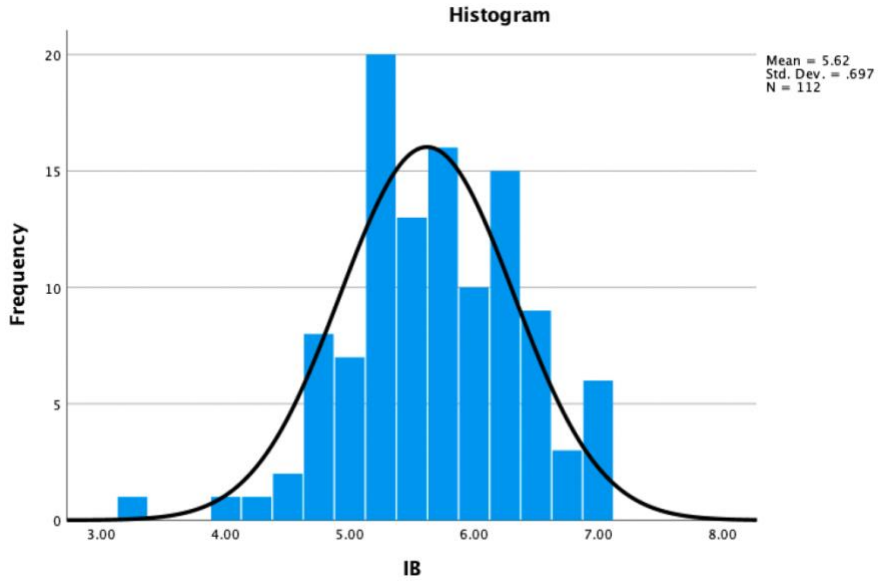
Appendix B

SPSS Output

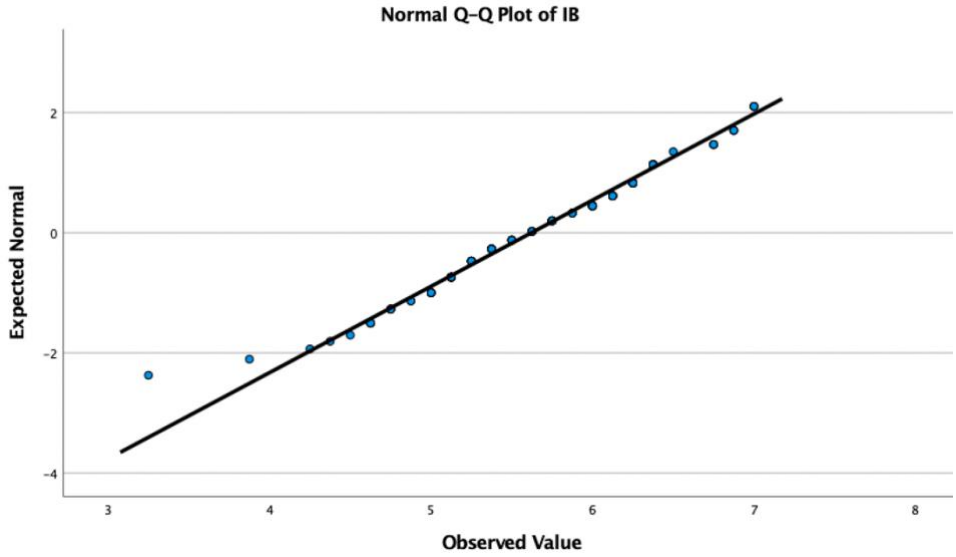
Boxplot of intrapreneurial behaviour for outliers. Data point 29 was excluded, however data point 16 was included.



