

Personal Traits and Digital Entrepreneurship: A Mediation Model Using SmartPLS Data Analysis

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Abstract: Technological advancements have created a plethora of opportunities for entrepreneurs to develop and extend their business operations. Hence, internet has promoted to the emergence of digital entrepreneurship as a growing form of entrepreneurship among many entrepreneurs, especially digital natives. This research examines to what extent personal traits of digital natives' impact on their digital entrepreneurship intention. The research examined the direct impact of the big five personal traits, i.e., openness to experience, conscientiousness, extraversion, agreeableness, and neuroticism, on digital entrepreneurship intention and the indirect impact through personal attitude. For this purpose, a pre-examined questionnaire was directed to senior students in computer sciences and information technology colleges at public universities in Kingdom of Saudi Arabia (KSA). The results of structural equation modeling using SmartPLS (version 4) confirmed a direct positive and significant impact of the big five personal traits on personal attitude. However, the results revealed that the impact of the big five personal traits (except agreeableness) on digital entrepreneurship intention were positive but insignificant. Additionally, a mediating effect was confirmed for personal attitude in the link between personal traits and digital entrepreneurship intention among senior students in KSA higher education. The results contributed to the research gap in relation to personal traits and its impact on personal attitude and ultimately on digital entrepreneurship intention, especially among digital natives. Several implications were merged and discussed for scholars, policy makers and educators in higher education institutions.

Keywords: personal traits; digital entrepreneurship intention; personal attitude; SmartPLS; quantitative analysis; Kingdom of Saudi Arabia

MSC: 91C99

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1. Introduction

The concept of digitization has altered the entire world, with the digital economy emerging as the second most important economic development after the industrial revolution [1,2]. The adoption of digital technologies regarded as a critical motivator for entrepreneurship [3]. Technology advancements have created a plethora of opportunities for entrepreneurs to develop and extend their business operations [4]. Internet and technology have dramatically altered how businesses are founded and the structure of the business environment, which has led to the emergence of a type of entrepreneurship known as “digital entrepreneurship” [5,6]. The connection between internet and entrepreneurship has been associated with several concepts as electronic entrepreneurship, digital entrepreneurship or internet entrepreneurship [7]. There has been a wide body of pub-

lished academic literature on the traditional entrepreneurship; however, there are a limited number of studies regarding digital entrepreneurship and digital entrepreneurship intention to the best of researchers' knowledge. The limited emergent literature clearly showed that the topic of digital entrepreneurship is still in its infancy and requires further understanding and investigation [8,9]. In general, digital entrepreneurship has been considered as a subset of traditional entrepreneurship in which some or all of what is tangible in a typical business is digitalized [10]. Digital entrepreneurship is the result of a newly launched digital business on the market or creative concept in response to a change that is carried out using technology [11]. Digital entrepreneurship gradually being regarded as a desirable career path, with approximately 10 million results returned by a Google search for "start an online business" as of November 2021 [12].

With regard to the relationship between personal traits and digital entrepreneurship, according to Zhao et al. [13], personal traits are a crucial component of the entrepreneur intention, which ideally have an impact on digital entrepreneurship intention. Personal traits affect the entrepreneurs' decisions towards their new venture goals [14]. Therefore, understanding the potential entrepreneur personal traits is crucial for policy-makers, economic planners and scholars. Additionally, understanding the correlation between personal traits and investment intention will be beneficial for planners to modify service and products to outfit their potential client's desires [15]. The literature review on personal traits attempted to determine multiple personality traits that might exist. For instance, in 1943, 16 personal qualities listed by Cattell [16], while Allport [17] proposed 4000 personality traits. Yet, these theories criticized for being overcomplicated. Hence, the "Big Five Trait Taxonomy" theory included five main personal traits, which was established as the list of adjectives related to personal. The five-factor theory are known as "OCEAN" which stands for openness to experience, conscientiousness, extraversion, agreeableness, and neuroticism. The theory has been initiated by Fiske's [18], work in 1949. The big five-personality model is a supportive tool toward the understanding of dissimilar individuals' personalities in different samples. The big five-personality theory [19,20], serves as the foundation for this research.

In the context Saudi Arabia, the Kingdom of Saudi Arabia (KSA) has witnessed structural modifications to support economic growth while maintaining stability and economic sustainability. This is visible in the strengthening of the business environment in Saudi Arabia as well as the ongoing effort to enable the private sector to assist economic diversification and overcome impediments to make it more appealing to invest in previously unexplored industries (<https://www.vision2030.gov.sa/>, accessed on 15 September 2022). Consequently, KSA's leadership is moving quickly to reform laws and regulations, remove barriers, and increase access to financing services in order to support young investors and entrepreneurs [21]. In this context, KSA government formed the "Monsha'at" as a singular authority to support small and medium-sized initiatives and to develop the spirit of entrepreneurship. In particular, Roomi et al. [22], stated that Saudi Arabia is presently ranked sixth on the Global Entrepreneurship Index (GEI), owing in great part to the government's economic assistance to boost the economy in general and to alleviate the economic effects of COVID-19 in particular, mainly among SMEs.

The current study defines the nature of university students' personal traits linked to their digital entrepreneurship intentions in KSA. It examines the extent to which the attitude towards behavior, as an important factor in the dimensions of theory of planned behaviour (TPB), influences university students' intentions toward digital entrepreneurship. The current research adopts a comprehensive model that investigate the direct impact of personal traits, particularly big five trait taxonomy "i.e., openness, extroversion, conscientiousness, agreeableness, and neuroticism" on digital entrepreneurship intentions among university senior students in KSA. Additionally, the study examines the indirect impact of students' big five traits taxonomy on their intention toward digital entrepreneurship through their personal attitude. More specifically, the current study has four objectives. First, it investigates the direct influence of big five trait taxonomy "openness,

extroversion, conscientiousness, agreeableness, and neuroticism” on the intention of higher education Saudi students toward digital entrepreneurship. Second, it examines the direct impact of attitude on intention for university students to engage in digital entrepreneurship activities. Third, it investigates the impact of student personal traits “big five” on students’ attitude toward behavior. Fourth, it examines the mediating roles of personal attitude in the relationship between big five-trait taxonomy on student intention of digital entrepreneurship. Thus, based on the above argument, there are four research questions (RQ) as follows:

RQ 1: What is the influence of big five-trait taxonomy on intention of university students toward digital entrepreneurship?

