How Big Five Personality Traits affect Information and Communication Technology Use: A Meta-Analysis

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Abstract

This study performed a meta-analysis of forty-eight studies to synthesize existing literature examining the relationship between 'Big Five' personality traits and the use of various Information and Communication Technologies (ICTs). We conducted sub-group analysis to investigate the potential moderators on the relationship between personality and ICT use. The results largely reveal that the 'Big Five' personality traits are significantly associated with the use of various ICTs. Specifically, 'extroversion' showed the strongest association with social networking, along with business and commerce-based ICTs, while 'openness' had the highest correlations with career and education, and information-based ICTs. The results also identified technology type, region of the country, and voluntariness as potential moderators. This paper offers theoretical and practical implications that researchers could embrace in enhancing understanding of traits-technology fit, and technology providers in improving crafting, marketing, and delivering technology at the individual, organizational, national, and global levels.

Keywords: Big Five personality traits, Information and Communication Technologies, Meta-analysis, Correlations, Sub-group analysis.

1 Introduction

Information and Communication Technologies (ICTs) have radically changed human lives in the last two decades. ICT comprises various technologies that facilitate information management, while assisting in various forms of communication (Amutha, 2020). The recent growth of ICTs has effectively reduced the distance between people across the globe with just a click. Such technological advancements enable people to access a wide array of services and online applications (e.g., e-learning/online teaching platforms, social networking sites or applications, online banking applications, and e-commerce applications, among others) using their smartphones and/or computers (Corcoran & Duane, 2018; da Silva Oliveira & Chimenti, 2021; Fernandes et al., 2021). ICTs thereby have emerged as an indispensable part of contemporary lifestyle, whereby individual personality effortlessly meshes with the fabric of human life, everyday situations, problems, and relationships (Alhassan et al., 2020; Donvito et al., 2020; Goyal et al., 2021; Soral et al., 2020). Extant literature is of the view that an individual

with a specific disposition exhibits a unique pattern of adoption and use[1,2], of various forms of technologies (Ratchford & Ratchford, 2021; Stachl et al., 2017). Therefore, in this technological age, it is of the utmost importance to examine the relationship between personality traits, and use of distinct ICTs to understand who uses what type of ICTs.

Scholars in the past, have made several attempts to investigate the same based on certain popular theories and models of personality; for example: Myer- Briggs Type Indicator (MBTI) model of personality (Brown & Akroyd, 2006), Personal Innovativeness in Information Technology (PIIT) and Openness (Davis et al., 2007), Big Five Model of personality (Lane, 2012), and Trust Model (Kipnis, 1996). Extant literature highlighted that the 'Big-Five' personality model has been considered the most parsimonious and comprehensive approach to measuring personality, comprising five different continuums (McCrae et al., 2008). It has been well-validated and reiterated that Big-Five traits significantly influence the choice of ICTs (Hamari & Keronen, 2017; Huang, 2019; Kayiş et al., 2016; Liu & Baumeister, 2016; Liu & Campbell, 2017). People can be differentiated based on the score on these five dimensions when using various ICTs (Chittaranjan et al., 2011; Kim et al., 2015).

However, existing literature consists of some antithetical empirical evidence concerning the relationships between the 'Big-Five' traits and ICT use (Kalmus et al., 2011; Ko et al., 2012; Tan & Yang, 2012). These contrasting findings may be attributed to a cluster of factors, including diversified sample, location, contexts of study, stage of technological advancements, cultural differences, and technology characteristics. Therefore, a meta-analysis of such divergent findings would enrich literature with a comprehensive, holistic, and clearer view.

The motivation for conducting this study is threefold: first, extant literature on the classification of ICTs did not account for recently introduced technologies, such as online learning applications, online dating applications, and virtual reality devices, to mention a few (Kircaburun et al., 2020; Mody, 1999; Rad et al., 2018; Rauschnabel et al., 2015). Existing taxonomies have primarily concentrated on the technical features of ICTs, and overlooked the individual psychological motivations, while classifying ICTs into certain groups that are very wide and diverse (e.g., e-Services, mobile technology, virtual world environment, etc.) (Inaba & Squicciarini, 2017; Mody, 1999; Rad et al., 2018). Therefore, based on the unique functionalities and individual motivations to use various ICTs, this study attempts to provide a distinct, comprehensive, and sparing classification of ICTs by synthesizing earlier taxonomies, and incorporating recently introduced ICT tools and services.

Second, a detailed review of literature unearthed contrasting shreds of evidence on the interaction between personality and ICT use. These inconsistent findings could potentially be perplexing for the research community at large, thereby calling for scholarly attention. Although some researchers have attempted to address these issues (Huang, 2019; Liu & Campbell, 2017; Marengo et al., 2020; Marino et al., 2018), most of them have had some limitations in terms of technology selection, such as focusing only on 'social networking' based ICTs. It may be noted herein that the fast-growing pace of technological advancements and increased access to ICTs can cause changes to the nature and extent of the association between personality traits and ICT use (Tan & Yang, 2012). Therefore, this study offers a detailed

[1] 'Adoption' and 'Use' are used interchangeably for the purpose of this study (Ayuning Budi et al., 2021; Rajput, 2015; Wymer & Regan, 2005).
[2] Technology adoption/use refers to accessing ICTs with varied frequency or time duration.

account of the personality traits – ICT use relationship by classifying the ICTs into six classes, based on psychological motivation to use, vis a vis their functionalities, making this study novel. Since this study provides a motivation-based, ICT-specific synthesis of the existing literature, it may be used as a guideline for problem formulation and explaining results for future studies.

Third, several studies have highlighted the relevance of technology type, individual voluntariness, and cultural diversities across different countries on use of various ICTs (Jayaprakash & Pillai, 2021; Rathore et al., 2021; Tao et al., 2020; Xiao et al., 2012). However, previous review studies have overlooked the role of these factors in the relationship between personality traits and ICT use. In an attempt to fill this knowledge gap, this study offers an advanced and comprehensive view of personality's role in ICT use by considering technology type, region of the country, and voluntariness as potential moderators in the above-stated relationship.

In the process, this study makes four significant contributions to extant literature. First, this study proposes an integrated, updated, and advanced classification of various ICTs by undertaking their core utilities and individual motivations. Second, this paper addresses and attempts to reduce inconsistencies in extant literature on the relationship between personality traits and the use of various ICTs. Third, this research underscores the significance of technology type, voluntariness, and country region in understanding personality-ICT use association by identifying them as moderators. Finally, this paper proposes a theoretical framework (see Figure 2) and practical implications that could be useful for academicians and practitioners to unfold the riddle of individual technology adoption.

This paper is further structured as follows: section 2 summarizes relevant literature, while highlighting the research gaps, and discussing the rationale of the present study. The applied methodology is discussed in section 3, followed by the results in section 4. Section 5 consists of discussion, implications, and limitations and future research directions; and finally, in section 6 we conclude.

2 Literature Review

This section comprises three sub-sections: section 2.1 briefly explains the Big Five model of personality; section 2.2 summarizes the findings of relevant previous research; section 2.3 summarizes previous meta-analytic studies, highlights the research gap, and underscores the rationale of the present study.

2.1 The Big Five Personality Model

Proposed by McCrae and Costa (1987), the Big Five model is the most widely used and well-validated taxonomy of personality traits that consists of five dimensions: extroversion, agreeableness, openness, conscientiousness, and neuroticism (John et al., 2008). Each trait is a part of a continuum, defined in the sub-sections of section 2.2 (section 2.2.1 to 2.2.5). For each dimension, people can fit anywhere along the spectrum. These Big Five dimensions explain a large amount of variance in personality, justifying thereby 'Big'. Personality researchers have reached a collective consensus that the territory of personality can be delineated by five super-ordinate constructs (Digman, 1990). This theoretical approach has been identified as the Five-Factor Model (FFM), whereby the dimensions are often referred to as the Big Five. Researchers have regarded FFM as the most comprehensive, yet concise and useful taxonomy for

examining personality (McCrae et al., 2008). Hence, we adopted the Big-Five as a measure of personality.

2.2 Extant Literature on Personality and ICTs Use

2.2.1 Extroversion and ICTs Use

Extroversion is characterized by an individual's tendency to be sociable, excited, talkative, emotionally expressive, and assertive (McCrae & Costa, 1987). Previous studies have shown extroverted people expressing a positive view of ICTs, vis a vis their usefulness, because they tend to be excited and outgoing. In other words, extroverts are inclined to use ICTs that facilitate interpersonal communication. Therefore, ICTs were found to be more beneficial and simpler to use by extroverts, while introverts were observed to be pickier while selecting ICTs (Mouakket, 2015; Nov & Ye, 2008; Sriyabhand & John, 2014; Svendsen et al., 2013; Wang, 2010). Extroversion has thereby been recognized as a personality trait that significantly influences the use of networking, online gaming, blogging, online friends, and finance-related apps (Guadagno et al., 2008; Nikbin et al., 2021; Singh, 2020; Tan & Yang, 2014; Teng, 2008), and leisure services (Butt & Phillips, 2008; Hamburger & Ben-Artzi, 2000). Bianchi and Phillips (2005) suggested that extroverts use ICTs for self-stimulatory purposes, which may explain why 'extroversion' was found to be positively linked with online gaming and leisure activities. Moreover, extroverts place a high value on close and warm interpersonal relationships (Watson & Clark, 1997) and maintain the same through online communications (Ross et al., 2009). In fact, the 'extroversion' score was found to be a significant predictor of online social networking activities and online social network strength (Lönnqvist et al., 2014; Rajput, 2015; Vaid & Harari, 2021). Similarly, this trait was found to be positively related to the use of online communication, online academic activities, and online economic activities (Mark & Ganzach, 2014; Vaid & Harari, 2021; Witt et al., 2011), which may be attributed to the talkative, social, and bold nature of extroverts. Interestingly however, 'extroversion' was found to be negatively linked to the use of productivity-enhancing mobile applications and online dating applications (Lane, 2012). In contrast to previous findings, Burtăverde et al. (2021) for instance, found 'extroversion' to be negatively associated with the use of entertainment applications, gaming applications, social media-based applications, and smartphone application use in general, but positively associated with dating apps. A possible explanation for such findings could be that extroverts spend most of their time in social activities that do not involve computer use (Landers & Lounsbury, 2006). However, they try to make new relationships using online platforms. Further, Tan and Yang (2012) argued that the time duration plays a vital role in creating and broadening the user base for mobile applications. Thus, such contrary findings necessitate a systematic evaluation of extant literature to unravel the nature of relationship between personality traits and ICTs use.