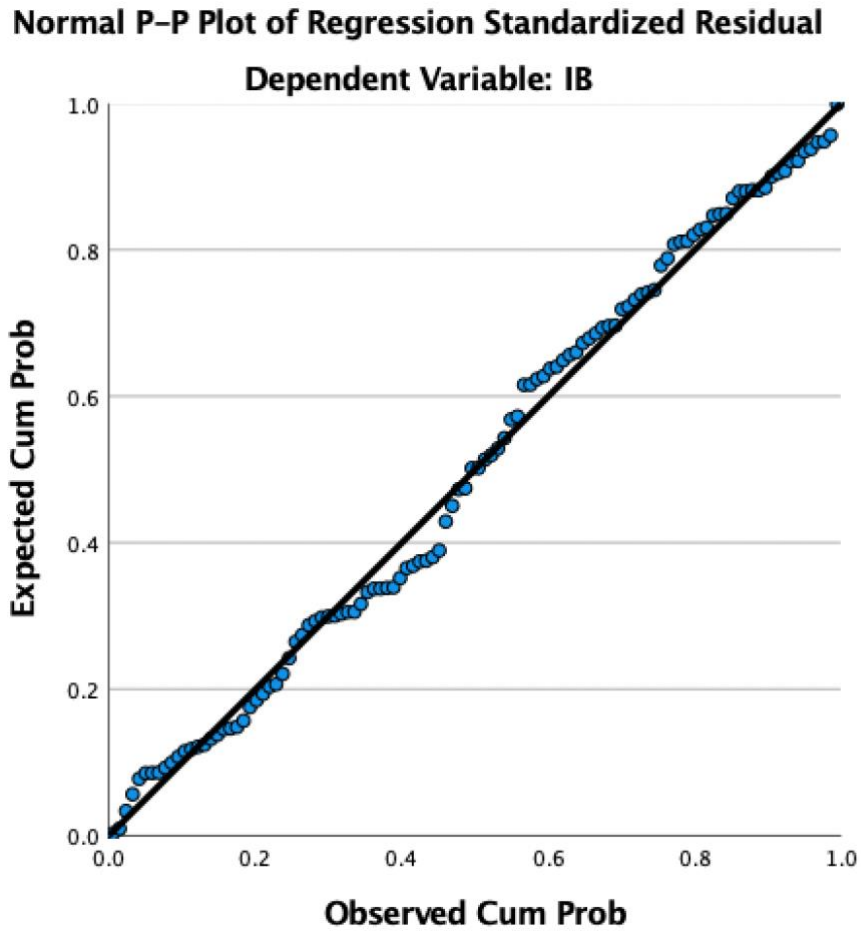
Histogram of residuals for normal distribution assumption



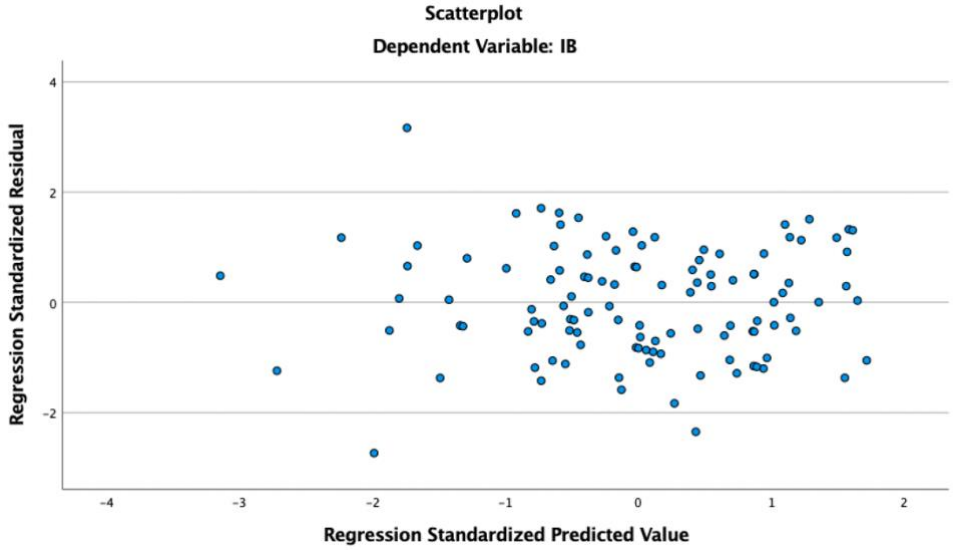
Q-Q plot of residuals for normality assumption



P-P plot for normality assumption



Scatterplot for homoscedasticity assumption



Moderation analysis: The interaction effect of job autonomy on the relationship between digital literacy and entrepreneurial behaviour