RQ 2: What is the influence of big five-trait taxonomy on personal attitude of university students toward digital entrepreneurship?

RQ 3: What the influence of personal attitude on students’ intention toward digital entrepreneurship?

RQ 4: How does students’ attitude intermediate between big five-trait taxonomy and digital entrepreneurship intention?

For achieving the purpose and answering the research question, we started Section 1 by highlighting the research gap and the purpose for conducting the research. We then moved to Section 2 presenting the study’s conceptual framework. We constructed research hypotheses and developed the theoretical model based on the review on personal traits and its association with digital entrepreneurship intention. In Section 3, we presented the study design and methods employed for data collection and analysis. We presented the findings of the study using SmartPLS structural equation modeling analysis in Section 4. In Section 5, we discussed the results compares to the earlier results to establish some implications for scholars and policy-makers. Finally, we highlighted the limitations of our study in Section 6, and future study directions.

2. Literature Review and Hypothesis Development

2.1. The Concept of Digital Entrepreneurship

According to Davidson and Vaat [23], digital entrepreneurship can be defined as “practice of pursuing new venture opportunities presented by new media and internet technologies”. Likewise, Younis et al. [11], added that digital entrepreneurship referred to generating new values with digital services or products, in a digital workplace, in digital market, through digital distribution channels, or some mixture of all of these factors. In that sense, the European Commission’s Digital Entrepreneurship Monitor [24] further defined digital entrepreneurship as the application of cloud and mobile technology and social media in the practice of entrepreneurship. The core elements of traditional and digital entrepreneurship are similar in aspects of idea generation, opportunity identification, and product/service commercialization [25]. Yet, the primary distinction between traditional and digital entrepreneurship is the usage of digital technology in the venture’s numerous value chain activities [26]. Martinez Dy [27] classified the digital entrepreneurship to simple e-commerce websites, complicated multimedia platforms and cloud computing space. While, Giones and Brem [28] offered three linked forms of technology entrepreneurship: (1) technology entrepreneurship, (2) digital technology entrepreneurship, and (3) digital entrepreneurship, which they used to develop their digital entrepreneurship theory.

2.2. Personal Traits and Personal Attitude towards Digital Entrepreneurship

According to Durand et al. [29], the motivator of human conduct is personality. A growing number of studies, e.g., [14,29], confirmed that decisions of individuals to engage in entrepreneurship activities influenced by personality traits. According to Caliendo et al. [30], personality traits distinguish entrepreneurs from non-entrepreneurs and have a significant impact self-employment intention [13,31]. Personality traits have been used to explain variations in behavior and choices in a variety of spheres of life, giving insight

into common ways of feeling, thinking, and acting [32]. According to Fietze and Boyd [33], the big five and narrow traits have been linked to entrepreneurship attitude and successful entrepreneurship [34–36]. Whereas, narrow traits were characterized by Caliendo et al. [30] as particular traits, sometimes known as entrepreneurial traits; they have been extensively examined in relation to their impact on career choice [37,38].

Ajzen [39] stressed that background variables, such as the big five personality traits, can affect the attitudes toward behavior, as well as their impact on intentions and resulting behaviors. It has been indicated that certain personality traits make people more likely to behave in particular ways when engaged with risky decisions [40]. Furthermore, Fini et al. [41], claimed that psychological traits such as motivational and emotional forces have been identified as the focal point of three major theoretical traditions (functional perspective, reinforcement perspective and the cognitive consistency perspective). Based on these theoretical traditions, when people anticipate being exposed to an action, they engage in a cognitive process to assess their capacity to handle it by changing their attitudes [42] and adopt a behavior toward these situations that is favorable or unfavorable, as the TPB has proposed. In the same context, Wu and Chen's [43] extended TPB and exposed the impacts of attitudes on behavioral intention are different in distinct groups divided by personality traits. Thus, personality traits, or innate qualities of an individual, may operate as the precursors of perceptual constructs in forecasting a person's behavioral intention [44]. For example, a cheerful individual would consider digital entrepreneurship pleasurable; thus, s/he could have a positive attitude toward digital entrepreneurship. Whereas, conscious persons would continually feel they do not have enough time or information for digital entrepreneurship. Han and Kim [45] extended TPB, which includes external elements to fully explain the development of people's intents to digital entrepreneurship and suggested that the big five personality traits that include extroversion, agreeableness, openness to experience, conscientiousness and neuroticism have an impact on attitude toward digital entrepreneurship, which in turn impact digital entrepreneurs' intentions of students. As result, the following hypotheses are proposed.

Hypothesis 1 (H1). *Agreeableness positively affect students' personal attitude in towards digital entrepreneurship.*

Hypothesis 2 (H2). *Conscientiousness positively affect students' personal attitude in towards digital entrepreneurship.*

Hypothesis 3 (H3). *Extroversion positively affect students' personal attitude in towards digital entrepreneurship.*

Hypothesis 4 (H4). *Neuroticism positively affect students' personal attitude in towards digital entrepreneurship.*

Hypothesis 5 (H5). *Openness to experience affect students' personal attitude in towards digital entrepreneurship.*

2.3. Personal Traits and Digital Entrepreneurship Intention

Personality traits encompass emotional and cognitive characteristics that affect numerous decisions of people [46]. Personality traits have an impact on investment management spending, and risk tolerance [47,48]. The big five trait model that projected by McCrae and Costa [32] is the most popular and well-known model in use today [49]. Agreeableness defined as “trusting, altruistic, cooperative, and modest, they show sympathy and concern for the needs of others” [36] (p. 387). Individual who are cooperative, caring and kind, are supposed to be agreeable. Jain [50] asserted that agreeableness has a positive significant role in entrepreneurial intention. Nevertheless, other studies, e.g., [51,52] indicated that agreeableness did not predict entrepreneurship intention. While,

Pak and Mahmood [53] argued that agreeableness negatively influence individuals' risky behavior. This is because it was argued that agreeableness is an attribute that is typically considered to be negatively connected with entrepreneurial activity since it calls for a lower level of competitiveness, a higher degree of social orientations, and a focus on others rather than on oneself.

