Workplace literacy skills—how information and digital literacy affect adoption of digital technology

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Abstract

Purpose – Information and digital literacy have recently received much interest, and they are being viewed as critical strategic organisational resources and skills that employees need to obtain in order to function at their workplaces. Yet, the role of employees' literacy seems to be neglected in current literature. This paper aims to explore the roles that information and digital literacy play on the employees' perception in relation to usefulness and ease of use of digital technologies and consequently their intention to use technology in the practices they perform at the workplace.

Design/methodology/approach – This paper builds a conceptual model with key constructs (information literacy and digital literacy) as new antecedents to the technology acceptance model and aims to establish that information literacy and digital literacy are indirect determinants of employees' intention to use digital technologies at the workplace. The data set used in this paper comprises of 121 respondents and structural equation modelling was used.

Findings – The findings reveal that both information literacy and digital literacy have a direct impact on perceived ease of use of technology but not on the perceive usefulness. The findings also show that both literacies have an indirect impact on the intention to use digital technology at work via attitude towards use.

Practical implications – Managers and decision-makers should pay close attention to the literacy levels of their staff. Because literacies are such an important skillset in the digital age, managers and chief information officers may want to start by identifying which work groups or individuals require literacy training and instruction, and then provide specific and relevant training or literacy interventions to help those who lack sufficient literacy.

Originality/value – This is one of the first studies to consider information literacy and digital literacy as new antecedents of the technology acceptance model at the workplace environment.

Keywords Digitalisation, Information literacy, Digital literacy, Technology, Workplace

Paper type Research paper

Introduction

Digitalisation is radically transforming job design, job resources, professional and economic activities all over the world, which warrant continuous exploration of how workplace

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digitalisation influences employees' engagement (Chan *et al.*, 2021). Digitalisation is the application of digital technologies and infrastructures in business, economy and society (Autio, 2017). Unexpected incidents could also make the digitalisation process even more complex and add new challenges to digital transformation journey (Iivari *et al.*, 2020; König *et al.*, 2020). For example, recent global pandemic situation has added a fair amount of complexity in, e.g. skills needed to execute remote work, activities and operations of the organisations. This is especially a major challenge for organisations which are used to traditional ways of performing their daily and routine activities. To cope with the challenges imposed by the digitalisation, organisations need to develop digital strategies and strive to identify the key success factors for their digital transformation journey (Hess *et al.*, 2016; Vial, 2019). Organisations that are unable to meet the timely and harmonised adoption, implementation and use of technological solutions will, inevitably, fail to flourish or in the worst case to survive. In addition, the real challenge of digitalisation is not merely technology, as introducing new technology into the workplace is not about hardware or software, it is about workforce who need to adopt to change, know how to use technology and their post-adoptive behaviours (Bala and Venkatesh, 2016; Colbert *et al.*, 2016). In this regard, Farrell *et al.* (2021) recently discovered that there is widespread agreement amongst policymakers that the existing workforce's literacies are inadequate to meet the literacy demands of the future workplace.

Therefore, organisations not only must adopt strategies to deal with digitalisation but also need to have a coherent strategy that includes a plan to reskill their workforces (Berger and Frey, 2016; Kane *et al.*, 2019). Moreover, in today's complex information landscape, the concept of literacy goes beyond being able to read and write that an individual either has or is lacking (Bawden, 2001). Literacy is considered as a range of competences [1], knowledge, and skills needed by people in different situations of their lives and through relationships with the colleagues, the communities and the environments in which they interact (Panel, 2002). As such, employers are looking more and more to hire new workforces with a high degree of literacies such as information literacy (IL) and digital literacy (DL) (e.g. Mietzner and Kamprath, 2013) and media literacy (Collard *et al.*, 2017). Such literacies have been identified as essential and generic skills as well as personal attributes in the digital age (Bowen and Johnson, 2019; Farrell *et al.*, 2021; Foster, 2019; Dede, 2010). Thus, it can be argued that to deliver an efficient transformative digitalisation and to become a digital prepared workplace, workplace literacies are necessary for all types of organisations, jobs titles, job design and individuals to enhance and fulfil their task performance, or even be evaluated as a productive employee.

We acknowledge that the terms literacies and skill-based literacies (Bawden, 2001; Stordy, 2015), are more suited to complex information settings, incorporating different types of literacy (e.g. information, digital, media, library and computer). However, in this paper, we will focus on IL and DL as they are primary and essential literacies, which have taken a centre stage in debates of individuals' abilities to access, retrieve and critically analyse the information that flows through digital technology in workplace context. In today's information-based digital era, knowing about information processing and technology enhances not only individual performance, but also organisational performance. In addition, we are aware that there are several definitions of IL and DL in the literature (e.g. Bawden, 2001; Lloyd, 2012; Stordy, 2015), and there are no agreed upon definitions for IL and DL. In this paper, we use the American Library Association definitions of IL and DL, which has produced often-quoted definitions.

IL is defined as a set of abilities to recognise when information is needed, to initiate search strategies to locate, evaluate, assess, analyse and effectively use the needed information, and to make decisions in formal and informal learning contexts, at work, at home and at the educational settings (ACRL, 2017, p. 12; Serap Kurbanoglu *et al.*, 2006). DL is defined as the

ability to use information and communication technologies to find, evaluate, create and communicate information, requiring both cognitive and technical skills (American Library Association, 2012, p. 1). So, while IL deals with information processing, DL is the awareness, attitude and ability of individuals to appropriately use and interact with digital technology (tools) to easily and effectively access information in different formats (e.g. text, videos and images) in a digital environment (Cetindamar *et al.*, 2021; Stordy, 2015; Van Dijk and Van Deursen, 2014).

The need for IL and DL has been highlighted in the literature as a critical dynamic capability of organisations during their digital transformations (Cetindamar *et al.*, 2021), and both literacies are considered as skills based on knowledge, perceptions and attitudes (Bawden, 2001). For example, Gui and Argentin (2011), have emphasised the need for and the relevance of both IL and DL in various workplace settings. Middleton *et al.* (2018), and Somerville *et al.* (2017), highlighted the critical role of literacies to perform tasks to achieve goals, success at workplaces and work performance in general. Moreover, employers are increasingly requiring their employees to acquire and develop critical literacies prior to starting work, as they are needed to meet organisational objectives (Kane *et al.*, 2019), and to cope with increasingly complex information environment at workplace (Raish and Rim-land, 2016; Van Laar *et al.*, 2017, p. 577). Therefore, workforce in digital age not only needs technological skills, but also the ability to adapt to changing and evolving job requirements (Ahmad *et al.*, 2013; Carnevale and Smith, 2013). Such workforces are expected to equip with skills, knowledge and abilities that fill the gap between existing and needed digital competencies (Ancarani and Di Mauro, 2018; Cetindamar *et al.*, 2021; Murawski and Bick, 2017).

From a theoretical perspective, while research on IL and DL mostly focuses on the educational contexts (e.g. Jang *et al.*, 2021; Mohammadyari and Singh, 2015; Ng, 2012), at the workplace context there are limited contributions where IL and DL are conceptualised and integrated into traditional models such as technology acceptance model (TAM: Davic, 1989). We also recognise that there is a wealth of research on intention to use technology and acknowledge that there are a large number of important contributions helping to understand what drives intention to use technology. However, given the importance of literacies at workplace, this paper aims to examine how IL and DL would impact employees' intention to use digital technology. In other words, it is not the aim of this paper to explain adoption/acceptance better, as the usage of these digital technologies in the workplace is now a common thing. Instead, the aim is to understand how IL and DL can be conceptualised at workplace context and how they influence the use of technology at the workplace. The next theoretical advance is to understand the explanatory power (if any) of these literacies on well-established theoretical models on the usage of digital technologies. In this way, our contribution is towards the literacy theory, examining the explanatory power of the IL and DL as a separate construct in a theoretical domain of technology acceptance.

Therefore, we include IL and DL as new antecedents of the TAM model (Davis, 1989). We argue that both IL and DL directly influence the TAM determinants, (perceived usefulness: PU, perceived ease of use: PEoU, and attitude towards use: ATU). Thus, IL and DL indirectly affect the intention to use technology at workplace mediated through the ATU. However, we are aware that the impact of literacies may depend on the type of technology (e.g. newness). If an employee knows well about the information environment (IL) and is able to use technology to retrieve and access information (DL), they may have a better understanding of technology, and find it easier to use (PEoU), therefore appreciating the usefulness (PU).