2.2.2 Agreeableness and ICTs Use

According to McCrae and Costa (1987), "Agreeableness refers to being compassionate, generous, cooperative, and empathetic in social situations rather than suspicious and antagonist." Many studies in the past have found 'agreeableness' to be relatively impertinent in the context of ICT use. Some studies incorporated this trait for the sake of totality, whereas others, omitted it based on the previous literary evidence of its irrelevance (Huang, 2019; Hughes et al., 2012; Keller & Karau, 2013; Kim et al., 2015; Lane & Manner, 2011; Mark & Ganzach, 2014; Mendonca, 2016; Rajput, 2015; Wang, 2010). Notably, such irrelevance may be attributed to unexamined mediators or moderators (Buckner et al., 2012). Other studies found

partial relevance of 'agreeableness' in predicting ICT use (Amichai-Hamburger et al., 2002; Benlian & Hess, 2010). Agreeable people tend to be conflict-averse and risk-avoiding. Therefore, the use of technologies having potential disharmony inherent in unexpected outcomes, such as online dating applications and location-based social networking technologies, is a rare phenomenon among them (Timmermans & de Caluwé, 2017; Zhang et al., 2017). Further, 'agreeableness' was found to be a significant predictor of perceived ease of use (Özbek et al., 2014), perceived usefulness of mobile-based applications (Zhou & Lu, 2011), online communication (Tsao, 2013), instant messaging and phone calls (Ehrenberg et al., 2008), and partial predictor of overall internet use (Tsao, 2013). The tendency of agreeable people to be generous, cooperative, and empathetic can explain the underlying reasons for using conversation-based ICTs. In the same vein, the score on the 'agreeableness' scale was found to be linked with the use of news and business-related applications (Burtăverde et al., 2021), ERP applications (Benlian & Hess, 2010), and social networking sites (Lönnqvist et al., 2014). Such intricacies in literature do translate into a clouded picture of the relationship between personality traits and use of ICTs, and require further investigation.

2.2.3 Openness to Experiences and ICTs Use

Openness describes an individual's preference for a wide range of interests and stimuli. According to McCrae and Costa (1987), "Openness is best characterized by characteristics, such as originality, imagination, broad interests, and daring." Open people are inclined to be receptive to new ideas and try new things. Therefore, in previous studies, open people showed a positive relationship with acceptance and use of online shopping applications (Mendonca, 2016), smartphones (Kim et al., 2015), e-government portals (Venkatesh et al., 2014), and online banking applications (Ko et al., 2012). People who score higher on 'openness', tend to perceive digital modes of learning, such as online academic courses (Svendsen et al., 2013), online learning (Tsao, 2013), and online academic activities (Mark & Ganzach, 2014), as valuable and satisfactory. Apart from educational and learning activities, 'openness' was also found to be a significant predictor of several online activities, including entertainment, communication, and social relationships, whereas a partial predictor of overall internet use (Tsao, 2013). Further, open individuals were found to be more aware of digital advancements (Ross et al., 2009), such as single sign-on-use for Google and/or Facebook (Pavlicek et al., 2018) and Google glasses (Rauschnabel et al., 2015), and thereby, tended to use them. The thirst for trying new and innovative technologies could possibly explain these findings further. As open people possess broad area interests, this trait was found to be positively linked to various online activities, such as the use of Facebook and Twitter (Anolli et al., 2005; Hughes et al., 2012; Kalmus et al., 2011; Nikbin et al., 2021), entertainment activities (Kalmus et al., 2011; Tsao, 2013), and online communication and leisure activities (Mark & Ganzach, 2014). However, some studies concluded that 'openness' has no role to play in technology usage (Ehrenberg et al., 2008; Landers & Lounsbury, 2006; Lane & Manner, 2011; Mark & Ganzach, 2014; Mendonca, 2016; Nov & Ye, 2008; Ross et al., 2009; Terzis et al., 2012; Xu et al., 2016). Additionally, it may be noted that some studies have disregarded 'openness' totally, because open individuals are receptive to a variety of ICTs, and this characteristic does not affect the use of ICTs (Kircaburun et al., 2020; Zhou & Lu, 2011). In light of these contradictory results, additional research is required to understand the association between 'openness' and ICT use.

2.2.4 Conscientiousness and ICTs Use

Conscientious people are characterized as being well-organized, hardworking, ambitious, persistent, consistent, dutiful, self-disciplined, and self-controlled by nature (McCrae & Costa, 1987). Since such individuals perceive time as a limited resource, they employ ICTs to manage time, and optimize their efforts in their day-to-day life, such as online shopping (Wu & Ke, 2015), formal and informal online communication, and e-government portals (Mark & Ganzach, 2014). High scorers on 'conscientiousness' avoid spending time on the internet for activities they consider unproductive and aimless, such as playing music and videos, photography, personalization apps, online gaming, social media browsing (leisure), and photo sharing apps (Landers & Lounsbury, 2006). In addition, conscientious people prefer ICTs that facilitate their personal and professional growth, wherefore this personality trait was found to be positively linked with the use of productive and utility applications, such as Facebook (academic), work-related mobile applications, and learning applications (Burtăverde et al., 2021; Landers & Lounsbury, 2006; Lane, 2012; Mark & Ganzach, 2014; Terzis et al., 2012; Venkatesh et al., 2014). As conscientious individuals tend to be self-disciplined, ambitious, and hardworking, they use digital means to enhance their skills and expand their knowledge base. Hence, conscientious people did seem to report a higher level of satisfaction with wiki-mediated learning, online academic courses, and other online learning activities (Altanopoulou & Tselios, 2015; Cohen & Baruth, 2017; Keller & Karau, 2013). Further, internet-assisted activities that push one to work hard and facilitate self-assessment were perceived as being favorable along with the above-mentioned activities (Terzis et al., 2012). This finding conforms to the self-controlled and dutiful tendencies of conscientious people. However, there are contrasting shreds of evidence in literature on pursuing internet-assisted leisure activities and instant messaging services (Benlian & Hess, 2010; Butt & Phillips, 2008; Landers & Lounsbury, 2006; Mark & Ganzach, 2014; Swickert et al., 2002). Interestingly, this trait was observed to be positively related to the use of location-based social networking technologies, online dating apps, and online gaming (Chorley et al., 2015; Lin & Ong, 2010; Nikbin et al., 2021; Teng, 2008; Timmermans & de Caluwé, 2017). These findings could be attributed to the tendency of time-saving while fulfilling recreational and social needs. Thus, extant research supports the notion that conscientious individuals use ICTs only to satisfy their need for achievement, optimize distribution of time and resources, and keep themselves well-maintained. However, several studies believed that 'conscientiousness' is irrelevant in relation to use of ICTs (Anolli et al., 2005; Devaraj et al., 2008; Özbek et al., 2014; Rajput, 2015; Terzis et al., 2012; Tsao, 2013; Zhang et al., 2017; Zhou & Lu, 2011). Thus, a meta-analysis of previous studies would indeed provide a holistic view of extant literature to address such contrasting findings.

2.2.5 Neuroticism and ICTs Use

Neuroticism is one of the Big Five personality traits proposed by McCrae and Costa (1987); it is characterized by moodiness, sadness, and emotional instability. People with a higher score on this dimension tend to experience mood swings, sadness, and irritability more frequently and intensely than others. In contrast, low scorers tend to be emotionally resilient, well adjusted, and relaxed (McCrae et al., 2008). As high-scoring individuals on 'neuroticism' are more receptive to negative aspects of a phenomenon, they perceive technology as a futile pursuit. Literature on the interaction of 'neuroticism' and technology use has been multifaceted. An individual who falls near the upper extreme of 'neuroticism' is inclined to be over-conscious about personal actions and persuasions (McCrae et al., 2008) . Therefore, these

individuals express a high need for quality information, quality services, and structural assurance to reduce their worries, accepting technology thereby (Zhou & Lu, 2011). In previous studies, 'neuroticism' was found to be positively correlated with the use of self-centered mobile application, such as photography apps and personalization apps, whereas negatively correlated with the use of social media apps, such as Facebook and Instagram, among others (Hassan & Pandey, 2021; Nikbin et al., 2021; Tan & Yang, 2014; Xu et al., 2016). Further, a high scorer on this dimension tends to avoid interacting with people in physical settings. In turn, they use digital space to satisfy social needs, self-expression needs, and daily necessities (Bosnjak et al., 2007; Mark & Ganzach, 2014; Tan & Yang, 2014). A recent study conducted to examine the impact of teachers' personality traits on using different ICTs showed that 'neuroticism' negatively affects the behavioral intention to use various ICTs (Camadan et al., 2018). In a nutshell, a preference for ICTs that conform to their personality traits is evident in extant literature.

2.2.6 Summary of Previous Research

Though ICT use has become a global phenomenon, it is substantially far from attaining global uniformity owing to personal, technological, and contextual factors. Extant literature observed that the relationships between individual characteristics and use of ICTs are likely to be different on the basis of technology type, voluntariness, age, gender, experience, use cases, and the region of a country (Baptista & Oliveira, 2016; Nadeem et al., 2022; Sait et al., 2004; Schlachter et al., 2018; Venkatesh et al., 2014; Vu & Lim, 2021). Tao et al. (2020) argued that the type of technology does exhibit a significant moderating impact on the relationship between individual attributes and technology adoption (Wang et al., 2018; Zabkar et al., 2017). Moreover, extant literature has been of the view that the use of personality – ICT relationship varies for ICTs with different characteristics and motivations (Mendonca, 2016). In other words, people with different personality traits vary in terms of psychological motivations, which in turn influence their selection and use of ICT tool/s (Mody, 1999; Xu et al., 2016). The congruence between individual disposition and ICT attributes do play a determining role in technology use (Mendonca, 2016). Previous studies have established that countries vary to a large extent in terms of the personalities of citizens that are reflected in their selection of both products and services (Mooradian & Swan, 2006). Allik (2012) examined the Big-Five traits of people from 56 countries, and argued that countries vary significantly in terms of their personalities; these differences influence their decision-making. Further, it may be noted that individuals' ICT use varies based on the requirement (voluntary or non-voluntary). For instance, people are more likely to use ICTs when it is part of their job or when there are organizational requirements. However, the pattern of ICT use may differ when ICTs are used voluntarily (Buchanan et al., 2005; Uesugi et al., 2010). Extant literature has been of the view that ICT use becomes more significant in case of non-voluntary (work-related) use of ICTs than voluntary use, because of work pressure and assigned responsibilities (Jarvenpaa & Lang, 2006; Schlachter et al., 2018). Thus, this study proposes to verify whether voluntariness (voluntary/ non-voluntary) does moderate the relationship between personality-ICT use. In line with prior studies, we examine the impact of three moderating factors (i.e., technology type, region of country, and voluntariness) on the link between personality and use of ICTs. Since most of the studies selected did not report statistics related to other potential moderators, such as age, gender, and experience, we considered the above-mentioned variables as moderators.