According to Zhao et al. [36] conscientiousness can be defined as "level of achievement, work motivation, organization and planning, self-control and acceptance of traditional norms, and virtue and responsibility toward others" (p. 384). Bandera and Passerini [54] added that a person's capacity for conscientiousness is defined as their capability to deliberate before acting, to adhere to standards and procedures, to behave analytically and responsibly (as opposed to emotionally or intuitively), and to plan and organize activities. conscientiousness was positively correlated with entrepreneurial intention and performance [55]. Likewise, Durand et al. [56] suggested that persons with conscious personalities have a favorable connection with their trading behavior. Yet, Jain et al. [50] added that conscientiousness does not have significant correlation with the entrepreneurial intention. Similarly, Bandera and Passerini [54] did not expect different levels of conscientiousness among traditional and digital entrepreneurs. Zhao et al. [36] defined extraversion as "gregarious, outgoing, warm, and friendly; they are energetic, active, assertive, and dominant in social situations; they experience more positive emotions and are optimistic" (p. 387). Extraversion has been demonstrated to have a considerable impact on investing decisions' tendency [57]. Additionally, extraversion fosters a positive attitude, which influences one's estimation of the likelihood of success and may lead to excessive confidence in one's ability to make sound financial decisions [58]. Since extraversion has been shown to highly correlate with interest in entrepreneurial activities, it is anticipated to have a positive and direct relationship with the development of entrepreneurial intentions [36]. Costa et al. [19] indicated that extroverted persons are more likely toward entrepreneurship intention. Likewise, Almandeel [59] proved that extraversion has significant impact on entrepreneurial intention.

Openness to experience can be defined as intellectually curious, imaginative, and creative seeks out new ideas and alternative values" [36] (p. 385). According to Martins [60], those who possess the trait of openness to experience are creative, resourceful, and broad-minded. They are motivated to innovation and aesthetics [61]. Whereas, Zhao et al. [36] stated that entrepreneurs are frequently viewed as heroes because they question the existing quo and follow their creative vision despite opposition and barriers. Depending on their level of risk tolerance and the effect of prior experience, digital entrepreneurs may or may not be more open to experience than traditional entrepreneurs may. However, the rapid pace and evolution of technology, particularly newly developed digital and internet-based technology, may necessitate a higher aptitude for change and embracing novel experiences, which would justify a higher expectation of openness in digital start-up founders as opposed to founders of conventional start-ups [54]. Almandeel [59] confirmed that openness is the strongest predictor of entrepreneurial intention and positively influence entrepreneurship intention. At the end, Baum and Locke [52] predicted that there are no differences in the level of conscientiousness between and traditional entrepreneurs.

Zhao et al. [36], defined neuroticism as experience a range of negative emotions more frequently and intensely, including anxiety and worry, depression, and low self-esteem" (p. 386). It is common knowledge that neuroticism is accompanied by unfavorable feelings like worry, anxiety, and sadness. People that exhibit these characteristics as entrepreneurs may be less likely to persevere, look for creative solutions, and may not be able to handle criticism and unforeseen difficulties successfully [54]. Neuroticism is likely to diminish people's willingness to take risks and their ability to acquire social capital [62]. In that sense, Pak and Mahmood [25] discovered that neuroticism has a negative relationship toward risky behavior. Likewise, Almandeel [59] argued that neuroticism did not influence entrepreneurship intention. In the context of digital entrepreneurship, individuals

may have higher needs for emotional stability and, consequently, exhibit lower neuroticism levels than traditional entrepreneurs gave their ability to pivot frequently, which is enabled by lower start-up infrastructure [26]. Additionally, it was suggested that persons who scored highly on the extroversion and openness scales had higher risk tolerance than persons who scored well on the conscientiousness scales [63]. Experiments by Oehler et al. [64], showed that extroversion and neuroticism had a considerable impact on individuals' behavior. To conclude, according to study conducted by [52], openness to experience was determined to be the most important predictor toward intention among the predictor variables, followed by extraversion. While the other factors agreeableness, conscientiousness and neuroticism have not a significant impact on digital entrepreneurial intention. Likewise, Brandstätter [65], argued that entrepreneurs generally higher levels of conscientiousness, extraversion and openness to experience, but lower levels of agreeableness and neuroticism.

In the context of digital entrepreneurial intention, can be defined as “the intention of an individual to start a new business through means of digital technology including internet, world wide web, mobile technologies, web 2.0 and related technologies” [12]. Intention toward digital entrepreneurship is a field that has received a less attention than intention toward traditional entrepreneurship [12]. Summing up, earlier studies, e.g., [66–69] have investigated the concept of traditional entrepreneurship, while there is very limited research to examine the intention toward to digital entrepreneurial. Based on these arguments, the following hypotheses are proposed.

Hypothesis 6 (H6). *Agreeableness positively affects students' intentions of digital entrepreneurship.*

Hypothesis 7 (H7). *Conscientiousness positively affects students' intentions of digital entrepreneurship.*

Hypothesis 8 (H8). *Extroversion positively affects students' intentions of digital entrepreneurship.*

Hypothesis 9 (H9). *Neuroticism positively affects students' intentions of digital entrepreneurship.*

Hypothesis 10 (H10). *Openness positively affects students' intentions of digital entrepreneurship.*

2.4. Attitude toward Digital Entrepreneurship Intention

According to the theory of reasoned action (TRA) proposed by Ajzen and Fishbein [70], behavioral intentions are perceptive and serve as a sign of a person's propensity to engage in a particular behavior. Additionally, TPB suggested that behavior was determined by intention, i.e., incentive to conduct a certain behavior [70,71]. Likewise, Elliott and Ainsworth [72] proposed that the behavioral intentions influenced mainly by attitude (attitudinal evaluations about acting the behavior). Similarly, Gibbs [73] emphasized that the intention is a psychological condition that reflects a person's plan of action and based on desires that are achievable. The intention is a significant aspect in the creation of behavior. To conclude, based on TPB the best predictor of behavior is intention because the tendency of someone to do or not do something referred to as his or her intention to conduct behavior [74]. The intent is described as a person's intention to perform a behavior based on attitudes toward behavior, behavioral control and subjective norms. Phan and Zhou [75], indicated that psychological elements such as optimism, risk attitude, herd behavior and overconfidence were the most important factor that influence the investment intention. Gopi and Ramayah [76], indicated that there was a positive connection between

attitude and intention to trade online. Younis et al. [11] emphasized that there is a significant correlation between student attitude and digital entrepreneurship. While the rest of TPB dimensions were not significantly correlate to digital entrepreneurship. On contrary, Lai and To [77], argued that perceived behavior control and subjective norms have a significant impact on digital entrepreneurship while individual attitude toward did not has a significant impact on digital entrepreneurship. Based on these arguments, it could be proposed that:

Hypothesis 11 (H11). *Personal attitude positively affects digital entrepreneurship intention of university students.*

2.5. The Mediating Effect of Attitude the Link between Personal Traits and Digital Entrepreneurship Intention

TPB implies that an individual will have higher intents to engage in a certain conduct if they have a more positive attitude about it. Attitudes are not as consistent as personality traits; they might vary with time and because of a person's interactions with their environment [78]. Additionally, TPB proposed that intention to act behavior is predicted through attitude towards behavior. The motivating variables that influence behavior are thought to be captured by intentions, which also serve as indicators of people's willingness to try to exert effort in order to carry out the behavior [79]. Several studies have employed TPB to determine the influence of attitude on intention, e.g., [13,48,74,80]. Such studies confirmed that attitude has a positive impact on individual intention. On the other side, studies, e.g., [12,36,81] have argued that personal traits have impact on digital entrepreneurship intention. Furthermore, a study conducted by Kusmintarti's et al. [82], indicated that attitude performed as a mediator between entrepreneurial traits and traditional entrepreneurial intentions. The current research can be considered as the first attempt to address the mediating role of personal attitude in the link between personal traits and digital entrepreneurship intention. All of the direct and indirect relationships are presented in Figure 1. Hence, it could be hypothesized that:

Hypothesis 12 (H12). *Attitude has a mediating effect on the link between Agreeableness and digital entrepreneurial intention of university students.*

Hypothesis 13 (H13). *Attitude has a mediating effect on the link between conscientiousness and digital entrepreneurial intention of university students.*

Hypothesis 14 (H14). *Attitude has a mediating effect on the link between extraversion and digital entrepreneurial intention of university students.*

Hypothesis 15 (H15). *Attitude has a mediating effect on the link between Neuroticism and digital entrepreneurial intention of university students.*

Hypothesis 16 (H16). *Attitude has a mediating effect on the link between openness to experience and digital entrepreneurial intention of university students.*

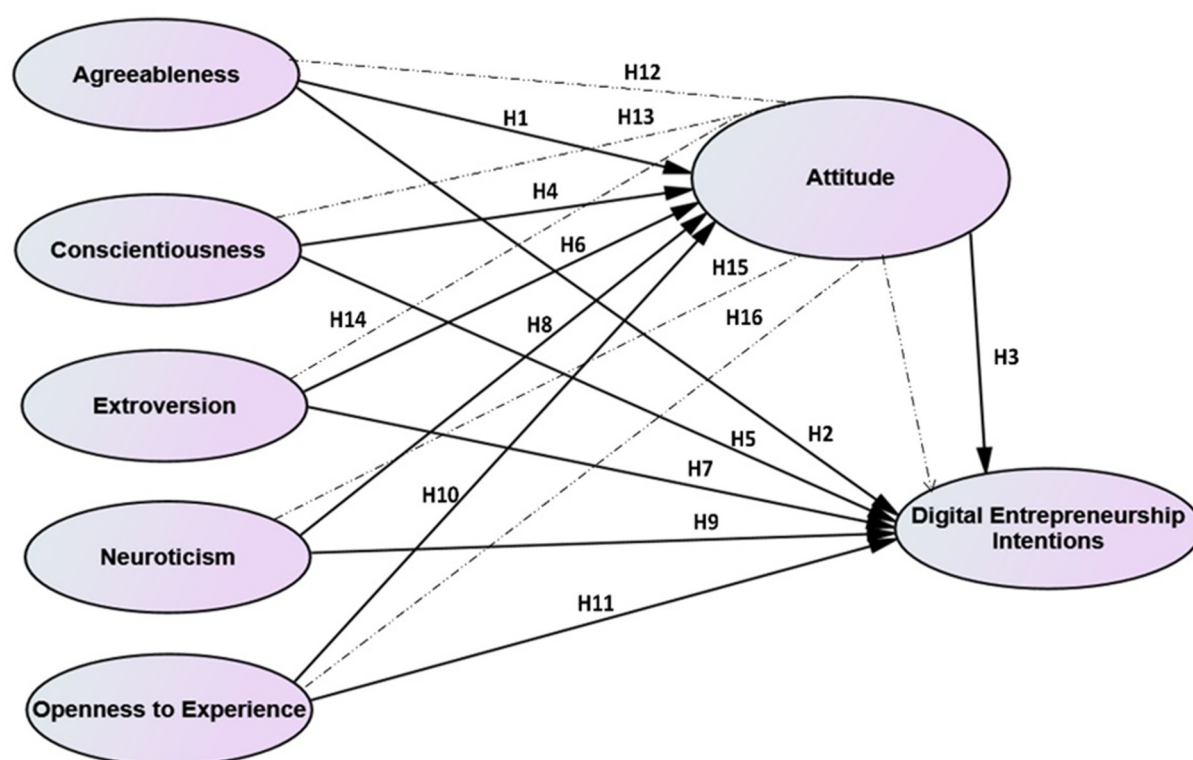


Figure 1. The theoretical model “straight line refers to direct effect; dotted line refers to indirect effect”.