This paper contributes to both literacy and technology acceptance literature by providing a grounded understanding of the relationship between IL, DL, ATU and intention to use digital technology at workplace. The question directing this research is "*what role does information and digital literacy play in the intention of employees to use digital technology at*

workplace?" To answer the question, we conducted empirical research, and collected data from respondents working in different workplaces in Finland. The data were analysed using partial least square structural equation modelling (PLS-SEM) technique. This paper expects to contribute to literature, by fostering the understanding of and adding essential knowledge about conceptualisation of IL and DL at workplace context. The remainder of the paper is laid out as follows. The following section will provide background information, followed by a theoretical discussion and the development of hypotheses. Then, we provide the research methodology and discussion of the results and the major findings. Finally, discussion and conclusion are presented followed by discussion on future work suggestions and limitations.

Literature review

In workplaces, information and knowledge are seen as providing a competitive advantage in business and in service provision. Therefore, information literate employees who can locate, evaluate and effectively use information) are an increasingly important strategic resource for organisations (Kirton and Barham, 2005; Lloyd, 2003; Middleton and Hall, 2021; Oman, 2001). Moreover, as information technology has become more flawless and user-friendly (Bilgihan, 2016), it is increasingly important to consider how individuals can interact with and apply the information at workplace context, which advanced technology makes accessible. In a workplace context, where individuals, specifically older generations of workforces, continue to resist adopting information technology (Lapointe and Rivard, 2005), the constant demand for decision-making and problem-solving abilities demonstrates the necessity for a highly skilled, competent and adaptive workforces (Simao and Franco, 2018; Renta-Davids *et al.*, 2014). Such abilities are needed next to the ability to interact with technology and information effectively (Urena *et al.*, 2019). In addition, with the rapidly changing landscape of digital technology at workplaces and demands of local, state, national and global economies (Nafukho *et al.*, 2017), employees are expected to be not only information literate, but also be equipped with other types of literacies, such as ICT literacy, technology literacy, media literacy, net/online literacy (Kasemsap, 2018; Marsh, 2018). These broad arrays of literacies enable workers to interact with technology and understand what the technology is and how to use it (Cetindamar *et al.*, 2021).

The importance of DL cannot be neglected, given today's modern workplaces. Eshet (2004, p. 100), argued that "to succeed in today's working environment, individuals must be able to use a diverse range of technologies". The author asserted that "DL includes a large variety of complex cognitive, motor, sociological, and emotional skills, which users need to function effectively in digital environments" (p. 93). Hunter (2018) also argued that in the digital era and in the workplace context, DL goes beyond functional IT skills and includes a richer set of digital behaviours, practices and identities, and that DL involves more than the mere ability to use software or operate a digital device. Furthermore, Ng (2012), introduced a framework of DL to investigate the ease of using unfamiliar digital technology amongst students in the educational context. The author found that for digital native (debatable concept) students, the technical aspects of unfamiliar technologies were not of foremost concern and concluded that if individuals are given the opportunity to engage with a purpose for adopting digital tools, they will be able to use and apply them in more appropriate and meaningful ways (Ng, 2012, p. 1077).

The workplace poses a specific context that affects the role of IL and DL, compared to; for instance, the educational context. Some studies (e.g. Colbert *et al.*, 2016) have shown that, in the digital era, different views exist on how employees perceive the impact of technology in their day-to-day activities. For example, Kohnke (2017) stated factors that influence the new generation of workforces' intention to use digital technologies might be different from others at workplaces. The individuals with low literacies are less likely to be critical about the

usefulness of technology or may find it difficult to use the work-related technology. Whereas those with higher literacies may be more confident to adopt the technology and establish a positive attitude towards the use of technology (Cetindamar *et al.*, 2021). Mohammadyari and Singh (2015), asserted that individuals with higher literacies would find the cognitive challenges of using different technology less difficult because they may be familiar with the content, interfaces, access choices, terminology and norms of new tools, amongst other things. Forster (2017) also argued that the new generation of workforces uses a wider range of new approaches to deal with information at the workplace and evaluate their interactions with information differently in terms of meaning, value, practices, and purpose. According to Forester (2017), at the workplace context, failure to access and use the most up-to-date and relevant information is not only a professional but also an ethical failure. At the workplace, IL, which is facilitated by a variety of business applications and ICT technologies, is a means to an end, and employees must interact with information both individually and with others to create business values. In contrast, in the educational setting, higher literacies help students to better understand the process of finding, analysing, summarising, integrating and presenting information for the learning and research objectives (Cheuk, 2017). In the workplace context, literacies are central to both personal and organisational performance and success, and are more context-specific, founded in practice rather than norms and generic guidelines, less structured and more collaborative than in higher education (Goldstein and Whitworth, 2015, p. 71).

Theoretical model and hypothesis development

To assess and evaluate the antecedent of intention to use technology at workplace, we draw on conventional acceptance theory (i.e. TAM) and integrated both IL and DL as new antecedents into the research model. In the following sub-sections, we motivate and justify our choice of theory and postulate several hypotheses depicting the path relationships in the research model (Figure 1).

Information literacy and digital literacy

Yu *et al.* (2017, p. 198) argued that IL enables people to master information content and extend their investigations to recognise when information is needed, and to effectively locate, evaluate and use the needed information. Ng (2012) argued that an information literate person is a critical thinker who can locate, and productively evaluate web-based information. Both Yu *et al.* (2017), and Ng (2012), studies are in line with the definition of IL provided by ACRL (2017, p. 12), where both studies refer to individual's abilities and skills required to operate in our contemporary complex information environment. In addition, the requirements for becoming an information literate may not be common in all contexts, but the ability of the workforce to effectively use information, locate, evaluate, store, retrieve and communicate is

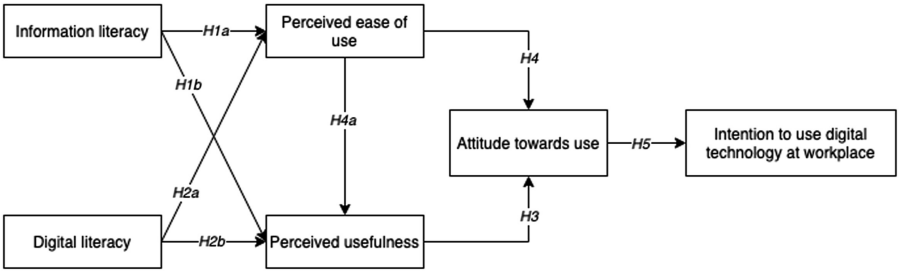

Figure 1.
Research model

vital to the success of any organisation (Kirton and Barham, 2005). In the workplace context, one of the main causes for the workforce's low level of IL is a lack of effective IL training preparation (Gilbert, 2017; Kirton and Barham, 2005). Naveed and Rafique (2018), for example, investigated the scientists' IL and discovered that while they were confident and knowledgeable in using searching tools and electronic information services, they were less confident in understanding and evaluating the quality of the information they collected. The authors concluded that workplaces must have standardised IL preparation and instruction programmes for their employees to improve their IL. In addition, Chang *et al.* (2020, p. 7) studied the impact of IL of nursing workforce and found that IL had a positive effect on their attitude, performance and effort expectancies, and thereby enhances the nursing information systems usage intentions.

While IL is an overarching concept for describing a persons' ability to manage and use information for different purposes, DL focusses the interaction with technology and the use ICTs to search, find and the use of information. For example, Gilbert (2017) not only found that organisations require generally diverse types of IL, which are the ability to use various resources and tools, to synthesise information, to evaluate information, to use information in practice, and to collaborate with colleagues, but also discovered that digital skills are highly expected from the workforces in the virtual world.