2.3 Extant Meta-Analytic Studies

In extant literature, we noted that some researchers had performed meta-analyses of studies that attempted to explain the relationship between the Big Five personality traits and specific ICT use, such as 'social networking' based ICTs and internet use (Huang, 2019; Liu & Campbell, 2017; Marengo et al., 2020; Marino et al., 2018). Although these studies reported personality traits to be significantly associated with various use of ICTs, most have some drawbacks and limitations (As summarized in Table 1).

Author and Year	Context/Objective	Key findings	Limitations/ Drawbacks
Liu and Campbell, 2017	Examining the relationships between social network site use and the Big Five traits (OCEAN) as well as the Big Two meta-traits (plasticity and stability).	'Extroversion' and 'openness' are the strongest predictors of SNS activities compared to other Big Five traits. Plasticity positively correlates with SNS activities, whereas stability is a negative predictor.	Considers various activities on social networking sites but overlooks other avenues of ICTs.
Marino et al., 2018	Summarize the findings of the recent literature on the relationship between Internet addiction (problematic Facebook use) and individual characteristics.	'Neuroticism' and 'conscientiousness' are the most clearly and strongly associated with problematic Facebook use. The other three traits are negatively but only mildly associated with problematic Facebook use.	Undertake only one social media platform (i.e., Facebook). Not inclusive in terms of technology selection.
Huang, C.,2019	Estimating the overall strength of the links between Big Five traits and SNS use.	The correlations of social network site use with 'neuroticism' and 'eextroversion' are positively small, while 'conscientiousness' has a negative and quite small correlation with social network site use. 'Openness' and 'agreeableness' are not significantly correlated with social network site use. Country of study and participants' genders moderate the examined relationship.	This study solely focuses on social networking sites and does not consider other ICTs.
Marengo et al., 2020	Envisage and understand the links between personality traits and technology users' addictive behavior by investigating associations between personality and individual differences in addictive smartphone use.	'Neuroticism' is positively associated with smartphone use disorder (SmUD), while 'conscientiousness' is negatively related. 'Agreeableness' and 'conscientiousness' showed a heightened inverse association with SmUD among older samples.	This study limits itself to the excessive use (addictive behavior) of smartphones.

Table 1. Summary of previous meta-analytic studies

After thoroughly investigating literature on both personality and technology adoption, we observed that it had many contrasting findings. For instance, Chorley et al. (2015) observed that the 'conscientiousness' score is positively linked to the use of 'business and commerce-based ICTs; Landers and Lounsbury (2006) found this linkage to be negative; whereas Ko et al. (2012) on the other hand stated that the 'conscientiousness' score does not influence the use of ICTs. These inconsistencies could be misleading, and a potential source of confusion for

future studies. Additionally, previous meta-analytic studies have not been inclusive in terms of technology selection; and the role of potential moderators has also not been much explored.

Therefore, this research addresses these issues by conducting a meta-analysis of earlier studies. We classified ICTs into six categories, based on their utilities and users' motivation to use (please see Table 4). They include 'business and commerce' (B&C), 'career and education' (C&E), 'communication' (COMM), 'entertainment' (ENT), 'information' (INFO), and 'social networking' (SN). Through our study, we believe that we would equip the research community with a better understanding of various classes of ICTs vis a vis the relationship between personality and technology use by answering the following questions:

RQ.1: How do personality traits affect ICT use in general and for specific purposes (i.e., 'career and education', 'communication', 'entertainment', 'social networking', 'business and commerce', and 'information')?

RQ.2: What potential variables moderate the relationship between personality traits and ICTs use?

3 Methodology

Meta-analysis is a statistical procedure that integrates the results of several independent studies that are considered to be combinable (Egger et al., 1997). Glass (1976) defined meta-analysis as a simple "analysis of analyses." It is the most objective and effective method of reviewing an extant body of literature (King & He, 2005). There are several techniques available in literature for conducting meta-analysis, such as Search, Appraisal, Synthesis, and Analysis (SALSA) (Grant & Booth, 2009); Cochrane Collaboration Guidelines for Systematic Reviews (Higgins et al., 2019); Preferred reporting Items for Systematic Review and Meta-Analysis (Prisma-P) (Moher et al., 2010), and PSALSAR (Mengist et al., 2020). Notably, the PSALSAR method is an updated form of SALSA with two additional steps: Research Protocols (P) and Reporting the results (R). Among these techniques, we opted for PSALSAR for conducting this study, as it is the most updated, relevant, and detailed method available in extant literature. It consists of six systematically arranged phases to obtain optimum output from the process.

The first step includes defining the study protocol based on the PICOC framework (Population, Intervention, Comparison, Outcome, and Context). This step defines the research scope (Booth, 2016). The objectives and scope of this study are presented as research questions in the previous section.

The second step, i.e. 'search', aims to locate the relevant work pieces. To find relevant literature, we used domain-specific key terms, vis a vis their combination that define the boundaries of the scope of research (Nayal et al., 2020; Papaioannou et al., 2010; Zhang et al., 2022). We used the following search databases/ engines and search strings:

- Search databases: Scopus, ABI/INFORM Global, Web of Science, Emerald, Business Source Complete, ScienceDirect, and Google scholar.
- Search String: ("Big Five personality traits" OR "Extroversion" OR "Agreeableness" OR "Openness" OR "Conscientiousness" OR "Neuroticism" OR "Emotional Stability" OR "Personality" OR "Individual Dispositions" OR "Individual Characteristics") AND ("Smartphone" OR "Social Media" OR "Facebook" OR "Instagram" OR "Twitter" OR "Tinder" OR "Online Dating Apps" OR "Mobile Applications" OR "Online Learning" OR

"Microsoft Teams" OR "Online Teaching" OR "Online Classes" OR "Online Academic Activities" OR "Google Meet" OR "Microsoft Teams" OR "Online Leisure Services" OR "Online Games" OR "Multi-player Games" OR "Online commerce" OR "Online Shopping" OR "Online Banking" OR "e-Banking" OR "Mobile Commerce" OR "e-Commerce" OR "e-Tail" OR "Online Selling" OR "Online Banking" OR "Mobile Banking" OR "Information and Communication Technologies" OR "Internet" OR "Computer" OR "Technology")

Figure 1 shows the results obtained by applying the search string in the selected databases; while Table 2 refers to both the inclusion and exclusion criteria for selecting extant literature.

Criteria	Decision
When selected keywords are available in the title, keywords, or abstract section of the paper	Inclusion
The paper is written in the English language	Inclusion
Studies that report the correlation statistics or p-value or t value	Inclusion
The paper includes the Big Five personality model or at least one dimension of the Big Five personality model	Inclusion
When the article discusses any form of ICTs and relates it to the Big Five personality trait	Inclusion
Papers that are duplicated within the search results	Exclusion
Papers that are not primary/original research	Exclusion
Papers that do not consist of prerequisite statistics	Excluded
Papers that do not meet any of the inclusion criteria	Excluded

Table 2. Inclusion and exclusion criterion for selection of literature

The third step of PSALSAR includes an appraisal of selected studies that evaluate the search results to be included in the study, based on the research scope, while describing their validity. Figure 1 presents the flow of selecting relevant papers. The number of articles used for further analysis consists of 9.6% of the original research works available in the databases.

The fourth step, i.e., 'synthesis', comprises extracting and classifying data from the publications selected to derive knowledge and conclusions. While collecting statistics for the meta-analysis, we found three types of statistics in different papers, and dealt with the prescribed methods (Table 3) (Krzywinski & Altman, 2013).

S.N.	Type of statistic	Formulae/tools used
1.	Correlation statistics(r)	Considered for the analysis
2.	t-value	$r = \sqrt{t^2 / (t^2 + DF)}$
3.	p-value	R software (to get t-value form p-value), $r = \sqrt{t^2 / (t^2 + DF)}$

Note. t value, calculated difference represented in standard error units; DF (Degrees of Freedom), sample size – 1.
Table 3. Processing various types of statistics reported in the selected papers

The forty-eight articles selected and examined, included diverse forms of ICTs, such as social networking sites and applications, online banking, mobile commerce, online games, e-government portals, online learning platforms, among others. Notably, these technologies are significantly different in terms of their functionalities and psychological motivation to use. Rad et al. (2018) proposed a conceptual classification based on technicalities of various ICTs that classify them into twelve groups. Though this taxonomy encompasses most of the ICTs, some recently introduced forms of ICTs are not included (e.g. Google glasses, online dating services, blogging, etc.) (Guadagno et al., 2008; Kircaburun et al., 2020; Rauschnabel et al., 2015).