3. Methodology

3.1. Study Measures

The survey’s first section introduced the study’s goals and provided instructions for completing the questionnaires. The second section asked respondents to provide information about themselves, including their demographics. The third part represents the research main questions using a five-point (1–5) Likert scale, in which 1 indicated “strongly disagree” and 5 indicated “strongly agree.” Digital entrepreneurship intention was measured by four items derived from Lee et al. [83], the items were modified to fit the study context, sample items include “I can stand the inconvenience caused by digital projects,” and “I will continue to invest in digital projects”. The scale items demonstrated high consistent reliability ($\alpha = 0.952$). The scale of the attitude toward established digital projects was generated by asking senior students 4-items derived from Ajzen’s theory of planned behavior scale [39], sample items include “I think that digital projects are an intelligent choice”. The attitude 4-items measure showed a satisfactory Cronbach alpha (α) reliability ($\alpha = 0.923$). The “big five-factor model” is one of the most popular personality research models [84]. Research on personality traits, such as agreeableness, extroversion, neuroticism, conscientiousness, and openness, has been studied in diverse intervals, cultures, and environments [85]. The scale items of personality traits in our study were derived from the “NEO Five-Factor Inventory” (NEO-FFI) [83,86,87]. Teng et al. [88] argued that a condensed version of the Big Five Personality Scale can reduce research expenses, increase the number of participants, and facilitate survey administration. The personality traits dimensions and items are presented in Table 1. The five employed five dimensions of personality traits demonstrated a satisfactory internal consistency reliability: agreeableness ($\alpha = 0.910$), extroversion ($\alpha = 0.931$), neuroticism ($\alpha = 0.928$), conscientiousness ($\alpha = 0.981$), and openness ($\alpha = 0.939$).

Table 1. Evaluation of the Outer Measurement Model & VIF for multicollinearity.

Abbr.		Outer Loading	α	C.R	AVE	VIF
Digital entrepreneurship intentions			0.952	0.953	0.912	
DEI_1	"I will recommend others to invest in digital projects".	0.946				4.510
DEI_1	"I will continue to invest in digital projects".	0.955				3.405
DEI_1	"I can stand the inconvenience caused by digital projects".	0.963				3.034
Attitude			0.923	0.926	0.811	
Att._1	"I think that digital projects are meaningful".	0.904				3.410
Att._2	"I think that digital projects are enjoyable".	0.891				3.257
Att._3	"I think that digital projects are novel".	0.897				3.288
Att._4	"I think that digital projects are an intelligent choice".	0.911				3.755
Personal traits						
Agreeableness			0.910	0.911	0.849	
Agre._1	"I am on good terms with nearly everyone".	0.872				2.131
Agre._2	"I often get into arguments with my family and co-workers".	0.950				3.750
Agre._3	"Some people think of me as cold and calculating".	0.940				2.322
Extroversion			0.931	0.936	0.879	
Ext._1	"I often feel as if I am bursting with energy".	0.929				3.380
Ext._2	"I am a cheerful, high-spirited person".	0.956				2.088
Ext._3	"I am a very active person".	0.927				3.875
Conscientiousness			0.981	0.983	0.945	
Cons._1	"I am pretty good about pacing myself so as to get things done on time".	0.987				3.331
Cons._2	"I make plans and stick to them".	0.985				4.309
Cons._3	"I continue my job until everything is perfect".	0.970				2.388
Cons._4	"I never seem to be able to get organized".	0.947				3.691
Openness to experience			0.939	0.945	0.891	
Open._1	"I often try new things".	0.942				2.835
Open._2	"I often enjoy playing with theories or abstract ideas".	0.911				3.720
Open._3	"I have little interest in speculating on the nature of the universe or the human condition".	0.977				2.457
Neuroticism			0.928	0.928	0.873	
Neur._1	"I often feel inferior to others".	0.938				4.148
Neur._2	"When I am under a great deal of stress, sometimes I feel like I am going to pieces".	0.946				4.526
Neur._3	"I seldom feel lonely or blue".	0.920				3.006

The scale was piloted by fifteen professors and twenty senior students from the faculties of computer science and information technologies to ensure its consistency, clarity, and simplicity, and no adjustments were made to the employed questionnaire. As stated in the introduction to the questionnaire, the collected information is guaranteed to be completely anonymous and kept in strict confidence. Since the primary method of data collection utilized by the research questionnaire is self-reporting, the likelihood of there being a common method variance has been increased (CMV) [89]. To identify any possible CMV, Harman's single-factor analysis was performed with the exploratory factor analysis (EFA) method, and the values of all the extracted factors were standardized to 1.0. The findings

showed that CMV is not an issue because only one single factor was extracted to explain 35% of the variance in the endogenous variables (less than 50%) [89].

3.2. Participants and Data Collection

Senior students in computer sciences and information technology faculties in the kingdom of Saudi Arabia (KSA) public universities were randomly targeted in our study through an online questionnaire. This specific population was targeted since they are expected to be engaged in digital entrepreneurship, because of their studies in computer science and information technology. Because senior students in computer science and information technology faculties frequently think about their future digital careers and may have an interest in starting their own digital businesses, we asked them to fill out the survey. The research team used their network to distribute the online questionnaire to three main universities in KSA: King Faisal University (Eastern Province), Imam Mohammad ibn Saud Islamic University (Riyadh Province), and Umm Al-Qura University (Mecca Province). In April and May of 2022, the questionnaire was distributed to the targeted sample. The research team was successful in collecting 440 online questionnaires, of which 420 answers were found to be valid and 10 surveys were excluded due to misplaced data, resulting in a response rate of 93% and a total of 410 valid questionnaires. The early and late collected responses' means were assessed employing an independent sample t-test. It was revealed that there were no significant variations ($p > 0.05$) between the early response mean and the late response means, which suggests that non-response bias was not an issue [90].

3.3. Data Analysis Techniques

Partial least squares structural equation modeling (PLS-SEM) techniques are used in our study to examine the collected data with SmartPLS 4. PLS-SEM is widely used in the field of management and information technology (IT), where it is said to yield reliable outcomes [91]. PLS-SEM is a non-parametric technique exploiting the explained variance in latent dimensions, that are not able to be observed in any direct way. Unlike the covariance-based SEM (COV-SEM), smart PLS-SEM requires less information about residual distributions, measurement scales, and sample sizes [92]. Smart PLS-SEM is deemed suitable for analyzing the complex research models that are proposed as an estimation framework incorporating related theories and empirical data. Following Leguina's [93], suggestion, a two-step approach was adopted, in which, the proposed theoretical model first tested the outer model for convergent and discriminant validity, then second the inner model was evaluated for hypotheses testing.