From a theoretical standpoint, Durodolu (2016), adopted the TAM model and found that the employees' resistance to information systems is the main factor for the failure of adoption of new technology in attaining IL. Moreover, Yoon (2016), found that both construct of TAM (i.e. PU and PEoU) had significant impact on the user's attitude and their intention to use mobile library applications. Booker *et al.* (2012), also used the TAM model and found that the amount of IL instruction and education considerably influence business students' attitude towards and intention to adopt online library resources. In addition, Oluwajana and Adeshola (2021), used the unified theory of acceptance and use of technology (UTAUT) model in higher education context, and found that students' perceptions of DL had a positive and significant impact on their attitude and behavioural intention to utilise digital learning tools. In addition, Nikou *et al.* (2019), and Nikou and Aavakare (2021), also in the educational context, investigated how DL impacts individual's intention to use digital technology and found that DL positively impacts the intention to use digital technologies for learning and teaching. Mohammadyari and Singh (2015), investigated the impact of DL on the employees' intention to use technology in small and medium-sized enterprises (SMEs) context and found that DL significantly impact the users' performance and intentions to use Web 2.0 tools.

Moreover, according to Ng (2012), a digitally literate individual possesses the technical and operational skills to use technology for various reasons, since DL is a system of skills and strategies employed by learners and users in digital settings. The author stated that DL is an intersection between three dimensions of technical, cognitive and social-emotional (Ng, 2012). In terms of technical dimension, employees are expected to be knowledgeable with the use of ICTs and have the ability to properly operate digital technologies such as the internet, computers, company's internal Web portals (intranet) and platforms in their workplace. Cognitive dimension refers to the ability to operate digital technology critically, being able to evaluate and properly manage digital information. Ng (2012) and some other authors stated that such ability significantly increases network navigation and help to avoid disorientation issues, and improve the knowledge building ability (Eshet, 2004, p. 100; Lee and Hsu, 2002). Therefore, such competence necessitates an employee's knowledge of ethical and moral issue problems, as well as the ability to assess the validity of resources (e.g. copyrights and plagiarism) (Ng, 2012, p. 1068). Finally, the social-emotional dimension involves being able to use Internet responsibly for communicating, socialising and learning, respecting others' privacy and adhering to ethical rules in different contexts and environments (Ng, 2012, p. 1068).

All in all, in the workplace context, we argue that both IL and DL affect workforce's perception of ease of use and but not the perception of usefulness of the technology. This is mainly due to the assumption that higher literacies may make people more critical, and hence less convinced. However, this depends on the type of technology and the quality. For instance, a badly designed technology may receive critical reception from individuals with higher literacies, whereas a well-designed one may be appreciated by individuals with higher literacies. In other words, an individual with high level of literacy is confident enough that she or he can use newly introduced technology at workplace but might be sceptical about it usefulness unless using the technology in practice, hence:

H1a. IL has a positive effect on ease of use of the technology at workplace

H1b. IL has no effect on the usefulness of the technology at workplace

H2a. DL has a positive effect on ease of use of the technology at workplace

H2b. DL has no effect on the usefulness of the technology at workplace

Perceived usefulness and perceived ease of use

TAM (Davis, 1989) is an established and widely used theoretical model in research on acceptance and adoption of new technological solutions both at the individual and organisational level. The determinants in the model are PU (subjective perception of users where they believe that using certain technologies can improve the performance of their work), PEoU (subjective perception of users who believe that using a particular system will be free from effort) and ATU (Davis, 1989). In this research, we focus on these main determinants of technology acceptance, while we could use and employ other adaptation or extended model of TAM such as UTAUT and UTAUT II (Venkatesh *et al.*, 2003, 2012). The main reason of such conceptualisation is the core theoretical aim of this research, which is adding IL and DL into an established theoretical model, and assessing the role that these literacies, through the TAM determinants, play on the intention to use technology at workplace. Prior studies showed that PEoU has a significant effect on the PU (Sun *et al.*, 2009), and that both PU and PEoU have a positive impact on the ATU of technology (Fagan *et al.*, 2008). Although the core relations in the TAM model are well-tested, we include them here as hypotheses as we aim to examine whether IL and DL indirectly affect attitude, mediated through PU or PEoU. Murray (2011), in a study of cross-generational workforce stated that it comes as no surprise that different generations respond to and utilise emerging technology in different ways. According to the author, as more millennials take on leadership roles, their ATU of technology will lead to different leadership standards than their predecessor generation, hence:

H3. PU has a significant effect on ATU of technology

H4. PEoU has a significant effect on ATU of technology

H4a. PEoU has a significant effect on PU

Attitude towards use

In a study of employees' ATU of technology in hospitability context, Solnet *et al.* (2012), found that individuals born between 1979 and 1994, exhibit different attitude to previous generations of employees entering the workforce and found that they embrace technology differently and takes electronic collaboration for granted (Solnet *et al.*, 2012). Moreover, Cai *et al.* (2017) in their meta-analysis on ATU of technology found that men exhibit more favourable attitude towards technology use than women and found that the attitudinal

differences towards technology use are often based on the individual characteristics such as age, gender and educational status, but the level of technology competency has often higher impact on the ATU of technology (p. 10). Oh *et al.* (2019) studied employees' attitude towards use of smart factory technology (e.g. big data technology, automation technology and supply chain integration technology) and found that employees with more favourable attitude towards technology tend to be more positive to experience and use new technology. The authors concluded that the success of a business heavily depends on organisation and individual related factors such as employees' ATU of technology and perceived ease of technology use (Oh *et al.*, 2019, p. 13).

Moreover, Ng (2012), studied students' attitude towards using e-learning technology in their learning before and after a course and did not find significant differences in the students' attitude; however, it was found that students were more positive towards using the technology in the learning after the course ended. Finally, Kimiloglu *et al.* (2017), used a sample of 106 of the top 500 corporations in Turkey and studied the ATU of e-learning technology for corporate training and found that most companies had a positive ATU of e-learning technology as they perceive advantages by infusing it into their established practices (Kimiloglu *et al.*, 2017, p. 347), hence:

H5. ATU has a positive effect on the intention to use technology at workplace

Intention to use technology at workplace

In this paper, intention to use technology at workplace is the dependent variable. Gu *et al.* (2013), conducted research on the antecedents that influence technology acceptance and discovered that the difference in technology adoption is dependent on how people use technology and how essential they find it to be. Moreover, Behringer and Sassenberg (2015), surveyed 315 employees within an organisation to determine if they intent to adopt new and emerging technologies at their workplace. The findings showed that positive intention could have an impact on employees' future usage of technology for exchanging knowledge within the organisation. Thus, the research model uses intention to use technology at the workplace as a dependent variable, see Figure 1.

Research methodology

We did not restrict the data collection on any particular sector, workplace domain, or company since this was an exploratory study. An online survey questionnaire was created to collect data before distributing the final version of the survey; we conducted a pilot study with 15 experts (industry and academic experts) to get their feedback on the clarity of the questions in the survey. We used a list of businesses and companies where Finnish workforces are registered in designated platforms to collect data and invitations were sent to potential respondents using that list. We also requested some employees' associations in Finland to share and post a link to the survey on their social media pages. The participants were then asked a series of questions about their personal characteristics (age, gender, education and type of organisation or industry sector).

Measures and survey instruments

Theoretical constructs were operationalised using validated items from prior research (see Appendix), some minor adjustments were made to better adapt to the context of this research. PU (five items) and PEoU (six items) were derived from Davis (1989). For measuring ATU of digital technology at workplace, five items were derived from Ng (2012). For example, "I like using digital technologies for working and learning", "I work/learn better with digital technologies". For measuring intention to use technology, we used seven items derived from

Lin and Lu (2011), and Venkatesh *et al.* (2003). For example, we asked questions such as "I would expect to use digital technologies to seek for information", or "I will continue using digital technologies in the future". The literacies scales, DL with ten items and IL with seven items were derived from (Ng, 2012; Serap Kurbanoglu *et al.*, 2006). For DL, we asked, e.g. "I know how to solve my own technical (ICT related) problems", or "I know about a lot of different digital technologies" or "digital technology enables me to collaborate better with my colleagues on project work and other working/learning activities". For IL, we asked "I am sometimes unsure of how much information I need for solving work related problems" or "I can determine the authoritativeness, correctness and reliability of the information". All items were measured on a 7-point Likert scale, where "1 = strongly disagree" to "7 = strongly agree" and SEM using SmartPLS was used to analysis the data.

Data collection and descriptive statistics

In the course of four weeks, a total of 210 survey invitations were sent, and 121 complete questionnaires were returned. As suggested by Hair *et al.* (2011), we performed the non-response bias test, comparing the first 25% of respondents with the final 25% of respondents for all survey items using the chi-square test. The non-response bias test result showed that the respondents do not differ significantly, thus we concluded that data are not biased.