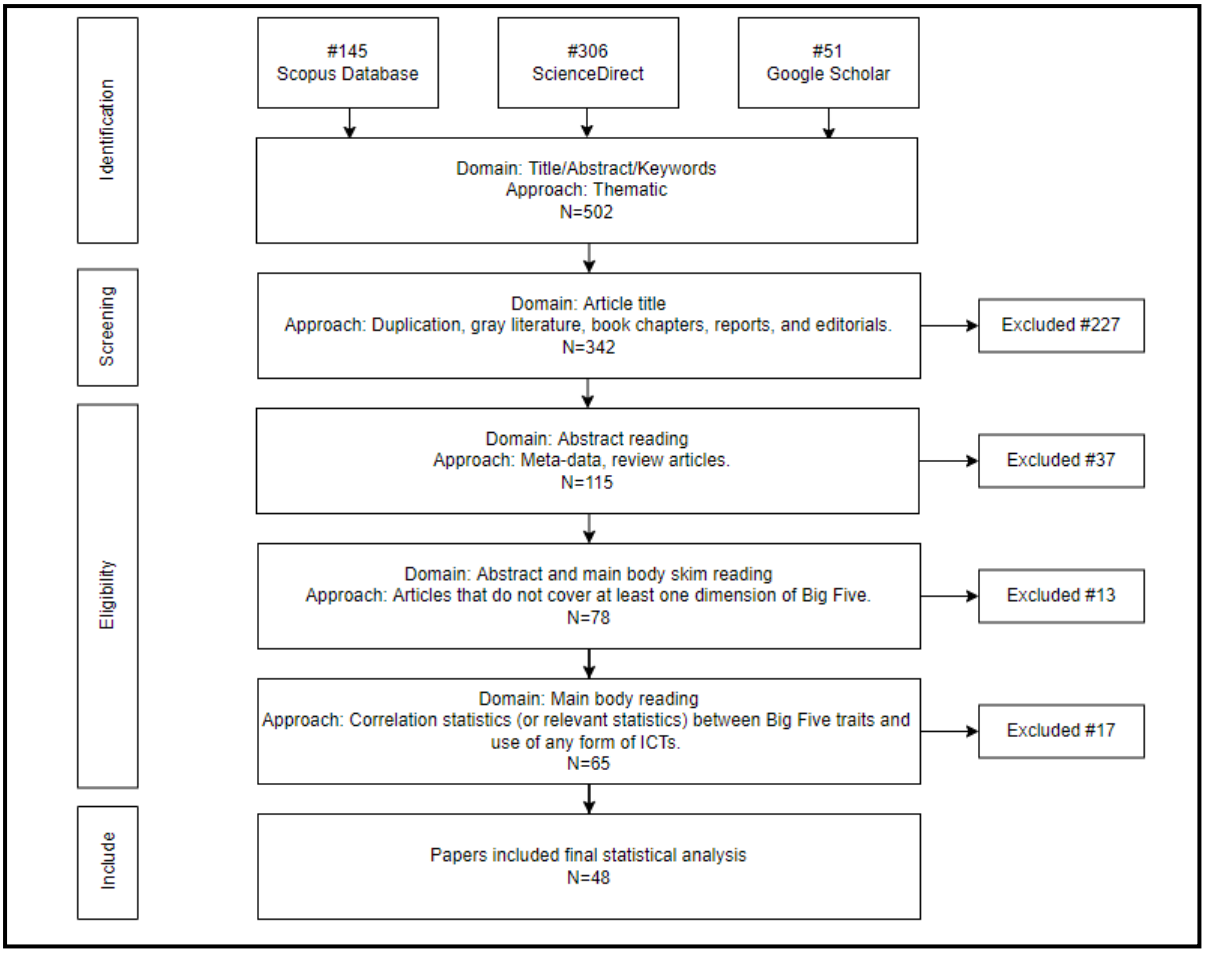


Figure 1. The flow diagram of the database search

Additionally, previous research has attempted to classify the activities even in the digital sphere (Mody, 1999). However, this classification also suffers from similar limitations. According to Technology and Innovation Report (Canton, 2021), the recent decades have witnessed rapid technological advancements in ICTs, along with their availability and accessibility. Therefore, by synthesizing earlier classification and incorporating modern forms of ICTs (Conole & Dyke, 2004; Inaba & Squicciarini, 2017; Mody, 1999; Rad et al., 2018), this study offers a simple, comprehensive, and parsimonious taxonomy of ICTs. This classification effectively has been based on the functional utility and users' psychological motivation (Chacón et al., 2017; Mody, 1999; Rad, Nilashi, Dahlan, et al., 2018), compartmentalizing ICTs into six brackets: 'career and education', 'communication', 'entertainment', 'social networking', 'business and commerce', and 'information'. The central idea behind this classification is that each ICT class possesses a distinctive set of features and offers different values. People with different personalities are driven by different motivations, and seek out ICTs with values and incentives matching their psychological motivations. Thus, the congruence of personality traits, psychological motivations, and ICT attributes does determine the use of different ICTs. Further, it may be noted that this taxonomy (Table 4) enables researchers to comprehend the relationship between psychological motivations and use of ICTs, identify the inimitable values of various ICTs, and classify them accordingly. Table 4 presents a detailed classification based on psychological motivation and ICT utility.

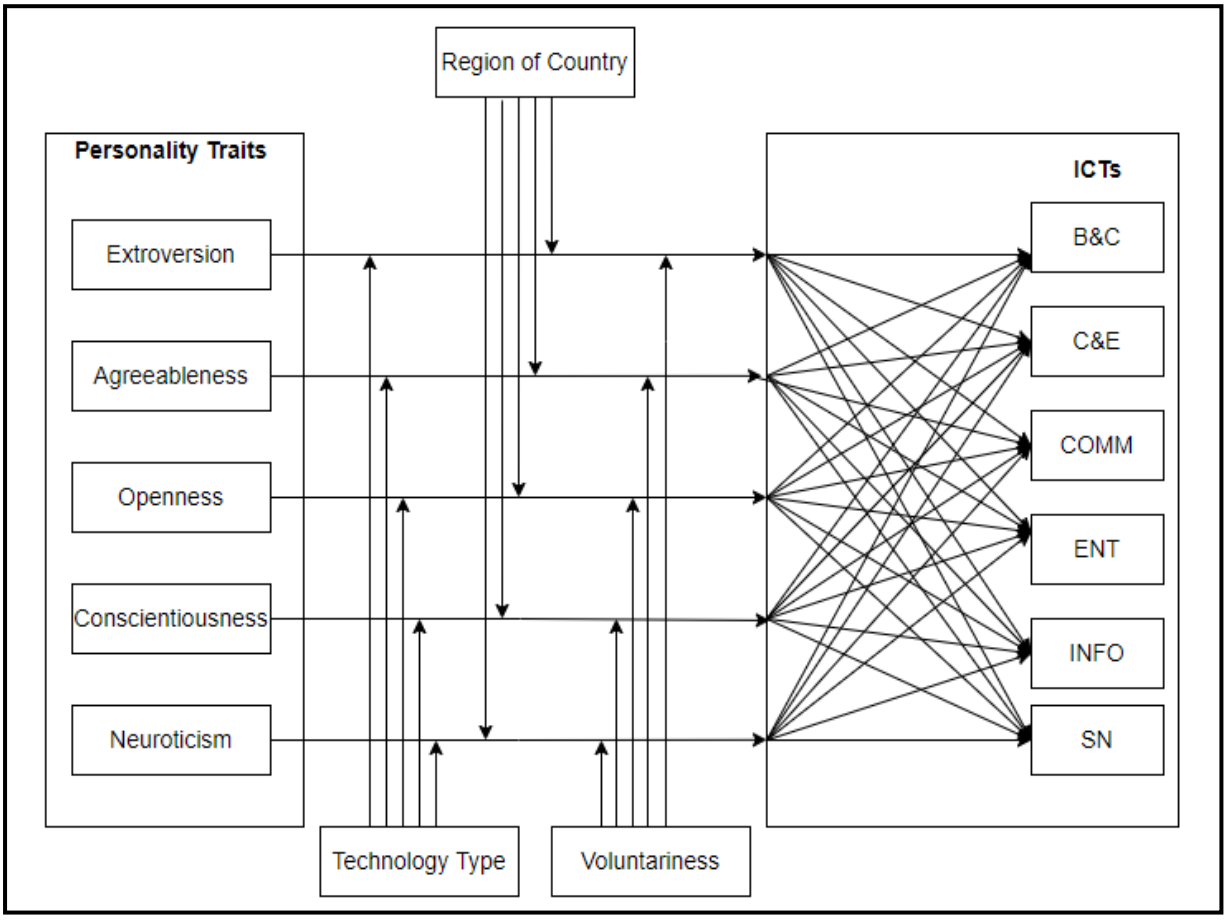
Psychological motivation	**ICT tools considered in research**	**ICT class**	**Nature of use**
Self-enhancement: Motivations centered on skill development, knowledge acquisition, self-development, and, in general, feeling better about oneself (Chacón et al., 2017).	Computer use for education, Educational apps, LinkedIn, Evernote, Wikipedia-based learning, Internet use (learning), Literacy mobile apps, Online academic course, Productivity-enhancing apps, Computer-based assessment, and Enterprise resource planning.	**Career and Education (C&E):** Digital platforms that provide learning opportunities and professional development through online courses and online training programs which offers flexibility in terms of time, money, pacing, study location, and facilitate individual's/employees' professional growth (Rad, Nilashi, Dahlan, et al., 2018).	V
	Online learning-based technology; Microsoft Excel Spreadsheet software; Web-based classroom technology system; eProject: Commercial collaborative system.		NV
Connectedness: Individual's motivation to contact other people and exchange information (Wei & Lo, 2016).	Smartphone use; Basic features of mobile; Calls; SMS; Communication apps; WhatsApp (calls and messages); Instant messaging apps.	**Communication (Comm):** Tools and apps specifically used to send, receive, and process information (Mody, 1999).	V
Recreation: Activities people do in their spare time to relax, refresh, and invigorate to refresh by physical or virtual influence (Mokhtarian et al., 2004).	Entertainment app; Online games; Google glasses; Leisure apps; Online music; Gaming apps; Multimedia apps; Music and audio apps; Online comics.	**Entertainment (Ent):** All ICTs that enable delivery of entertainment experience to the users by creating and improving components (Mody, 1999).	V
Socialization: Motivations based on humans' urge to engage and interact with other people in informal settings (Chacón et al., 2017)	Online social interaction; Twitter (social); Facebook; Online acquaintances; Social networking apps; Location-based social networking apps; Instagram; WhatsApp (Social); Social networking websites; Online dating apps; Online friends apps.	**Social networking (SN):**Conversational web-based sites/apps that allow users to develop profiles of themselves, upload personal information and connect with multiple networks (Rad et al., 2018).	V
Convenience: A degree to which users feel that the use of a system of technology will make them free from difficulty (Brown & McEnally, 1992).	E-Commerce; m-Commerce; Online transaction apps; Finance apps; Business apps; Shopping apps; Online investments; Online banking.	**Business and Commerce (B&C):** Applications of information technology that are integrated into the business for smoothening the operations of business (Mody, 1999; Rad et al., 2018).	V
Understanding: Motivations oriented to acquiring and/or improving knowledge and experiences to enhance the grasp on a particular phenomenon (Chacón et al., 2017).	E-Government Portal; Online Blogs; Information services; Twitter (Info); Facebook (Info); Online news and information; Work and information-based apps; Technical knowledge management system; Travel apps; Online browsers; e-Health apps; Utility apps; Digital bulletin board system; Sports apps; Lifestyle apps.	**Information (Info):** Websites and apps that facilitate accessing a large amount of information related to various domains (Mody, 1999).	V
	Online software.		NV

Note. V, Voluntary - 'Voluntary use' refers to wilful use of ICTs without incentive or force. ; NV, Non-voluntary - 'Non-voluntary use' refers to work-related ICT use as a part of job.

Table 4. Classification of ICTs reported in the selected papers

The fifth step included 'analysis'; herein, we employed the Comprehensive Meta-Analysis (CMA) software (a licensed web-based application) for conducting the correlational meta-analysis and calculating the pooled correlation coefficients (Table 5). CMA allows the creation of moderating variables that can be utilized in the analysis by performing a sub-group analysis (Borenstein et al., 2009). We performed sub-group analysis to identify potential moderators by applying technology type, region of the country, and voluntariness as moderating variables. The countries of the study were classified into four continents, namely North America, Asia, Australia, and Europe, as all of the shortlisted studies were conducted in the countries belonging to these continents. These continents were considered, since there were at least three studies that were conducted for each continent. Moreover, we classified the ICTs into two categories, based on voluntariness (i.e., voluntary and non-voluntary).