4. Findings

4.1. Demographic and Descriptive Statistics

The tremendous majority (79%) of the respondents were male, and 75% were aged between 17 to 24 years old. 35% of the senior student were from King Faisal University, 30% from Mohammad ibn Saud Islamic University, and 35% from Umm Al-Qura University. The respondents' mean (M) values ranged from 2.50 to 4.01, and the standard deviation (S.D.) values ranged from 0.960 to 1.05, indicating that the results were more dispersed and less condensed around the mean value [90]. The skewness and kurtosis values of the data distribution, have no values exceeding -2 or $+2$, indicating the data follows a normal distribution curve [88]. Additionally, the VIF values for all the study variables (as depicted in Table 1) were found to be less than 0.5 indicating that multicollinearity is not a problem in our study [94].

4.2. Evaluation of the Outer Measurement Model

Several statistics were employed to calculate the reliability and validity of the study outer model as suggested by Hair et al. [92], Kline [95]. These statistics include "composite

reliability" (CR); "internal consistency reliability" (Cronbach's alpha); "convergent validity"; and "discriminant validity". First, according to Table 1, Cronbach's alpha (α) values ranged from 0.910 to 0.981 and composite reliability (CR) values ranged from 0.911 to 0.983, indicating that the scale has acceptable internal reliability [95].

Second, each of the factors had values of "Standardized Factor Loading" (SFL) that were greater than 0.70, which provided further evidence that the study dimensions have a satisfactory level of reliability. Third, convergent validity was ensured by evaluating whether or not AVE values were higher than 0.5 [89]. This value is the minimum level of acceptability that is considered to be adequate convergent validity.

Additionally, three main criteria were employed to ensure the scale has an adequate discriminant validity as suggested by Leguina [93]. These criteria included the "cross-loading matrix", the "Fornell-Larcker criterion method", and the "heterotrait-monotrait method" ratio (HTMT). To start, as shown in Table 2, the outer-loading (bolded) of each latent unobserved variable needs to be higher than the cross-loading (with other measurements) to guarantee discriminant validity. In addition, as can be seen in Table 3, the bolded diagonal AVE values are greater than the inter-variable correlation coefficient, which is indicative of high discriminant validity [89]. Finally, as stated by Leguina [89], HTMT values should be under 0.90. Study HTMT levels were significantly lower than the reference value (see Table 3). Taken together, the previous results confirm and support the scale reliability, discriminant, and convergent validity as approved in the study measurement outer model. Accordingly, we can move forward with the structural outer model to test the study hypotheses.

Table 2. Factors Cross-loading.

	Agreeableness	Attitude	Conscientiousness	Digital Entrepreneurship Intentions	Extroversion	Neuroticism	Openness to Experience
Agre._1	0.872	0.344	0.126	0.128	0.088	0.134	0.081
Agre._2	0.950	0.361	0.097	0.122	0.003	0.140	0.106
Agre._3	0.940	0.363	0.101	0.096	0.079	0.143	0.136
Att._1	0.352	0.904	0.194	0.741	0.131	0.210	0.192
Att._2	0.294	0.891	0.183	0.615	0.181	0.141	0.183
Att._3	0.317	0.897	0.167	0.641	0.128	0.218	0.224
Att._4	0.429	0.911	0.204	0.566	0.151	0.177	0.169
Cons._1	0.101	0.198	0.987	0.156	0.163	0.216	0.116
Cons._2	0.095	0.185	0.985	0.164	0.157	0.225	0.102
Cons._3	0.123	0.218	0.970	0.183	0.157	0.197	0.125
Cons._4	0.134	0.203	0.947	0.164	0.178	0.207	0.123
DEI_1	0.095	0.668	0.150	0.946	0.224	0.040	0.106
DEI_2	0.125	0.674	0.163	0.955	0.226	0.007	0.093
DEI_3	0.138	0.708	0.178	0.963	0.266	0.032	0.091
Ext._1	0.006	0.149	0.146	0.250	0.929	0.322	0.015
Ext._2	0.010	0.153	0.177	0.248	0.956	0.239	0.029
Ext._3	0.024	0.158	0.149	0.203	0.927	0.313	0.021
Neur._1	0.152	0.193	0.203	0.035	0.331	0.938	0.077
Neur._2	0.176	0.191	0.221	0.066	0.309	0.946	0.105
Neur._3	0.098	0.201	0.185	0.096	0.231	0.920	0.092
Open._1	0.109	0.203	0.123	0.103	0.028	0.084	0.942
Open._2	0.120	0.193	0.076	0.070	0.002	0.126	0.911
Open._3	0.104	0.209	0.137	0.110	0.033	0.073	0.977

Table 3. Inter-construct correlations, the square root of AVE, and HTMT results.

	Fornell-Larcker Criterion							HTMT Results						
	1	2	3	4	5	6	7	1	2	3	4	5	6	7
1-Agreeableness	0.92													
2-Attitude	0.38	0.90						0.422						
3-Conscientiousness	0.11	0.20	0.97					0.123	0.217					
4-Digital Entrepreneurship Intention	0.12	0.71	0.17	0.95				0.134	0.759	0.177				
5-Extroversion	0.01	0.16	0.16	0.25	0.93			0.072	0.177	0.176	0.264			
6-Neuroticism	0.15	0.20	0.21	0.01	0.31	0.93		0.165	0.224	0.228	0.076	0.336		
7-Openness to Experience	0.11	0.21	0.12	0.10	0.02	0.09	0.94	0.127	0.229	0.123	0.106	0.024	0.107	

4.3. Assessment of the Structural Inner Model

A structural equation investigation was employed to test the study proposed hypotheses. Specifically, the main aim is to examine the model's aptitude to explain and predict the variation in the endogenous variables caused by the exogenous variable [89]. Furthermore, Chin [96], suggested R2 value of at least 0.10 to ensure a satisfactory model fit. Accordingly, the endogenous variables "attitude" has an R2 value of 0.462, similarity, "digital entrepreneurship intention" has an R2 value of 0.631, both R2 values exceeded the recommended threshold score and designating that the study model sufficiently represents the collected data (Table 4). Likewise, The Stone-Geisser Q2 calculation displayed a value of (0.252) for attitude and 0.314 for digital entrepreneurship intention, both values are more than zero (Table 4), indicating a satisfactory predictive power of the structure model [97]. Finally, the SRMR value should be less than 0.08 and the NFI value should be more than 0.90 to guarantee a good model fit to data [98], as shown in Table 4 the SRMR value is 0.038 and the NFI value is 0.961 exceeding the recommended threshold value and approving a good of fit (GoF).

Table 4. Coefficient of determination (R2) and (Q2) and model fit (SRMR-NFI).