Of the respondents participating in this research 61% ($n = 74$) were men and 37% ($n = 45$) were women, two respondents did not indicate their gender. The average age of the respondents was 36.7 years old with a minimum being 21 and a maximum being 64 years old. Most of the respondents had either a bachelor's degree or a master's degree (see Table 1). When we asked respondents to choose a category that best describes the industry they work for, 20% mentioned they work in the educational institutions, 15% mentioned they work for the scientific and technical service organisations and 11% mentioned they work for a software company. The rest indicated working for, finance and insurance, retail, construction, mining, information services and data processing. Moreover, 80 (66%) respondents indicated that they work for the private sectors, 30 respondents worked for the public sectors and only five respondents indicated they work for non-profit organisations, see Table 1.

We also asked respondents to rate "1: Not proficient at all, 4: Neutral and 7: Very proficient", their proficiency with using digital devices, software and applications. Table 2 shows that respondents have scored above the average in all items. For instance, over 74.4% of them mentioned they were proficient or very proficient with MS Office, and as much as 61% mentioned they were proficient or very proficient with file sharing applications (e.g. Dropbox).

	N	Percentage
Education		
High school diploma	7	5.8
Bachelor's degree	37	30.6
Master's degree	64	52.9
Ph.D	10	8.3
Other	3	2.5
Type of organisation or industry sector		
Public sector (e.g. government)	30	24.79
Private sector (e.g. businesses, individuals)	80	66.12
Not-for-profit sector	5	4.13
Other	6	4.66

Table 1. Demographic information

Data analysis and measurement model results

Gefen and Straub (2005) recommended analysing the path relationships in the research model following first the measurement model and then the structural model. All indicators (survey items) were reflective in our model; therefore, we assessed the reliability and validity of the items (Hair *et al.*, 2013), by examining the outer loadings, composite reliability and average variance extracted (AVE) analysis. As indicated by Hulland (1999) the values of outer loadings should be above 0.70, in this paper all indicators were loaded on their respective constructs with primary loadings of 0.70 or above (see Table 3). However, items IL2, DL10 and INT7, from IL, DL and intention to use were removed due to low factor loading threshold. But it should be noted that this does not create any validity issues, as we have enough number of items in those constructs. Moreover, the items are reflective, meaning that one item can be replaced for another without affecting the meaning of the scale. The low value of factor loading indicates that the item did not measure its respective construct.

Moreover, composite reliability (CR) test examining the internal consistency was computed and all values were all above the threshold of 0.70 (Hair *et al.*, 2011) or higher with the minimum of 0.878. Also, we performed convergent validity test by computing the AVE values for each contruct. The results showed that all values were above the recommended value of 0.50 (Bagozzi and Yi, 1988), with the minimum value of 0.591 for IL.

To examine the internal consistency of latent constructs, Cronbach's alpha values were assessed, and the results showed that all constructs had higher value above the recommended threshold of 0.70. Nevertheless, as indicated by some authors (e.g. Bagozzi and Yi, 1988; Hair *et al.*, 2012), Cronbach's alpha (α) tends to provide a conservative measurement in PLS-SEM and it is often used to measure internal consistency reliability; therefore, it is recommended to use the CR as a replacement (Hair *et al.*, 2012), see Table 3.

We also checked the common method bias (CMB), to see if any bias attributed to the measurement method could be found by following two different approaches. In the first approach, we computed Harman's one-factor test, as recommended by Podsakoff *et al.* (2003). The test result showed that none of the constructs had a value of more than 50% of the variance. In the second approach, the CMB was assessed via the common latent factor (CLF) technique. Podsakoff *et al.* (2012) argued that the CLF provides a more robust understanding of the CMB than from Harman's one-factor test. So, we compared the chi-square values of two models: unconstrained model and a model where all the paths were constrained to zero. The result showed that no path in the model was affected by CMB.

Finally, the discriminant validity test was computed to assess for the uniqueness of a measuring construct, using the value of the square root of AVE in each latent variable Henseler *et al.* (2015). The results indicated that data are free from discriminant validity issue (Fornell and Larcker 1981) and provided evidence suggesting reasonable discriminant validity in the data, see Table 4.

Table 2.
Proficiency with digital technology/ applications at workplace

Digital technology/application	Mean
Microsoft Office	5.98
File sharing (e.g. Google Drive, Dropbox)	5.72
Mobile devices organiser (e.g. address book, calendar)	5.75
Email services (e.g. Outlook, Gmail)	6.26
Social media (e.g. Facebook, Instagram)	5.62
Microsoft Teams	3.79
Skype for business	4.97
ERP system	2.6

Construct	Items	Factor loadings	Mean	Std	Cronbach's α	CR	AVE
Perceived usefulness	PU1	0.89	5.90	1.22	0.94	0.95	0.81
	PU2	0.93	5.91	1.17			
	PU3	0.92	5.88	1.13			
	PU4	0.89	6.07	1.06			
	PU5	0.85	6.22	0.99			
Perceived ease of use	PEoU1	0.86	5.82	1.14	0.92	0.95	0.72
	PEoU2	0.82	5.45	1.24			
	PEoU3	0.86	5.71	1.11			
	PEoU4	0.80	5.42	1.19			
	PEoU5	0.86	5.72	1.14			
	PEoU6	0.86	5.69	1.19			
Digital literacy	DL1	0.89	5.26	1.47	0.93	0.94	0.64
	DL2	0.87	5.69	1.29			
	DL3	0.82	5.24	1.41			
	DL4	0.80	5.00	1.45			
	DL5	0.75	5.79	1.17			
	DL6	0.86	5.60	1.34			
	DL7	0.72	6.02	0.98			
	DL8	0.79	5.69	1.29			
	DL9	0.70	5.99	0.99			
Information literacy	IL1	0.75	5.64	0.93	0.83	0.88	0.59
	IL3	0.74	5.38	1.09			
	IL4	0.70	5.17	1.44			
	IL5	0.80	5.35	1.33			
	IL6	0.85	5.48	1.08			
Intention to use	INT1	0.76	6.38	0.97	0.92	0.94	0.72
	INT2	0.87	6.52	0.78			
	INT3	0.91	6.49	0.81			
	INT4	0.89	6.53	0.80			
	INT5	0.80	6.59	0.76			
	INT6	0.77	6.68	0.72			
Attitudes towards use	ATU1	0.82	6.17	0.93	0.88	0.91	0.68
	ATU2	0.86	5.74	1.17			
	ATU1	0.81	5.55	1.30			
	ATU2	0.84	5.26	1.30			
	ATU5	0.79	5.73	1.14			

Table 3.
Reliability and validity

Construct	ATU	DL	IL	INT	PEoU	PU
Attitude towards use	0.82					
Digital literacy	0.55	0.80				
Information literacy	0.53	0.58	0.77			
Intention to use digital technology	0.40	0.48	0.46	0.84		
Perceived ease of use	0.59	0.76	0.68	0.54	0.85	
Perceived usefulness	0.58	0.48	0.43	0.45	0.53	0.90

Table 4.
Discriminant validity

We assessed the discriminant validity using the heterotrait-monotrait (HTMT) ratio of correlations to establish that a reflective construct has the strongest relationships with its own indicators. The results of HTMT showed no issue that our data suffers from discriminant validity, see Table 5.

Structural model results

To test the research hypotheses and examine the path relationships between constructs in the model, SEM technique was employed. The SEM results showed that the intention to use digital technology at workplace was explained by variance of 21% and attitude towards use (ATU) was explained by variance of 52%. The SEM results showed that both IL ($\beta = 0.36$, $t = 4.297$, $p < 0.001$) and DL ($\beta = 0.55$, $t = 6.447$, $p < 0.001$) had a significant effect on the PEoU; therefore, both H1a and H2a were supported by the model (Figure 2).

As expected, the SEM results show that neither IL nor DL has any significant effect on PU; therefore, both H1b and H2b were supported by the model. In addition, the SEM results reveal that both PU ($\beta = 0.37$, $t = 4.427$, $p < 0.001$) and PEoU ($\beta = 0.39$, $t = 5.483$, $p < 0.001$) significantly influence ATU; therefore, both H3 and H4 were supported by the model. In addition, the path between PEoU and PU ($\beta = 0.33$, $t = 2.058$, $p < 0.05$) was found to be significant; therefore, H4a was supported by the model. Finally, the path relationship between ATU and intention to use technology at workplace was found to be significant ($\beta = 0.40$, $t = 5.136$, $p < 0.001$); thus, H5 was supported as well.