The last step included 'reporting', comprising the description, presentation of the methods, and results derived from the relevant literature selected. Fernández del Amo et al. (2018) divided this phase into two sub-phases: 1. Description of the primary procedure followed, and 2. Public presentation of the results, such as journal articles.



Note. B&C, Business and Commerce; C&E, Career and Education; COMM, Communication; ENT, Entertainment; INFO, Information; SN, Social Networking.

Figure 2. Proposed Theoretical Framework

4 Results

Figure 1 presents the flow diagram for study selection; at the end of selection and appraisal phase, we found 48 studies to be eligible for further analysis (Appendix 1). In addition, we

extracted multiple correlation trials from several other studies, as they examined the association of Big Five personality traits with the use of different forms of ICTs. Thus, we considered a total of 379 correlation trials for our meta-analysis. Figure 2 depicts the proposed theoretical framework.

4.1 Study Characteristics

Most of the studies were conducted in the past 12 years (90%). The sample size in individual studies ranged from 22 to 9482. Selected studies considered at least one of the Big Five personality traits as an independent variable (IV), and the use of any form of ICT as a dependent variable (DV). Based on Table 4, the ICTs included in our study belonged to the six categories.

4.2 Meta-analysis

Initially, we examined the correlations between the Big Five traits (IV) and overall ICT use (DV) (five correlations). Next, we analyzed the relationship between the Big Five traits (IV) and six classes of ICTs (DV) (thirty correlations). Thus, a total of thirty-five correlations were examined with a minimum of three trials. The random-effect model was chosen over the fixed-effect model, as selected studies consisted of samples from different populations. Table 5 depicts the results of meta-analysis, tests of heterogeneity, and publication bias. Heterogeneity is a measure of variation in study outcomes between studies, which is primarily employed in systematic reviews and meta-analytic studies (Fletcher, 2007; Nayal et al., 2020). The I^2 statistic measures the percentage of variation across studies, caused by heterogeneity rather than chance. This measure of heterogeneity is better than other instruments (such as Q-statistics) as it does not depend on the number of studies (Higgins & Green, 2011). We observed a high level of heterogeneity (Table 5) across most of the correlations, which indicated the presence of potential moderators. Further, we tested publication bias using Begg and Mazumdar rank correlation and Egger's regression test. Out of 35 correlations, Egger's regression test reported the existence of publication bias for only one correlation: Agreeableness-Communication (t= 2.91, p=0.01). Thus, the results of the publication bias' test indicate an absence of significant publication bias and the robustness of the search strategy (Higgins et al., 2019; Tao et al., 2020).

The meta-analysis results showed that 85% of the pooled correlation coefficients were significant. All pooled correlation coefficients were positive except for N – C&E (-0.13), C – COMM (-0.04), C – ENT (-0.02), and C – SN (-0.04). All of the Big Five traits, besides 'agreeableness', were significantly related to using ICTs in general. Thus, most of the correlations between Big Five traits and the use of ICTs in general, and different forms of ICTs were supported. The 95% confidence intervals for the pooled correlations of N-ICT, O- ICT, and C – ICT were narrower than those of other correlations, signifying that these correlations were robust throughout the studies. These findings relate to the use of ICTs in general. In addition, the 95% confidence intervals for the pooled correlations of N - INFO, C – SNS, and C – C&E were narrower than those of other correlations between the Big Five traits and classified six categories of ICTs. This indicates the robustness and consistency of these correlations across the trials. Among all correlations, O – C&E (0.18), C – C&E (0.18), E – B&C (0.17), and E – SN (0.16) were found to be the most significant and strong correlations.

Pairwise Cor-relations	No. of trials	Total sample size	Effect size r (p-value)	Confidence Interval (95%)		Homogeneity Q	I^2	Publication bias	
				Lower	Upper			Test	t- stat (p-value)
E – ICT	88	99332	0.11***	0.09	0.14	544.69***	83.82%	RC	0.47 (0.64)
A – ICT	71	99331	0.02	-0.01	0.05	197.07***	63.96%	RC	1.69 (0.10)
O – ICT	70	77448	0.1***	0.07	0.12	503.80***	86.08%	RC	0.65 (0.55)
C – ICT	74	44221	0.03*	0.01	0.06	549.06***	86.52%	RC	0.09 (0.93)
N – ICT	76	90895	0.03*	0.01	0.05	277.45***	72.56%	RC	0.41 (0.68)
E – B&C	7	1,177	0.17***	0.06	0.28	23.13***	69.57%	ER	0.22 (0.83)
A – B&C	5	1,181	0.03	-0.09	0.15	19.05**	73.68%	ER	1.49 (0.23)
O – B&C	5	1,909	0.14***	0.07	0.21	8.35	37.50%	ER	1.20 (0.31)
C – B&C	5	9,937	0.03*	0.01	0.05	10.52*	50.00%	ER	1.54 (0.21)
N – B&C	7	10,124	0.02*	0.01	0.04	30.63***	76.67%	ER	0.67 (0.53)
E – C&E	14	20,236	0.10***	0.05	0.15	106.59***	86.79%	ER	1.42 (0.15)
A – C&E	19	15,012	0.13***	0.07	0.18	118.39***	83.90%	ER	1.05 (0.29)
O – C&E	19	20,013	0.18***	0.13	0.22	158.46***	87.97%	ER	1.33 (0.18)
C – C&E	20	15,634	0.18***	0.12	0.24	189.99***	89.42%	ER	1.71 (0.08)
N – C&E	16	21,230	-0.13***	-0.25	0.01	944.51***	98.31%	ER	1.18 (0.26)
E – COMM	17	20,073	0.13***	0.08	0.17	168.95***	89.88%	ER	1.24 (0.22)
A – COMM	14	13,024	0.12***	0.04	0.2	163.67***	91.41%	ER	2.91 (0.01)
O – COMM	6	19,869	0.11***	0.01	0.21	174.06***	96.55%	ER	0.03 (0.98)
C – COMM	10	11,259	-0.04	-0.1	0.02	122.01***	91.80%	ER	1.25 (0.24)
N – COMM	12	10,974	0.06	-0.01	0.12	132.63***	90.91%	ER	1.51 (0.15)
E – ENT	11	19,446	0.05*	0.01	0.1	31.45***	64.52%	ER	1.43 (0.18)
A – ENT	5	1,685	0.07***	0.03	0.11	16.25**	68.75%	ER	1.06 (0.34)
O – ENT	12	11,042	0.02*	-0.01	0.04	30.11**	60.00%	ER	1.16 (0.24)
C – ENT	4	18,810	-0.02	-0.08	0.03	25.53***	84.00%	ER	0.30 (0.78)
N – ENT	8	1,406	0.06*	0.02	0.08	31.47***	74.19%	ER	0.08 (0.94)

E – INFO	14	13,363	0.04**	0.02	0.06	103.78	86.41%	ER	0.63 (0.54)
A – INFO	14	5,212	0.08***	0.04	0.13	25.60*	44.00%	ER	0.21 (0.83)
O – INFO	14	15,451	0.13***	0.07	0.18	80.60***	82.50%	ER	1.72 (0.11)
C – INFO	15	21,762	0.05***	0.03	0.06	100.27***	85.00%	ER	0.29 (0.77)
N – INFO	13	13,131	0.02*	0.01	0.03	37.18***	64.86%	ER	0.73 (0.48)
E – SN	23	19,703	0.16***	0.11	0.21	226.29***	89.82%	ER	1.62 (0.12)
A – SN	16	18,167	0.04**	0.01	0.07	40.30***	60.00%	ER	0.92 (0.37)
O – SN	14	19,909	0.06***	0.04	0.07	95.88***	85.26%	ER	0.85 (0.41)
C – SN	20	20,928	-0.04*	-0.05	-0.03	126.90***	84.13%	ER	1.10 (0.26)
N – SN	20	19,560	0.03***	0.02	0.05	101.27***	80.20%	ER	0.40 (0.69)

Note. E, Extroversion; A, Agreeableness; O, Openness; C, Conscientiousness; N, Neuroticism; C&E, Career and Education; COMM, Communication; ENT, Entertainment; INFO, Information; B&C, Business and Commerce; SN, Social Networking, RC: Begg and Mazumdar Rank Correlation; ER: Egger's Regression Intercept.

Table 5. Results of Meta-analysis for pairwise correlations

Notably, the relationship strength personality traits – ICT use varied across different forms of technologies. Out of the five personality traits, Conscientiousness (0.18) and Openness (0.18) were found to be most significantly correlated with C&E, Extroversion (0.13), and Agreeableness (0.12) with COMM, Agreeableness (0.07) and Extroversion (0.05) with ENT, Openness (0.13) and Agreeableness (0.08) with INFO, Extroversion (0.17) and Openness (0.14) with B&C, and Extroversion (0.16) and Openness (0.06) with SN.

4.3 Subgroup Analysis

As illustrated in Table 5, high value of I^2 for most of the correlations indicates a substantial level of heterogeneity, indicating the existence of potential moderating variables (Nayal et al., 2020). We performed subgroup analysis to examine the moderating effects of technology type, region of the country, and voluntariness on the personality trait-ICT use relationship (Nayal et al., 2020; Tao et al., 2020). The results of the subgroup analysis are summarized in Table 6.

Technology type (as categorized in table 4) moderated all relationships except the relation of Agreeableness – ICTs use. Out of relationships between personality traits and use of ICTs, Neuroticism – ICTs use ($Q= 79.51$, $p<0.01$) was the most significantly impacted by the technology type as moderator, followed by Conscientiousness – ICTs use ($Q=40.77$, $p<0.01$), Openness – ICTs use ($Q=24.85$, $p<0.01$), and Extroversion – ICTs use ($Q= 15.96$, $p<0.01$).

We grouped the studies in our data-set under four regions based on the continents of the countries, where the studies were actually conducted; they included North America, Australia, Europe, and Asia. The region of the country, as a moderator, moderated the relationship of Extroversion – ICTs use ($Q=27.84$, $p<0.001$) most significantly, followed by Conscientiousness-ICTs use ($Q=21.22$, $p<0.001$), and Agreeableness-ICTs use ($Q=10.58$, $p<0.05$). However, the remaining two correlations were not moderated by region of the country.