Endogenous Latent Factors	(R2)	(Q2)
Attitude	0.462	0.252
Digital entrepreneurship intention	0.631	0.314
Model Fit indices	SRMR	NFI
	0.038	0.961

In the end, a bootstrapping method was implemented in smart PLS4 to determine the path coefficient and its associated t-value for both the direct and mediating relationships. The current research paper suggested sixteen hypotheses, 11 out of the 16 are direct relationships and 5 are indirect. The smart PLS results showed that all the direct impacts of the five dimensions of personality traits on attitude are positive and significant: agreeableness ($\beta = 0.312$, t-value = 0.5.69, $p < 0.001$); conscientiousness ($\beta = 0.27$, t-value = 4.151, $p < 0.001$); extroversion ($\beta = 0.21$, t-value = 4.364, $p < 0.000$); Neuroticism ($\beta = 0.25$, t-value = 5.279, $p < 0.001$), and openness to experience ($\beta = 0.31$, t-value = 7.255, $p < 0.001$), consequently, hypotheses H1, H2, H2, H4, and H5 were supported respectively. On the other hand, the results revealed that all the direct impacts of personality traits (except agreeableness) on attitude are positive but insignificant: conscientiousness ($\beta = 0.13$, t-value = 0.291, $p = 0.771$); extroversion ($\beta = 0.08$, t-value = 1.241, $p = 0.092$); neuroticism ($\beta = 0.11$, t-value = 1.869, $p = 0.62$), and openness to experience ($\beta = 0.03$, t-value = 0.265, $p = 1.135$). hence hypotheses H7, H8, H9, and H110 were not supported. One exception is the impact of agreeableness on digital entrepreneurship intention which was found to be positive and significant ($\beta = 0.160$, t-value = 3.046, $p < 0.000$) hence supporting hypothesis H6. Ad-

ditionally, the Smart PLS4 results demonstrated a high direct positive and significant impact on attitude on digital entrepreneurship intention ($\beta = 0.69$, $t\text{-value} = 12.11$, $p < 0.000$) supporting hypothesis H11. The results also give data about the specific indirect effect to test the mediation effects attitude in the relationship between the five dimensions of personality traits on digital entrepreneurship intention (see Table 5 and Figure 2). All the specific indirect effects were found to be positive and significant supporting the mediation effects of attitude in the relationships between: agreeableness and digital entrepreneurship intention ($\beta = 0.22$, $t\text{-value} = 7.12$, $p < 0.000$); extroversion and digital entrepreneurship intention ($\beta = 0.15$, $t\text{-value} = 4.26$, $p < 0.000$); neuroticism and digital entrepreneurship intention ($\beta = 0.17$, $t\text{-value} = 4.97$, $p < 0.000$); conscientiousness and digital entrepreneurship intention ($\beta = 0.19$, $t\text{-value} = 4.00$, $p < 0.000$); and openness to experience to digital entrepreneurship intention ($\beta = 0.23$, $t\text{-value} = 2.92$, $p < 0.000$); hence supporting hypotheses H12, H13, H14, H15, and H16 was supported.

Table 5. Study Tested Hypotheses.

Study Tested Hypotheses		Beta (β)	(T-Value)	p Values	Results
H1	Agreeableness -> Attitude	0.31	7.265	0.000	Accepted
H2	Conscientiousness -> Attitude	0.27	4.151	0.000	Accepted
H3	Extroversion -> Attitude	0.21	4.364	0.000	Accepted
H4	Neuroticism -> Attitude	0.25	5.279	0.000	Accepted
H5	Openness to Experience -> Attitude	0.31	7.225	0.000	Accepted
H6	Agreeableness -> Digital Entrepreneurship Intention	0.16	3.046	0.000	Accepted
H7	Conscientiousness -> Digital Entrepreneurship Intention	0.01	0.291	0.771	Not Accepted
H8	Extroversion -> Digital Entrepreneurship Intention	0.08	1.214	0.092	Not Accepted
H9	Neuroticism -> Digital Entrepreneurship Intention	0.11	1.869	0.62	Not Accepted
H10	Openness to Experience -> Digital Entrepreneurship Intention	0.03	1.135	0.256	Not Accepted
H11	Attitude -> Digital Entrepreneurship Intention	0.69	12.11	0.000	Accepted
H12	Agreeableness -> Attitude -> Digital Entrepreneurship Intention	0.22	7.12	0.000	Accepted
H13	Conscientiousness -> Attitude -> Digital Entrepreneurship Intention	0.19	4.00	0.000	Accepted
H14	Extroversion -> Attitude -> Digital Entrepreneurship Intention	0.15	4.26	0.000	Accepted
H15	Neuroticism -> Attitude -> Digital Entrepreneurship Intention	0.17	4.97	0.000	Accepted
H16	Openness to Experience -> Attitude -> Digital Entrepreneurship Intention	0.23	2.92	0.003	Accepted