We also tested the mediation result, accounting for the role ATU play between IL and DL to intention to use technology at workplace. The results showed that there are indirect effect of IL and DL to intention to use, mediated through ATU, such that IL ($\beta = 0.08$, $t = 2.525$, $p < 0.01$), and DL ($\beta = 0.11$, $t = 2.819$, $p < 0.05$), both indirectly influence the participants' intention to use technology at workplace. It should be noted that both effects are through PEoU, and we did not find any mediation effect through the PU.

Discussion

According to Prensky (2001a, b), one of the main reasons for the disparity in perceptions of technology's impact is that many employees come from a generation that is essentially resistant to change. As such, this may cause a divide between workforces who embrace digital technologies and those who do not, necessitating the need to study IL and DL in

Table 5.
Discriminant validity, HTMT approach

Construct	ATU	DL	IL	INT	PEou	PU
Attitude towards use						
Digital literacy	0.59					
Information literacy	0.61	0.66				
Intention to use digital technology	0.43	0.52	0.51			
Perceived ease of use	0.64	0.82	0.77	0.58		
Perceived usefulness	0.63	0.51	0.47	0.48	0.56	

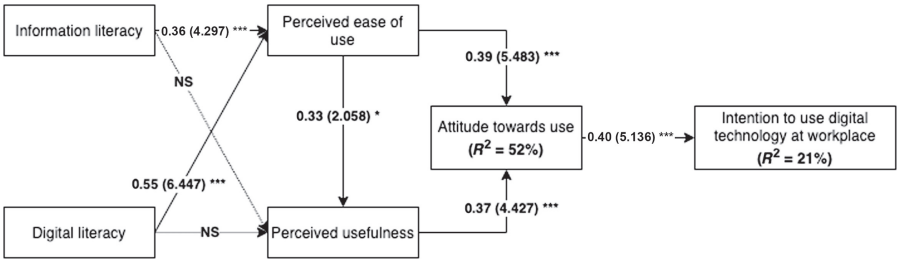

Figure 2.
Conceptual model results

Note(s): *$p < 0.05$. **$p < 0.005$. ***$p < 0.001$

relation to technology acceptance. However, we acknowledge that there is fairly strong (Kirschner and De Bruyckere, 2017) and seems to be widespread debate about the Prensky's classification of individuals based on their age as digital natives and digital immigrants (Vodanovich *et al.*, 2010; Wang *et al.*, 2012), suggesting that the terms need to be refined further through more extensive research on individual's interactions with information, and digital technology. Therefore, in this paper, we developed a conceptual model, integrating IL and DL as antecedents of TAM model to examine the intention to use technology at the workplace. The SEM results reveal that both dimensions of modern literacies, i.e. IL and DL significantly, but indirectly, impact the intention to use technology at workplace context.

We also found that while IL and DL both positively influence the perception of ease of use (PEoU) technology, they do not have any impact of the employees' PU of technology. A plausible reason for such results could be as if an individual knows better how to use technology, or how to process digital information, then it seems easier to her or him to use the digital technologies at workplace. Whereas the technology does not become directly more useful if she or he knows how to use technologies. To put it another way, we argue that individual with higher level IL and DL are more comfortable to use digital technology to retrieve information from information sources. A potential explanation is that people that understand how to retrieve information from (digital) technologies find it easier to use these technologies. Possibly, highly literate workers are more comfortable dealing with technologies, making them more positive about the expected ease of use. Arguably, the impact could differ between technologies: well (or poorly) designed technologies may in fact be recognised to be so by highly literate workers, and thus be evaluated more positively (or negatively) on ease of use. In our study, we focussed on well-known and established workplace technologies, and it would be interesting to replicate our findings for novel technologies that have not yet found their dominant design.

Another interesting finding is that, in line with our expectation, literacies have no influence on the PU of digital technologies in the workplace environment. Apparently, workers do not evaluate the utility of technologies, for instance for achieving their tasks, in light of their literacy skills. This interpretation lends support to a core idea in the TAM model, which is that ease of use and usefulness are separate concepts, and that ease of use is a necessary yet not sufficient condition for usefulness. Alternatively, the literacy skills play no role in the assessment of utility of a technology. This would imply that workers need no literacies in order to appreciate (or disapprove of) the usefulness of a technology to achieve their goals. Once more, a caveat is the type of technology being discussed: for well-designed and appropriate digital technologies, workers with high literacies may be more appreciative of the usefulness, while the same highly literate workers may be more capable of seeing through less appropriate technologies.

The findings also revealed that both IL and DL influence the development of a positive attitude towards the usage of technology at work via PU and PEoU. This is an interesting result, as we found a significant positive relationship between attitude towards technology use ($\beta = 0.40$, $t = 5.136$, p 0.001), and intention to use technology at workplace.

These findings point to the relevance of workplace literacy and show that employees' IL and DL may have direct impact on their personal achievement and organisation performance. As a result, a greater understanding of technology acceptance in the workplace may aid in better predicting the use of new information resources. In addition, our findings regarding the impact of IL to workforce's intention to use technology supports earlier findings of Durodolu (2016), who also indicated that IL has a significant effect on adoption of new technology. The results obtained in this paper are also in line with Yu *et al.* (2017), who also found that both IL and digital skills impact adoption behaviour and concluded that the level of IL of the individuals is an important factor. The results also showed that our proposed conceptual model is an appropriate model for literacy research at workplace context, and differs to some

extent, to educational models, as the effect of both IL and DL in workplace is central to both professional and organisational performance. Our findings are similar to Forester's (2017), who argued that at workplace context, ability to access and use of relevant information is directly associated with the professional and also organisational achievement.

Conclusion

This is one of the first studies which includes IL and DL as new antecedents of TAM in the workplace context measuring the workforce intention to use digital technology. Building on the IL and DL, we theoretically contribute to the acceptance literature by showing that these two dimensions of literacy in modern workplace impact workforces' decisions to use digital technology at their workplaces. Given that the inclusion of IL and DL, in addition to PU and PEoU explained as much as 52% of the variance in the ATU of technology, we argue that we may be approaching the possibility to explain individuals' decision to use digital technologies in the workplace context. This paper additionally contributes to the literature by making a case for the importance of conducting literacy related IS research in workplace context. We also contribute to research stream on literacy by showing that although age character has commonly been used as a denominator to classify individuals as digital natives and digital immigrants and use of digital technology (e.g. Nikou *et al.*, 2019), other influential factors such as perception of IL and DL could be used instead to assess the intention to use technology at workplace context (Paganin and Simbula, 2021). Such findings represent fresh theoretical contributions to the literature on literacy and technology acceptance.

Our research results also provide some practical implications. For example, decision makers and managers should pay a careful attention to their employees' literacy levels. As literacy skills are critical skillset in the digital age, managers or chief information officers may first aim at identifying the work groups or individuals who needs literacy training and then aim at providing specific and relevant training or literacy instruction to enhance those with a low level of literacy. This is important as employees' literacy skills will have a significant impact on organisations that rely on a skilled workforce to stay competitive in the digital age (Farrell *et al.*, 2021). The importance of literacies skills can further be emphasised as interests in such skills in the workplace continues to grow (Forster, 2019), as well as in many workplaces job performance dictates that employees should be competent and keep skills up to date (Ali and Richardson, 2018). Furthermore, the findings of the study may help managers in comprehending how and why IL and DL are important, particularly as new generations enter the workforce. In addition, managers can ensure that their employees' anxiety when encountering new tools is reduced by creating an environment where digital technology engagement can be built and strengthened. This allows them to interact with new technologies more easily and comfortably (Tufts, 2010; Vodanovich *et al.*, 2010). Another implication is that, for managers faced with low literacies amongst their workforce, they should demonstrate the ease of using digital technologies, and not the usefulness of those technologies. In other words, scarce resources should not be spent on convincing workers that a digital technology is helpful for their purposes. Instead, those resources should be spent on teaching how to use the technology or convincing workers that a technology requires little effort to learn.