Finally, we examined the impact of voluntariness on the personality – ICT use relationship by classifying the ICTs into two classes, i.e., voluntary and non-voluntary. The results revealed that voluntariness (voluntary and non-voluntary) moderated all relationships (except for Neuroticism – ICTs use) in a way that the Big Five – ICT use relationships become more significant in case of non-voluntary ICTs. Specifically, the relationship of Openness – ICTs use was observed to be most significantly moderated by voluntariness (Q=49.28, p<0.01), followed by Conscientiousness – ICTs use ((Q=20.88, p<0.01), Extroversion – ICTs use (Q=12.80, p<0.01), and Agreeableness – ICTs use (Q=9.10, p<0.01).

Correlations	**Technology Type (Moderator)**		**Region of country (Moderator)**		**Voluntariness (Moderator)**	
	Impact	*Q (p-value)*	*Impact*	*Q (p-value)*	*Impact*	*Q (p-value)*
E-ICT	Moderated	15.96(0.01)	Moderated	27.84(0.01)	Moderated	12.80(0.01)
A-ICT	Not Moderated	9.81(0.08)	Moderated	10.58(0.01)	Moderated	9.10 (0.01)
O-ICT	Moderated	24.85(0.01)	Not Moderated	5.70(0.13)	Moderated	49.28(0.01)
C-ICT	Moderated	40.77(0.01)	Moderated	21.22(0.01)	Moderated	20.88(0.01)
N-ICT	Moderated	79.51(0.01)	Not Moderated	6.16(0.10)	Not Moderated	1.61(0.20)

Note. E: Extroversion; A: Agreeableness; O: Openness; C: Conscientiousness; N: Neuroticism.

Table 6. Results of subgroup analysis

5 Discussion

We conducted a meta-analysis of forty-eight studies that quantitatively investigates the use of various forms of ICTs in view of the Big Five model of personality. This study highlights the relevance of Big Five traits in unfolding the riddle of individual ICT adoption. The findings of our study explain how Big Five traits effectively influence the adoption and use of certain ICTs. Further, to understand the intricacies of personality – ICT use relationship, we explored the moderating role of technology type, region of the country, and voluntariness.

5.1 Primary findings

The results of the meta-analysis demonstrate that two personality traits, namely 'extroversion' and 'openness', were the most significantly and consistently related to the use of ICTs in general and across various classes. Previous research has documented similar findings and attributed them to the intrinsic proclivities of individuals (Burtăverde et al., 2021; Stachl et al., 2017; Xu et al., 2016). As extroverts derive their energy from the presence of other people, they continuously seek out new opportunities that offer social interactions. The paradigm shift from physical settings to the virtual world may push them more to use 'social networking' based ICTs than other individuals. Similarly, open individuals possess a wide variety of interests and enjoy novel experiences, wherefore they are more likely to use any innovative or updated form of ICTs. The meta-analysis results found variability in the magnitude of effect sizes because of the characteristics of various personality traits and different forms of ICTs. Each personality trait comprised a set of individual dispositions, while each type of ICT differed from the others in terms of motives and means of using technology. Correlating these

two reflects their association, and their interpretation may be used for important practical purposes.

Overall, the results of the meta-analysis showed that all Big Five personality traits are significantly associated with ICT use in general except 'agreeableness'. However, the relative strength of the associations varied across the different personality traits, signaling thereby 'variability' across the selected relationships. Our study showed that both 'extroversion' and 'openness' are most significantly associated with the use of ICTs. However, 'extroversion' does have a relatively stronger association with ICT use than 'openness'. It implies that because of the widespread availability and accessibility of ICTs, 'openness' has become less important than 'extroversion'. However, this is not true for the newly introduced forms of ICTs. Timmermans and de Caluwé (2017) argued that 'openness' does have an essential and determining role in adopting novel technologies, such as online learning platforms, online skill development programs, online business and commerce applications, and online information portals. Therefore, 'openness' exhibited significant and stronger correlations with B&C, C&E, INFO-based ICTs. These findings concur with Rauschnabel et al. (2015) study, which stated that 'openness' plays a central role in the success of a newly introduced ICT. We found 'conscientiousness' to be significantly associated with the use of ICTs in general. In particular, this personality trait demonstrated significant positive correlations with 'career and education', 'information', along with 'business and commerce' based ICTs, while it showed significant negative correlations with 'social networking' based ICTs. Notably, since conscientious people tend to be self-disciplined, dutiful, and achievement-oriented; hence, in congruence with their psychological motivation for self-enhancement, they prefer utilizing ICTs to help them in skill development, staying informed, being well-organized, and avoiding the use of those ICTs, which they perceive as being unproductive (Eşkisu et al., 2017; Hughes et al., 2012; Tan & Yang, 2014).

We found 'agreeableness' to be significantly and positively associated with the use of various ICTs, except for 'business and commerce'. Next, 'career and education' based ICTs on the other hand, seemed to assist internet-based skill development courses, lecture delivery, online classes, student evaluation, and online training, among others. As agreeable people tend to be cooperative, sensitive, and conflict-averse, they readily accept suggestions, and follow instructions, which can explain this positive correlation (A-C&E). Further, high scorers on 'agreeableness' are disposed to be social and easy-going. Such people desire to get along with others, form friends easily, and seek out a 'virtual community'. Importantly, these proclivities can act as a motivation for agreeable people to use 'communication' and 'social networking' based ICTs (Bowden-Green et al., 2021). Therefore, in line with (Xu et al., 2016) and in contrast to (Tsao, 2013), we observed significant positive correlation between 'agreeableness' with 'communication' and 'social networking' based ICTs. Furthermore, it may be noted that extant literature has been of the view that agreeable people are driven by potential benefits of 'information' based ICTs, and thereby use the virtual worlds for recreational purposes (Bowden-Green et al., 2021). In line with Lin et al. (2017), our study reported that high scorers on 'agreeableness' are likely to use 'entertainment' and 'information' based ICTs.

Further, 'neuroticism' showed significant correlations with the use of all categories of ICTs, except for 'communication'. Neurotic individuals prefer solace and avoid interactions with people; wherefore, the relationship of N – COMM was found to be insignificant. Notably, 'neuroticism' had the most negative strong and significant association with 'career and

education' based ICTs. Researchers have also noted that people's self-improvement efforts are significantly influenced by their emotional stability (Altanopoulou & Tselios, 2015; McCrae & Costa, 1987). Consequently, individuals with a low score on 'neuroticism' are motivated to gain new skills, and increase their knowledge using digital means, justifying in the process, the nature of N – C&E relationship. Next, we observed that 'neuroticism' was positively linked with 'social networking' based ICTs. According to previous research, neurotic individuals experience social pressure and anxiety while interacting with others in physical environments (Kircaburun et al., 2020). Such people express themselves better in the digital realm, as it provides enhanced control over the flow of conversation and eliminates the anxiety caused by social consciousness. Therefore, to fulfill social needs, neurotic individuals seek some alternate channel for self-expression and socialization, which effectively explains their fondness for 'social networking' based ICTs. In similar lines, it may be noted that neurotic individuals prefer spending most of their time alone, and avoid meeting people. Hence, to satiate their basic and recreational needs, they use 'business and commerce', 'information' and 'entertainment' based ICTs such as online shopping, online banking, online blogs, online information websites, online news applications, online games, online music, and video applications. These findings justify the consistency of an individual's personality and behavior in the physical settings and digital space.

Further, our findings reveal three moderators, namely, technology type, region of the country, and voluntariness. Technology type significantly moderated four out of five pairwise correlations, indicating that distinct personality types are associated with variations in technology use. The variability in the use of ICTs based on the type of technology has been consistently reported in extant literature (Bowden-Green et al., 2021; King & He, 2005; Lai et al., 2022). These results explain the variations in the correlation coefficient between personality traits and the use of ICTs. Moreover, in the results of preliminary analysis, we observed that the effect size of the correlation C – C&E was larger than other correlations in C&E class, whereas the effect size of the correlation between E – SN was larger than other correlations in the SN class. Similarly, the effect size of the correlation O – INFO was observed as being relatively larger and more significant. These findings are to be read with the classification offered by this study (Table 4) to understand WHY these effect sizes actually vary. For instance, conscientious individuals are motivated for achievements and self-development, and likely to use those ICTs, which in turn, facilitate being organized, achieving goals, skill development, and staying updated. Therefore, 'conscientiousness' did show a larger and positive effect size for 'career and education', along with 'information' based ICTs. On the other hand, extroverts tend to be talkative, social, and outgoing. Such individuals try to find various ways to express themselves and talk to others. Therefore, 'extroversion' exhibited a larger and positive correlation with social networking sites, and 'communication' based ICTs. Similarly, open individuals are disposed to be receptive to any novel or updated form of ICTs. Therefore, they would readily accept newly introduced technology, such as online payment applications, and virtual reality devices, among others. Hence, 'openness' showed a more significant effect size for 'information', 'business and commerce', and 'career and education' based ICTs. This suggests that type of technology would accentuate the relationship between personality traits and ICT use, which in turn, would expand knowledge on condition (i.e., type of technology), especially in enabling the use of ICTs. Thus, in light of the present study, it would be judicious to infer that people with different personalities are driven by different

motivations. Therefore, ICT selection and use decisions are determined by the congruence between personality traits and the utility of ICT.

Next, the region of the country emerged as another moderator. Although this moderator was less significant than the technology type, it moderated three out of five pairwise correlations. This can be attributed to cultural differences in various regions of the countries across the world. Hofstede's National Cultural dimension indices depict the dispositions of their citizens at the national level. These scores could help in explaining the moderation effects of continents of the country. For example, the continents, including countries that score higher on individualism (such as North America and Australia), comprise a larger number of citizens using individual-based ICTs, such as photo editing applications, online shopping websites and applications, online skills up-gradation courses, personalization applications, and blogging. Similarly, European and Asian countries (such as Greece, Romania, Turkey, and South Korea) that score higher on the dimension of uncertainty avoidance consist of a substantial number of citizens who avoid using ambiguous forms of ICTs, such as online dating applications and location-based social network applications (Hofstede & Fink, 2007; Matusitz & Musambira, 2013). Researchers have also studied the pattern of Big-Five traits distribution across national cultures and observed significant differences across the globe (Allik, 2012; Schmitt et al., 2007). As a corollary, Asians are more interested in 'career and education' based ICTs, because of their conscientious nature; while Europeans are more likely to use 'information' and 'social networking' based ICTs due to their open personality (please see Appendix 2). Further, the disparities in ICT use across different countries could be attributed to the digital divide caused by state of national economic development (Vu & Lim, 2021). Previous literature for instance, has observed a significant impact of GDP, education, internet price, and regulatory frameworks and digitalization index (Billon et al., 2010). We also observed significant differences in terms of ICT use across different continents. Thus, our results go on to validate the impact of global differences on ICT use and support extant literature thereof.