It is also necessary to discuss the limitations of this research. For example, using self-report to evaluate both dependent and independent variables raise questions regarding the validity of causal inferences due to systematic answer distortions, method variance bias and survey items' reliability and validity. We did, however, control for potential bias by doing rigorous statistical analyses to ensure our data were free of it. Furthermore, the participants studied in this study are assumed to have a high degree of DL and IL skills. This assumption is supported by Sulkunen and Malin's research (2018), who found that, in

terms of literacy proficiency, adults in Finland exceed many other countries in the world, including their peers in other Nordic countries. Nonetheless, we recommend that future study include other participants with lower or higher literacy skills who may demonstrate different behaviours on the path relationships proposed in the research model. Further studies could examine how other socio-demographic factors influence the employee's decision to use digital technologies in their workplaces. Finally, while the aim of this study was to look into the impact of IL and DL on intention to use, future studies could look into if using technology increases IL and DL and test whether this assumption is theoretically correct in other words testing the causality. Needless to mention that our sample size was rather small, and future studies with a larger sample size could replicate our research to see if other and different results could be gained.

Note

1. http://uis.unesco.org/en/glossary-term/literacy

References

Ahmad, M., Karim, A.A., Din, R. and Albakri, I.S.M.A. (2013), "Assessing ICT competencies among postgraduate students based on the 21st century ICT competency model", *Asian Social Science*, Vol. 9 No. 16, pp. 32-39.

Ali, M.Y. and Richardson, J. (2018), "Workplace information literacy skills: library professionals' competency at university libraries in Karachi, Pakistan", *Information and Learning Science*, Vol. 119 Nos 7/8, pp. 469-482.

American Library Association (ALA) (2012), *Digital Literacy, Libraries, and Public Policy: Report of the American Library Association Digital Literacy Task Force*, ALA, Chicago.

Ancarani, A. and Di Mauro, C. (2018), "Successful digital transformations need a focus on the individual", in Schupp, F. and Wöhner, H. (Eds), *Digitalisierung im Einkauf*, Springer Gabler, Wiesba-den, doi: 10.1007/978-3-658-16909-1_2.

Association of College and Research Libraries (2017), *Framework for Information Literacy Sandbox*, American Library Association, available at: http://sandbox.acrl.org/.

Autio, E. (2017), *Digitalisation, Ecosystems, Entrepreneurship and Policy, Perspectives into Topical Issues is Society and Ways to Support Political Decision Making*, Government's Analysis, Research and Assessment Activities Policy Brief, Vol. 20.

Bagozzi, R.P. and Yi, Y. (1988), "On the evaluation of structural equation models", *Journal of the Academy of Marketing Science*, Vol. 16 No. 1, pp. 74-94, doi: 10.1007/BF02723327.

Bala, H. and Venkatesh, V. (2016), "Adaptation to information technology: a holistic nomological network from implementation to job outcomes", *Management Science*, Vol. 62 No. 1, pp. 156-179.

Bawden, D. (2001), "Information and digital literacies: a review of concepts", *Journal of Documentation*, Vol. 57 No. 2, pp. 218-259.

Behringer, N. and Sassenberg, K. (2015), "Introducing social media for knowledge management: determinants of employees' intentions to adopt new tools", *Computers in Human Behaviour*, Vol. 48, pp. 290-296.

Berger, T. and Frey, B. (2016), *Digitalisation, Jobs, and Convergence in Europe: Strategies for Closing the Skills Gap*, Oxford Martin School, Oxford, Vol. 50.

Bilgihan, A. (2016), "Gen Y customer loyalty in online shopping: an integrated model of trust, user experience and branding", *Computers in Human Behaviour*, Vol. 61, pp. 103-113.

Booker, L.D., Detlor, B. and Serenko, A. (2012), "Factors affecting the adoption of online library resources by business students", *Journal of the American Society for Information Science and Technology*, Vol. 63 No. 12, pp. 2503-2520.

Bowen, M.M. and Johnson, K.R. (2019), "Entrepreneurial skills for the 21st century workplace: the SME sector", *Handbook of Research on Promoting Higher-Order Skills and Global Competencies in Life and Work*, IGI Global, pp. 56-69.

Cai, Z., Fan, X. and Du, J. (2017), "Gender and attitudes toward technology use: a meta-analysis", *Computers and Education*, Vol. 105, pp. 1-13.

Carnevale, A.P. and Smith, N. (2013), "Workplace basics: the skills employees need, and employers want", *Human Resource Development International*, Vol. 16 No. 5, pp. 491-501.

Cetindamar, D., Abedin, B. and Shirahada, K. (2021), "The role of employees in digital transformation: a preliminary study on how employees' digital literacy impacts use of digital technologies", *IEEE Transactions on Engineering Management*, pp. 1-12, doi: 10.1109/TEM.2021.3087724.

Cetindamar Kozanoglu, D. and Abedin, B. (2021), "Understanding the role of employees in digital transformation: conceptualization of digital literacy of employees as a multi-dimensional organizational affordance", *Journal of Enterprise Information Management*, Vol. 34 No. 6, pp. 1649-1672.

Chan, A.J., Hooi, L.W. and Ngui, K.S. (2021), "Do digital literacies matter in employee engagement in digitalised workplace?", *Journal of Asia Business Studies*, Vol. 15 No. 3, pp. 523-540.

Chang, I.C., Lin, P.J., Chen, T.H. and Chang, C.H. (2020), "Cultural impact on the intention to use nursing information systems of nurses in taiwan and China: survey and analysis", *Journal of Medical Internet Research*, Vol. 22 No. 8, pp. 1-8.

Cheuk, B. (2017), "The hidden value of information literacy in the workplace context: how to unlock and create value", *Information Literacy in the Workplace*, Facet Publishing, pp. 131-148.

Colbert, A., Yee, N. and George, G. (2016), "The digital workforce and the workplace of the future", *Academy of Management Journal*, Vol. 59 No. 3, pp. 731-739.

Collard, A.S., De Smedt, T., Dufrasne, M., Fastrez, P., Ligurgo, V., Patriarche, G. and Philippette, T. (2017), "Digital media literacy in the workplace: a model combining compliance and inventivity", *Italian Journal of Sociology of Education*, Vol. 9 No. 1, pp. 122-154.

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

Dede, C. (2010), "Technological supports for acquiring 21st century skills", in Baker, E., McGaw, B. and Peterson, P. (Eds), *International Encyclopaedia of Education*, 3rd ed., Elsevier, Oxford, England, pp. 158-166.

Durodolu, O. (2016), "Technology Acceptance Model as a predictor of using information system to acquire information literacy skills", *Library Philosophy and Practice, (E-journal)*, available at: http://digitalcommons.unl.edu/libphilprac/1450.

Eshet, Y. (2004), "Digital literacy: a conceptual framework for survival skills in the digital era", *Journal of Educational Multimedia and Hypermedia*, Vol. 13 No. 1, pp. 93-106.

Fagan, M.H., Neill, S. and Wooldridge, B.R. (2008), "Exploring the intention to use computers: an empirical investigation of the role of intrinsic motivation, extrinsic motivation, and perceived ease of use", *Journal of Computer Information Systems*, Vol. 48 No. 3, pp. 31-37.

Farrell, L., Newman, T. and Corbel, C. (2021), "Literacy and the workplace revolution: a social view of literate work practices in Industry 4.0", *Discourse: Studies in the Cultural Politics of Education*, Vol. 42 No. 6, pp. 898-912.

Fornell, C. and Larcker, D.F. (1981), "Evaluating structural equation models with unobservable variables and measurement error", *Journal of Marketing Research*, Vol. 18 No. 1, pp. 39-50.

Forster, M. (Ed.) (2017), *Information Literacy in the Workplace*, Facet Publishing.

Forster, M. (2019), "'Ethnographic' thematic phenomenography: a methodological adaptation for the study of information literacy in an ontologically complex workplace", *Journal of Documentation*, Vol. 75 No. 2, pp. 349-365.

Gefen, D. and Straub, D. (2005), "A practical guide to factorial validity using PLS-graph: tutorial and annotated example", *Communication of the Association for Information Systems*, Vol. 16 No. 5, pp. 91-109.

Gilbert, S. (2017), "Information literacy skills in the workplace: examining early career advertising professionals", *Journal of Business and Finance Librarianship*, Vol. 22 No. 2, pp. 111-134.

Goldstein, S. and Whitworth, A. (2015), "Determining the value of information literacy for employers", *European Conference on Information Literacy*, Springer, Cham, pp. 70-79.