Finally, voluntariness moderated four out of five pairwise correlations (all except N – ICT). We noticed that the relationships between personality traits and ICT use are uniformly stronger for non-voluntary ICTs, indicating that individuals with different kinds of personality use work-related or non-voluntary ICTs in a similar pattern (please see appendix 2). Following the 'Empowerment/Enslavement Paradox', this finding concurs with Jarvenpaa and Lang (2006). It may be noted herein that in a large-scale study examining the experience of mobile technology within a multinational context, Jarvenpaa and Lang (2006) reported that work-related demands actually reduce the influence of other individual and organizational factors in the case of non-voluntary ICT use. In the same vein, the researchers also noted work pressure or job commitments as a vital factor in case of non-voluntary ICT use (Schlachter et al., 2018). Thus, it could be inferred that organizational factors (such as job requirements) matter more in the context of non-voluntary ICT use.

5.2 Implications

5.2.1 Theoretical Implications

The theoretical implications of this study are fivefold: first, this study proposes an updated and integrated classification of ICTs (Mody, 1999; Rad et al., 2018). This categorization is predicated primarily on the psychological motivations and utilities of ICTs, grouped into six distinct clusters. Each cluster possesses certain exclusive features, offers unique value, and is related to distinct psychological motivations. For instance, 'social networking' based ICTs

promote socialization (or social needs) by creating a feeling of proximity in digital space. On the other hand, 'career and education' based ICTs facilitate skill development and self-enhancement, which in turn, foster the need for achievement or intellect. Thus, the proposed taxonomy does function as a classification tool to categorize ICTs, based on prescribed criteria (Table 4), and thereby facilitates developing an enhanced understanding of the uniqueness of various forms of ICTs.

Second, this study enriches literature with knowledge concerning the role of individuals' personality traits in using various ICTs by statistically synthesizing previous studies' results and establishing relationships between personality traits and six categories of ICTs. Since this study explains WHY different people have varying preferences for various ICTs, the findings may be employed to drive future research on the determinants of adoption and use of ICTs with specific values and attributes. Though extant literature consists of a number of theoretical models that explain variance in ICTs' use (such as TRA, TAM, UTAUT, UTAUT 2), personality has not been considered in any of these models (Dwivedi et al., 2019). Also, previous review studies highlighted the need of incorporating the 'individual differences'-based variables in technology adoption models (Dwivedi et al., 2019). Thus, the larger findings of this study imply that incorporating personality into extant technology adoption models would significantly enhance their explanatory power.

Third, this study addresses and minimizes inconsistencies relating to the relationship between personality traits and use of various forms of ICTs, and thus, provides a clearer picture of how personality traits are actually associated with the use of various forms of ICTs (or ICTs in general). Previous studies reported varied nature and strength of similar personality traits – ICT use relationships in terms of their statistical significance, i.e., positively significant, negatively significant, and non-significant. In other words, extant literature seemed to lack the comprehensive view of the relevance of personality traits in ICT use. The present meta-analysis of earlier studies, do signal a significant positive correlation (except A – B&C, N – C&E, C – COMM, N – COMM, and C – SN). Notably, higher heterogeneity scores indicate that these differences in extant literature may be attributable to moderators. We considered technology type, region of country, and voluntariness as moderators, and offer explanations to reduce such inconsistencies that existed in earlier studies. Further, we group similar ICTs into six distinctive clusters, analyze the previously reported relationships, and offer a comprehensive view of how personality traits are actually linked to different ICT use. Furthermore, in line with Gollwitzer and Bargh (1996) study, we explain the nature and strength of the Big Five traits – ICT use relationship by linking individual dispositions with six groups of ICTs, along with their respective psychological motivations. The results could assist the research community in developing a comprehensive grasp of the association between personality traits and usage of different kinds of ICTs, and serve as a strong foundation for future studies.

Fourth, this research unearthed three potential moderators: technology type, region of country, and voluntariness, that influence the relationship between personality traits and ICT use. These findings explore and report the relevance of ICT characteristics, national culture diversities, and individual's desire with respect to the personality – ICT use relationship. Thus, present research underlines the significance of contextual variables while interpreting the results of this study and recommend considering these variables while examining the ICT

adoption. These findings and explanations could facilitate problem formulation and explaining the results of future studies.

Finally, this study noted that some personality traits are more relevant when examining adoption/use of specific ICT that have distinct functionalities and offer certain benefits. For instance, 'extroversion', 'agreeableness', and 'openness' play a determining role in the context of 'communication' related ICTs. Similarly, 'extroversion' and 'openness' are of higher significance when studying 'business and commerce' related ICTs. In accordance with the prior research, this study verifies the irrelevance of 'agreeableness' in case of ICT in general. Thus, this research offers recommendations with respect to technology-specific trait selection in order to make research model comprehensive and parsimonious while studying adoption/use of specific ICT.

5.2.2 Managerial Implications

The results of this study offer actionable insights to ICT designers, marketers, service providers, business strategists, human resource managers, and policymakers on possible measures to enhance the business plan and optimize resource allocation. First, the significant role of an individual's dispositional factors suggests that it may be insufficient for ICT providers to merely craft and traditionally deliver the ICTs. The characteristics of ICTs and delivery approach should align with the targeted consumer group's characteristics and requirements. A personalized user interface that adopts its functioning style to align with the user's personality could be perceived as being more useful and more likely to be accepted by customers (Bosnjak et al., 2007; Ruijten, 2021). For example, conscientious people avoid using leisure mobile apps, such as music and photography, along with personalization apps that negatively affect their productive activities. On the other hand, neurotic individuals tend to adopt such apps, owing to their fussy and picky nature, and their interest in creative activities (Xu et al., 2016). Thus, personalized suggestions may result in attaining the right trait-technology fit and offering the services accordingly. Such user-friendly interfaces and navigations can be attained by aligning the interface characteristics with human principles and continuous evaluation process while crafting ICTs (Or & Tao, 2012).

Second, the nature and strength of relationships between personality traits and ICTs use suggest that technology providers require additional efforts to identify the cluster of targeted consumers with certain proclivities and preferences. Various personality tests could be employed for this purpose by administering a quick survey to determine the test-takers' personality. For example, the Ten Items Personality Inventory (TIPI) could be administered along with collecting demographic variables by providing a small reward for filling up the form. The scores obtained through personality tests would facilitate consumers and technology providers in making decisions regarding technology selection and crafting a marketing strategy, respectively (Donvito et al., 2020; Rojas-Méndez et al., 2013; Ruijten, 2021; Wang et al., 2018; Zabkar et al., 2017). For instance, if a technology provider plans to introduce a variant of ICT that would help people be organized, additional efforts are required to locate those who are more conscientious, apart from merely crafting and delivering ICTs. Similarly, if a company intends to introduce a new social media platform, it should identify and target the cluster of outgoing and sociable people. Information about the number and types of pre-installed applications and browsing history of users (with the consent of device users) could facilitate identifying dominant personality traits. Next, the negatively significant association of N-C&E implies that neurotic individuals are more receptive to the negative aspects of

'career and education' based ICTs. Hence, when presenting self-enhancement-based ICTs, it is crucial that all pertinent information, prospective advantages, and guarantee of promised services be provided in an organized manner. Further, ICTs should be created with a strategy that promotes and communicate an interactive user interface and user-friendly navigation to minimize the doubts and concerns of customers. For instance, if a bank plans to offer a mobile banking app, then it should circulate a detailed document or float a video comprising all required information related to its know-how, key functions, safety and security features, certifications, and benefits of use in a structured way through the authentic channel. Doing so would aid in obtaining and maintaining neurotic clients. These practices may also facilitate technology providers in gaining consumers' trust and spreading positive word-of-mouth that plays a significant role in acquiring agreeable consumers.

Third, the variation in the pairwise correlations implies that individual dispositions should be aligned with the assigned tasks to optimize employee performance (Palmer et al., 2019; van der Schyff et al., 2020). For instance, in the case of an information technology company, open employees could be assigned to test newly developed ICTs and work using recently introduced ICTs, such as data analytics, machine learning, big data, and cloud technology, whereas low scorers on the 'openness' could be assigned to work on conventional technologies such as traditional database management using MS SQL, Microsoft Word, and Microsoft Excel.

Fourth, the moderating effect of technology type recommends that practitioners should figure out the customized design and implementation strategy for different types of ICTs. For instance, people interested in 'career and education' based ICTs may be less interested in using 'social networking' based ICTs. Therefore, a single design and implementation strategy may not work well for all forms of ICTs; thus, business strategies should be contextualized accordingly. Practitioners, who target the international market to introduce any form of ICT, should consider the aspect of variability in technology use across different cultures. We found the differences in users across different cultures, which effectively indicate a need to recognize culture-specific factors in determining the use of ICTs, and thereby ensure successful technology delivery and implementation in local markets. Finally, the moderating effect of voluntariness indicates the variances in personal (voluntary) and work-related (non-voluntary) technology use patterns. Voluntary use of ICT is subject to individual needs, wants, and desires; therefore, ICT providers should focus more on psychological and functional incentives (as discussed in Table 4), enhancing user interface, and personalized marketing. On the other hand, non-voluntary ICTs are acquired and implemented by organizations; thus, technology providers should prioritize matching client's requirements, offering competitive business advantages, and ensuring dependable assistance. Hence, ICT providers are recommended to modify their business strategies with respect to the use cases.

5.3 Limitations and Future Research Directions

This study has some limitations that should be noted and addressed by future research. First, we only included variables with at least three trials for the purpose of meta-analysis. Though this is standard practice for conducting a meta-analysis, this may have prevented us from understanding the complete scenario of interaction between human personality and ICT use. Future studies are encouraged to examine this research domain using qualitative methods, such as morphological analysis and narrative literature review. Second, the results of tests for publication bias indicate the absence of significant publication bias; however, a high value of

heterogeneity does indicate the presence of unexamined factors that influence the pairwise correlations (Nayal et al., 2020). Although we examined the moderating effect of select variables, data availability limitations in the selected papers and study design prevented us from assessing other moderators' roles. Future studies are recommended to provide more data on the age group, education level of the participants, and additional relevant information and conduct their investigations in light of potential moderators. Third, our study considered only correlational statistics and not path coefficients. The number of studies containing path coefficients was less than the number of studies containing correlation statistics. This could be addressed by conducting a meta-analysis of both correlation coefficients and path coefficients when sufficient data on such relationships is available in literature (Zhang et al., 2022). Moreover, assessment on use of technology in online/offline could have added value but use of technology in online/offline mode were not adequately reported in the studies shortlisted. Future studies could add this as a potential moderator. Fourth, some of the meta-analyzed correlations were found to be statistically insignificant. This finding could be attributed to the possibility of the presence of other variables that are not considered in our study. Therefore, apart from individual personality, future studies are recommended to examine other individual and organizational variables with respect to the use of various ICTs. Finally, we observed that the studies included in the meta-analysis, employed a variety of instruments to measure the Big Five personality traits. Though previous studies have examined the measurement tool for validity and reliability (Cohen & Baruth, 2017; Rauschnabel et al., 2015; Tsao, 2013), we recommend future studies employ detailed taxonomy to capture an accurate picture of personality.