Gu, X., Zhu, Y. and Guo, X. (2013), "Meeting the "digital natives": understanding the acceptance of technology in classrooms", *Journal of Educational Technology and Society*, Vol. 16 No. 1, pp. 392-402.

Gui, M. and Argentin, G. (2011), "Digital skills of internet natives: different forms of digital literacy in a random sample of northern Italian high school students", *New Media and Society*, Vol. 13 No. 6, pp. 963-980.

Hair, J.F., Ringle, C.M. and Sarstedt, M. (2011), "PLS-SEM: indeed, a silver bullet", *Journal of Marketing Theory and Practice*, Vol. 19 No. 2, pp. 139-152.

Hair, J.F., Sarstedt, M., Ringle, C.M. and Mena, J.A. (2012), "An assessment of the use of partial least squares structural equation modelling in marketing research", *Journal of the Academy of Marketing Science*, Vol. 40 No. 3, pp. 414-433.

Hair, J.F., Hult, G.T., Ringle, C.M. and Sarstedt, M. (2013), *A Primer on Partial Least Squares Structural Equation Modelling (PLS-SEM)*, Sage, Thousand Oaks.

Henseler, J., Ringle, C.M. and Sarstedt, M. (2015), "A new criterion for assessing discriminant validity in variance-based structural equation modelling", *Journal of the Academy of Marketing Science*, Vol. 43 No. 1, pp. 115-135.

Hess, T., Matt, C., Benlian, A. and Wiesböck, F. (2016), "Options for formulating a digital transformation strategy", *MIS Quarterly Executive*, Vol. 15 No. 2, pp. 123-139.

Hulland, J. (1999), "Use of partial least squares (PLS) in strategic management research: a re-view of four recent studies", *Strategic Management Journal*, Vol. 20 No. 2, pp. 195-204.

Hunter, I. (2018), "Digital literacy in the workplace: a view from the legal sector", *Business Information Review*, Vol. 35 No. 2, pp. 56-59.

Iivari, N., Sharma, S. and Ventä-Olkkonen, L. (2020), "Digital transformation of everyday life–How COVID-19 pandemic transformed the basic education of the young generation and why information management research should care?", *International Journal of Information Management*, Vol. 55, 102183.

Jang, M., Aavakare, M., Nikou, S. and Kim, S. (2021), "The impact of literacy on intention to use digital technology for learning: a comparative study of Korea and Finland", *Telecommunications Policy*, Vol. 45 No. 7, 102154.

Kane, G.C., Phillips, A.N., Copulsky, J.R. and Andrus, G.R. (2019), *The Technology Fallacy: How People Are the Real Key to Digital Transformation*, MIT Press, Boston, MA.

Kasemsap, K. (2018), "Encouraging digital literacy and ICT competency in the information age", *Encyclopaedia of Information Science and Technology*, 4th ed., IGI Global, pp. 2253-2263.

Kimiloglu, H., Ozturan, M. and Kutlu, B. (2017), "Perceptions about and attitude toward the usage of e-learning in corporate training", *Computers in Human Behaviour*, Vol. 72, pp. 339-349, doi: 10.1016/j.chb.2017.02.062.

Kirschner, P.A. and De Bruyckere, P. (2017), "The myths of the digital native and the multitasker", *Teaching and Teacher Education*, Vol. 67, pp. 135-142.

Kirton, J. and Barham, L. (2005), "Information literacy in the workplace", *The Australian Library Journal*, Vol. 54 No. 4, pp. 365-376.

König, J., Jäger-Biela, D.J. and Glutsch, N. (2020), "Adapting to online teaching during COVID-19 school closure: teacher education and teacher competence effects among early career teachers in Germany", *European Journal of Teacher Education*, Vol. 43 No. 4, pp. 608-622.

Kohnke, O. (2017), "It's not just about technology: the people side of digitization", *Shaping the Digital Enterprise*, Springer, Cham, pp. 69-91.

Lapointe, L. and Rivard, S. (2005), "A multilevel model of resistance to information technology implementation", *MIS Quarterly*, Vol. 29 No. 3, pp. 461-492.

Lee, J.J. and Hsu, Y. (2002), "Web navigation: the role of metaphor, concept map and individual differences", in Barker, P. and Rebelsky, S. (Eds), *Proceedings of ED-MEDIA, 2001 World Conference on Educational Multimedia, Hypermedia & Telecommunications*, Association for the Advancement of Computing in Education, Norfolk, VA, pp. 1000-1001.

Lin, K.Y. and Lu, H.P. (2011), "Intention to continue using Facebook fan pages from the perspective of social capital theory", *Cyberpsychology, Behaviour, and Social Networking*, Vol. 14 No. 10, pp. 565-570.

Lloyd, A. (2003), "Information literacy: the meta-competency of the knowledge economy? An exploratory paper", *Journal of Librarianship and Information Science*, Vol. 35 No. 2, pp. 87-92.

Lloyd, A. (2012), "Information literacy as a socially enacted practice. Sensitising themes for an emerging perspective of people-in-practice", *Journal of Documentation*, Vol. 68 No. 6, pp. 772-783.

Marsh, E. (2018), "Understanding the effect of digital literacy on employees' digital workplace continuance intentions and individual performance", *International Journal of Digital Literacy and Digital Competence (IJDLDC)*, Vol. 9 No. 2, pp. 15-33.

Middleton, L. and Hall, H. (2021), "Workplace information literacy: a bridge to the development of innovative work behaviour", *Journal of Documentation*, Vol. 77 No. 6, pp. 1343-1363.

Middleton, L., Hall, H., Muir, L. and Raeside, R. (2018), "The interaction between people, in-formation and innovation: information literacy to underpin innovative work behaviour in a Finnish organisation", *The Proceedings of the Association for Information Science and Technology*, Vol. 55 No. 1, pp. 367-376.

Mietzner, D. and Kamprath, M. (2013), "A competence portfolio for professionals in the creative industries", *Creativity and Innovation Management*, Vol. 22 No. 3, pp. 280-294.

Mohammadyari, S. and Singh, H. (2015), "Understanding the effect of e-learning on individual performance: the role of digital literacy", *Computers and Education*, Vol. 82, pp. 11-25.

Murawski, M. and Bick, M. (2017), "Digital competences of the workforce – a research topic?", *Business Process Management Journal*, Vol. 23 No. 3, pp. 721-734.

Murray, A. (2011), "Mind the gap: technology, millennial leadership and the cross-generational workforce", *The Australian Library Journal*, Vol. 60 No. 1, pp. 54-65.

Nafukho, F.M., Alfred, M., Chakraborty, M., Johnson, M. and Cherrstrom, C.A. (2017), "Predicting workplace transfer of learning", *European Journal of Training and Development*, Vol. 41 No. 4, pp. 327-353.

Naveed, M.A. and Rafique, F. (2018), "Information literacy in the workplace: a case of scientists from Pakistan", *Libri*, Vol. 68 No. 3, pp. 247-257.

Ng, W. (2012), "Can we teach digital natives digital literacy?", *Computers and Education*, Vol. 59 No. 3, pp. 1065-1078.

Nikou, S. and Aavakare, M. (2021), "An assessment of the interplay between literacy and digital technology in higher education", *Education and Information Technologies*, Vol. 26 No. 4, pp. 3893-3915.

Nikou, S., Brännback, M. and Widén, G. (2019), "The impact of digitalization on literacy: digital immigrants vs. Digital natives", *Proceedings of the 27th European Conference on Information Systems (ECIS 2019)*, Stockholm, Sweden, June 10th-14th, 2019.

Oh, J.H., Seo, J.H. and Kim, J.D. (2019), "The effect of both employees' attitude toward technology acceptance and ease of technology use on smart factory technology introduction level and manufacturing performance", *Journal of Information Technology Applications and Management*, Vol. 26 No. 2, pp. 13-26.

Oluwajana, D. and Adeshola, I. (2021), "Does the student's perspective on multimodal literacy influence their behavioural intention to use collaborative computer-based learning?", *Education and Information Technologies"*, Vol. 26, pp. 5613-5635.

Oman, J. (2001), "Information literacy in the workplace", *Information Outlook*, Vol. 5 No. 6, pp. 33-35.

Paganin, G. and Simbula, S. (2021), "New technologies in the workplace: can personal and organizational variables affect the employees' intention to use a work-stress management app?", *International Journal of Environmental Research and Public Health*, Vol. 18 No. 17, pp. 2-16.

Panel, I.L. (2002), *Digital Transformation: A Framework for ICT Literacy*, Educational Testing Service, available at: http://www.ets.org/Media/Tests/Information_and_Communication_Technology_Literacy/ictreporpdf (accessed 8 April 2022).

Podsakoff, P.M., MacKenzie, S.B., Lee, J.Y. and Podsakoff, N.P. (2003), "Common method biases in behavioural research: a critical review of the literature and recommended remedies", *Journal of Applied Psychology*, Vol. 88 No. 5, pp. 879-903.

Podsakoff, P.M., MacKenzie, S.B. and Podsakoff, N.P. (2012), "Sources of method bias in social science research and recommendations on how to control it", *Annual Review of Psychology*, Vol. 63, pp. 539-569.

Prensky, M. (2001a), "Digital natives, digital immigrants, part 1", *On the Horizon*, Vol. 9 No. 5, pp. 1-6.

Prensky, M. (2001b), "Digital natives, digital immigrants Part 2: do they really think differently?", *On the Horizon*, Vol. 9 No. 6, pp. 1-6.

Raish, V. and Rimland, E. (2016), "Employer perceptions of critical information literacy skills and digital badges", *College and Research Libraries*, Vol. 77 No. 1, pp. 87-113.

Renta-Davids, A.I., Jiménez-González, J.M., Fandos-Garrido, M. and González-Soto, Á.P. (2014), "Transfer of learning: motivation, training design and learning- conducive work", *European Journal of Training and Development*, Vol. 38 No. 8, pp. 728-744.

Serap Kurbanoglu, S., Akkoyunlu, B. and Umay, A. (2006), "Developing the information literacy self-efficacy scale", *Journal of Documentation*, Vol. 62 No. 6, pp. 730-743.

Simao, L. and Franco, M. (2018), "External knowledge sources as antecedents of organizational innovation in firm workplaces: a knowledge-based perspective", *Journal of Knowledge Management*, Vol. 22 No. 2, pp. 237-256.

Solnet, D., Kralj, A. and Kandampully, J. (2012), "Generation Y employees: an examination of work attitude differences", *Journal of Applied Management and Entrepreneurship*, Vol. 17 No. 3, pp. 36-54.

Somerville, M.M., Imhof, R., Bruce, C.S. and Abdi, E.S. (2017), "Workplace information literacy: Co-designed information experience-cantered systems and practices", *European Conference on Information Literacy*, Springer, Cham, pp. 3-10.

Stordy, P. (2015), "Taxonomy of literacies", *Journal of Documentation*, Vol. 71 No. 3, pp. 456-476.

Sulkunen, S. and Malin, A. (2018), "Literacy, age and recentness of education among Nordic adults", *Scandinavian Journal of Educational Research*, Vol. 62 No. 6, pp. 929-948.

Sun, Y., Bhattacherjee, A. and Ma, Q. (2009), "Extending technology usage to work settings: the role of perceived work compatibility in ERP implementation", *Information and Management*, Vol. 46 No. 6, pp. 351-356.

Tufts, D.R. (2010), *Digital Adults: Beyond the Myth of the Digital Native Generation Gap*, Doctoral dissertation, Fielding Graduate University.

Urena, R., Kou, G., Dong, Y., Chiclana, F. and Herrera-Viedma, E. (2019), "A review on trust propagation and opinion dynamics in social networks and group decision making frameworks", *Information Sciences*, Vol. 478, pp. 461-475.

Van Dijk, J.A. and Van Deursen, A.J. (2014), *Digital Skills: Unlocking the Information Society*, Palgrave Macmillan, New York.

Van Laar, E., Van Deursen, A.J., Van Dijk, J.A. and De Haan, J. (2017), "The relation between 21st-century skills and digital skills: a systematic literature review", *Computers in Human Behaviour*, Vol. 72, pp. 577-588.

Venkatesh, V., Morris, M.G., Davis, G.B. and Davis, F.D. (2003), "User acceptance of information technology: toward a unified view", *MIS Quarterly*, Vol. 27 No. 3, pp. 425-478.

Venkatesh, V., Thong, J.Y. and Xu, X. (2012), "Consumer acceptance and use of information technology: extending the unified theory of acceptance and use of technology", *MIS Quarterly*, Vol. 36 No. 1, pp. 157-178.

Vial, G. (2019), "Understanding digital transformation: a review and a research agenda", *The Journal of Strategic Information Systems*, Vol. 28 No. 2, pp. 118-144.

Vodanovich, S., Sundaram, D. and Myers, M. (2010), "Research commentary—digital natives and ubiquitous information systems", *Information Systems Research*, Vol. 21 No. 4, pp. 711-723.

Wang, E., Myers, M.D. and Sundaram, D. (2012), "Digital natives and digital immigrants: towards a model of digital fluency", *the proceedings of the ECIS 2012, paper 39*, available at: https://aisel.aisnet.org/ecis2012/39.

Yoon, H.Y. (2016), "User acceptance of mobile library applications in academic libraries: an application of the technology acceptance model", *The Journal of Academic Librarianship*, Vol. 42 No. 6, pp. 687-693.

Yu, T.K., Lin, M.L. and Liao, Y.K. (2017), "Understanding factors influencing information communication technology adoption behaviour: the moderators of information literacy and digital skills", *Computers in Human Behaviour*, Vol. 71, pp. 196-208.

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Appendix

Digital literacy (Ng, 2012; Serap Kurbanoglu *et al.*, 2006)	
DL1	I know how to solve my own technical (ICT related) problems
DL2	I can learn new digital technologies easily
DL3	I keep up with important new digital technologies
DL4	I know about a lot of different digital technologies
DL5	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
DL6	I have good digital technology skills
DL7	I am confident with my search and evaluation skills to obtain information from the Web
DL8	I am familiar with issues related to web-based activities e.g. cyber safety, search issues, plagiarism
DL9	Digital technology enables me to collaborate better with my colleagues on project work and other working/learning activities
DL10	I frequently obtain help with my work tasks from my colleagues over the Internet e.g. through Skype, Microsoft teams
Attitude towards using digital technology (Ng, 2012)	
ATU1	I like using digital technologies for working/learning
ATU2	I work/learn better with digital technologies
ATU3	Digital technologies make working/learning more interesting
ATU4	I am more motivated to work/learn with digital technologies
ATU5	Digital technologies enable me to be a self-directed and independent worker/learner
Information literacy (Ng, 2012; Serap Kurbanoglu *et al.*, 2006)	
IL1	When given a work task, I feel confident determining what information I need to search
IL2	I am sometimes unsure of how much information I need for solving work related problems
IL3	I can easily get my hands-on right information when needed
IL4	I understand the organisation of information in my company
IL5	When looking for information I can easily identify the right information sources (e.g. organisation's platforms, colleagues and clients)
IL6	I can determine the authoritativeness, correctness and reliability of the information
IL7	I am not confident that the information I get is accurate
Perceived ease of use (Davis, 1989)	
PEOU1	Learning to operate digital technologies would be easy for me at work
PEOU2	I would find it easy to get digital technologies to do what I want to do in my job
PEOU3	My interaction with digital technologies is clear and understandable
PEOU4	I would find digital technologies to be flexible to interact with
PEOU5	It would be easy for me to become skilful at using digital technologies
PEOU6	I would find digital technology easy to use
Perceived usefulness (Davis, 1989)	
PU1	Using digital technologies in my job would enable me to accomplish tasks more quickly at work
PU2	Using a digital technology would improve my job performance
PU3	Using digital technologies would enhance my effectiveness at work
PU4	Using digital technologies would make it easier to do my job
PU5	I would find digital technologies useful in my job
Intention to use digital technology at workplace (Lin and Lu, 2011; Venkatesh *et al.*, 2003)	
INT1	I will not hesitate to use digital technologies to access information
INT2	I plan to use digital technologies to seek information
INT3	I would expect to use digital technologies to seek for information
INT4	I intend to use digital technologies to seek for information
INT5	I am very likely to use digital technologies to gain information
INT6	I will continue using digital technologies in the future
INT7	I will recommend my colleagues to use digital technologies

Note(s): Highlighted items were removed from analysis due to low factor loadings

Table A1.
Survey items