6 Conclusion

This study quantitatively synthesizes previous studies that examine the relationship between the Big Five personality traits and ICTs use. Additionally, we identify three significant moderators, namely technology type, region of the country, and voluntariness, which enhances the understanding of personality's role in the use of varied technology contexts. Based on our results, we proposed an updated and inclusive classification of available technologies based on their unique functionalities and distinct psychological motivations. Successful identification of personality traits that affect use of ICTs would effectively benefit practitioners and researchers in crafting an appropriate business plan and developing an integrated perspective of factors affecting ICTs use, respectively. Future efforts may be dedicated to including additional relevant moderators, such as educational background, age, gender, and technology frames to explain further the relationship among personality traits and the use of various ICTs.

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Appendix 1

Study characteristics of selected studies

Study	Sample Size	Country	Technology Evaluated	Techno-logy type	Examined Big-Five traits	Voluntar-iness	Theoretical Models
Altanopoulou & Tselios, 2015	85	Greece	Wiki-based learning	C&E	E,A,O,C,N	V	FFM
Amichai-Hamburger et al., 2002	40	Israel	Internet Use	SN	E,N	V	FFM
Behrenbruch et al, 2013	272	Germany	Mobile applications	SN	E	V	FFM, TAM
Benlian & Hess,2010	232	Germany	Enterprise resource planning	C&E	E,A,O,C,N	V	FFM, Software Evaluation

							Criteria Model
Bernett et al.., 2015	347	USA	Web based classroom technology system	C&E	E,A,O,C,N	NV	FFM, UTAUT
Burtăverde et al., 2019	341	Romania	Smartphone use	B&C, ENT, INFO, SN	E,A,O,C,N	V	FFM, HEXACO, Dark Triad
Butt & Phillips, 2008	115	Australia	Calls and SMS	I&C	E,A,C,N	V	FFM
Camden et al., 2018	425	Turkey	Technology use	C&E	E,A,O,C,N	V	FFM, TAM
Chorley et al., 2015	174	UK	Use of Location Based Social Networks	SN	C,N	V	FFM
Clemens et al., 2017	137	Germany	Smartphone use	B&C, COMM, ENT, INFO	E,A,O,C,N	V	FFM
Cohen & Baruth, 2017	72	Israel	Online learning based technology	C&E	O,C	NV	FFM
Davis et al., 2007	111	USA	Microsoft Excel Spreadsheet software	C&E	O,N	NV	FFM, IT-Specific Traits Model
Devraj et al., 2008	180	USA	e-Project: Commercial collaborative system	C&E	A,O,N	NV	FFM, TAM
Ehrenberg et al., 2008	200	Australia	Smartphone use	COMM	E,A,N	V	FFM
Eşkisu et al., 2017	482	Turkey	Facebook	C&E, SN	E,A,O,C,N	V	FFM
Guadagno et al, 2008	89	USA	Blogging	INFO	E,A,O,C,N	V	FFM
Hamburger& Ben-Artzi,2000	72	Israel	Online services	INFO, ENT	E,N,	V	FFM
Hughes et al., 2012	300	UK	Facebook and Twitter	INFO, SN	E,A,O,C,N	V	FFM
Kalmus et al., 2011	1507	Estonia	Internet use	INFO,SN	O,C,N	V	FFM
Keller & Karau., 2013	250	USA	Online academic course	C&E	E,A,O,C,N	V	FFM
Kim et al., 2015	9482	South Korea	Mobile Applications	C&E, COMM, INFO, SN, ENT	E,A,O,C,N	V	FFM
Kircaburun et al., 2018	1008	Turkey	Social media based technologies	SN	E,A,O,C,N	V	FFM

Ko et al., 2012	301	USA	Internet banking	B&C	A,O	V	FFM, TAM
Lane & Manner, 2011	312	USA	Smartphone use	COMM	E,A,N	V	FFM
Lane, 2012	233	USA	Mobile Applications	B&C, C&E, SN	E,A,C	V	FFM, TAM
Lin & Ong, 2010	65	China	Digital bulletin board system	INFO	A,O	V	FFM, TAM
Mark & Ganzach, 2014	8984	USA	Internet Use	C&E, ENT, COMM	E,O,C,N	V	FFM
McElroy et al., 2007	132	USA	Internet Use, e-Commerce	B&C	E,N,O	V	FFM
Mouakket, 2015	397	UAE	Facebook	SN	E,A,C,N	V	FFM, TAM
Ozbek et al., 2014	401	Turkey	Smartphone use	COMM	E,A,O,C,N	V	FFM, TAM
Rajput, 2015	137	India	WhatsApp	SN, COMM	E,A,O,C,N	V	FFM
Rauschnabel et al., 2015	146	Germany	Google glass	ENT	E,O,N	V	FFM
Rosen & Kluemper, 2008	522	USA	Social media based technologies	SN	E,C	V	FFM, TAM
Ryan& Xenos, 2011	1324	Australia	Facebook	INFO, SN	E,A,O,C,N	V	FFM
Sriyabhand & John, 2014	320	Thailand	m-Social Networking Technologies	SN	O	V	FFM, TAM
Sullivan, 2012	251	USA	Technology Knowledge Management Systems	INFO	E,A,O,C,N	V	FFM
Svendsen et al.., 2013	1004	Norway	Online software	INFO	E,A,O,N	NV	FFM, TAM
Swickert et al., 2002	206	USA	Internet Use	SN	E,A,O,C,N	V	FFM
Tan & Yang, 2012	148	Taiwan	Internet Applications	B&C, SN	E,N	V	FFM
Tan&Yang, 2014	172	Taiwan	Mobile Applications	COMM, SN, ENT, B&I,	E,A,O,C,N	V	FFM
Terzis et al., 2012	117	Greece	Computer based assessment	C&E	E,O,N	V	FFM
Tosun & Lajunen, 2010	427	Turkey	Social media based technologies	SN	E	V	FFM
Tsao, 2013	429	Taiwan	Internet Use	ENT, COMM,	A, O	V	FFM
Venkatesh et al., 2014	311	India	e-Governance	INFO	E,A,O,C,N	V	FFM
Wang, 2010	228	China	Instant messaging applications	COMM	E,C,	V	FFM, TAM

Xu et al., 2016	22	Switzer-land	Mobile Applications	SN	E,A,N	V	FFM
Zhang et al., 2017	213	USA	Location based social networks	SN	E,A,O,C,N	V	FFM
Zhou & Lu, 2011	268	China	Mobile Commerce	B&C	E,A,O,C,N	V	FFM

Note: V, Voluntary; NV, Non-voluntary; B&C, Business and Commerce; C&E, Career and Education; COMM, Communication; ENT, Entertainment; INFO, Information; SN, Social Networking; FFM, Five Factor Model; TAM, Technology Acceptance Model.

Appendix 2

Moderation Analysis Results

Correlation	Technology Type (Moderator)						Region of Country (Moderator)				Voluntariness	
E-ICT	**B&C**	**C&E**	**COMM**	**ENT**	**INFO**	**SN**	**North America**	**Australia**	**Europe**	**Asia**	**V**	**NV**
N	7	14	17	11	14	23	12	10	20	25	80	8
Effect size	0.17	0.1	0.13	0.05	0.04	0.16	0.17	0.1	0.12	0.03	0.11	0.18
CI	(0.06-0.28)	(0.05-0.15)	(0.08-0.17)	(0.01-0.10)	(0.02-0.06)	(0.11-0.21)	(0.13-0.21)	(0.02-0.18)	(0.03-0.20)	(0.00-0.06)	(0.08-0.12)	(0.14-0.21)
Q (p-value)	15.96(0.01)						27.84(0.01)				12.80(0.01)	
A-ICT												
N	5	19	14	5	14	16	11	11	13	19	64	10
Effect size	0.03	0.13	0.12	0.07	0.08	0	0.04	-0.06	0.11	0.03	0.07	0.14
CI	(-0.09-0.15)	(0.07-0.18)	(0.04-0.02)	(0.03-0.11)	(0.04-0.13)	(0.01-0.07)	(-0.04-0.12)	(-0.13-0.01)	(0.03-0.19)	(0. 01-0.06)	(0.05-0.10)	(0.10-0.19)
Q (p-value)	9.81(0.08)						10.58(0.01)				9.10 (0.01)	
O-ICT												
N	5	19	6	12	14	14	12	4	14	23	61	9
Effect size	0.14	0.18	0.11	0.02	0.13	0.06	0.07	0.09	0.11	0.01	0.09	0.25
CI	(0.07-0.21)	(0.13-0.22)	(0.01-0.21)	(-0.01-0.04)	(0.07-0.18)	(0.04-0.07)	(0.00-0.14)	(0.05-0.13)	(0.07-0.14)	(-0.06-0.08)	(0.07-0.11)	(0.21-0.28)
Q (p-value)	24.85(0.01)						5.70 (0.13)				49.28(0.01)	
C-ICT												
N	5	20	10	4	15	20	13	9	18	20	67	7
Effect size	0.03	0.18	-0.04	-0.02	0.05	-0.04	0.02	-0.04	0.07	0.17	0.04	0.15
CI	(0.01-0.05)	(0.12-0.24)	(-0.10-0.02)	(-0.08-0.03)	(0.03-0.06)	(-0.05-(-0.03))	(-0.02-0.06)	(-0.09-0.01)	(-0.01-0.15)	(0.07-0.26)	(0.02-0.06)	(0.11-0.19)
Q (p-value)	40.77(0.01)						21.22(0.00)				20.88(0.01)	
N-ICT												
N	7	16	12	8	13	20	13	9	20	16	68	8
Effect size	0.02	-0.13	0.06	0.06	0.02	0.03	-0.01	0.04	0.02	0.06	0.01	-0.24
CI	(0.01-0.04)	(-0.25-0.01)	(-0.01-0.12)	(0.02-0.08)	(0.01-0.03)	(0.02-0.05)	(-0.03-0.03)	(-0.02-0.11)	(-0.06-0.09)	(0.02-0.10)	(-0.03-0.03)	(-0.55-0.13)
Q (p-value)	79.51(0.01)						6.16(0.10)				1.61(0.20)	

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