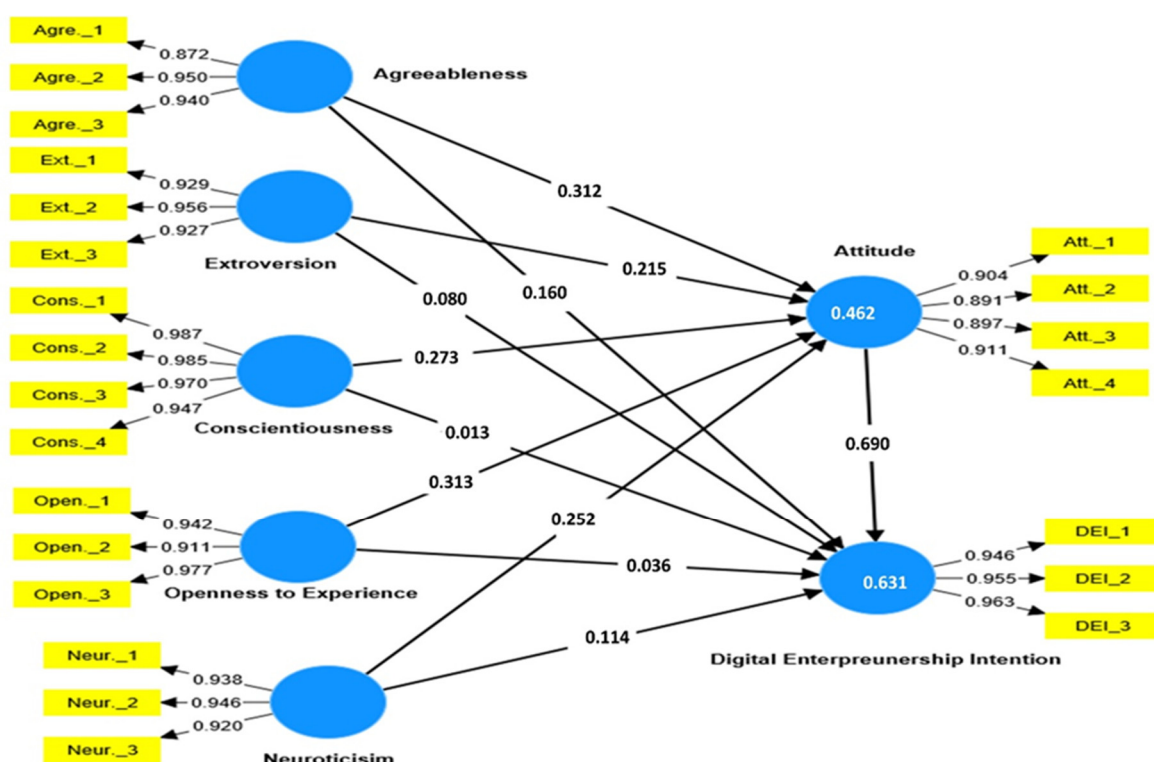


Figure 2. Inner & Outer Model.

5. Discussion and Implication

This study was established to examine the direct effect of the big five personal traits on digital entrepreneurship intention among higher education senior students in KSA and the indirect effect through their personal attitude. As hypothesised, the results of structural equation modelling using Smart PLS4 (version 4) analysis supported all the direct paths and impacts of the big five personal traits on personal attitude towards the use of technology in entrepreneurship as all paths were positive and significant. More specifically the findings supported the first set of research hypotheses. First, there was a direct positive significant impact of agreeableness of senior students on their personal attitude towards digital entrepreneurship, which supported H1. Second, there was a direct positive significant impact of conscientiousness of senior students on their personal attitude towards digital entrepreneurship supporting H2. Third, the results supported H3 on a direct positive significant impact of extroversion of senior students on their personal attitude towards digital entrepreneurship. Fourth, the results supported H4 on a direct positive significant impact of neuroticism of senior students on their personal attitude towards digital entrepreneurship, which supported H4. Fifth, there was a direct positive significant impact of openness to experience of senior students on their personal attitude towards digital entrepreneurship, which supported H5. These results extend the use of TPB by confirming that the big five personality traits, including agreeableness, extroversion, openness to experience, conscientiousness and neuroticism, are determinants of personal attitude and have an impact on personal attitude toward digital entrepreneurship, which also coincidence with the results of previous research studies, e.g., [43,44].

On the other hand, all the direct paths of the big five personal traits (except agreeableness) on digital entrepreneurship intention were positive but insignificant. Thus, only H6 was supported on the direct positive impact of agreeableness on the digital entrepreneurship intention of senior students. However, the research hypotheses H7, H8, H9, and H10 were not supported respectively. This means that conscientiousness, extroversion, neuroticism and openness to experience had no significant positive impact on senior student's digital entrepreneurship intention. These results do not support the work of Lai

[43] that personality traits operate as the precursors of perceptual constructs in forecasting a person's behavioral intention. More specifically, these results do not support previous that conscientiousness positively correlated with entrepreneurial intention [53]; extraversion has significant impact on entrepreneurial intention [19,49]; and openness is the strongest predictor of entrepreneurial intention and positively influence entrepreneurship intention [49]. Nonetheless, it partially supports the work of Jain et al., [49], who found that conscientiousness does not have significant correlation with the entrepreneurial intention. One exception of these big five personal traits was the impact of agreeableness on digital entrepreneurship intention, which was found to be positive and significant. These results coincide with the recent work of Jain et al., [49] that agreeableness has a positive significant role in entrepreneurial intention. Nevertheless, the results are not in line with other old studies, e.g., [50,51], which indicated that agreeableness do not have a positive significant impact on entrepreneurship intention or even a negative impact on individuals' risky behavior [52]. These results confirm that when graduates show a cooperative, altruistic and sympathy traits, they are more likely to engage in digital entrepreneurship intention.

The results also supported the assumption of TPB [38] and confirmed a direct positive impact of personal attitude and digital entrepreneurship intention confirming H11. Additionally, the results, for the first time, confirmed that all the specific indirect effects were found to be positive and significant. The findings supported the last set of research hypotheses (H12, H13, H14, H15 and H16 respectively). This confirms mediating effects of personal attitude in the link between the five personal traits of senior students in the KSA universities: agreeableness, conscientiousness, extroversion, neuroticism, openness to experience and their digital entrepreneurship intention. This means that attitude has the ability to change the effect of big five personal traits on digital entrepreneurship intention of senior university student.

The above results have numerous implications for scholars, especially in relation to personal traits and its association with personal attitude as well as digital entrepreneurship intention. The current study contributes to the academic body of literature on personal traits and its impact on personal attitude as well as digital entrepreneurship intention. The literature has confirmed that, with no doubt, internet has promoted the emergence of digital entrepreneurship [5]. Nonetheless, it was confirmed that there are a limited number of studies regarding digital entrepreneurship and digital entrepreneurship intention [6,8]. Intention toward digital entrepreneurship is a field that has received a less attention than intention toward traditional entrepreneurship [12]. Additionally, the literature gave contradictory findings about the direct effect of personal traits on entrepreneurial intention in general with limited attention to digital entrepreneurship intention, which did not receive full attention from researchers to date. The literature did not also give full attention to the direct effect of personal traits on digital entrepreneurship intention through constructs of TPB. The current study extends the theory of TBP and contributes significantly to this research gap. The results confirmed, for the first time, the indirect effect of personal traits on digital entrepreneurship intention through personal attitude. This means that personal attitude has an effect on this relationship and can change this relationship. Despite there was no direct effect of personal trait on digital entrepreneurship intention. This effect was achieved through the effect of personal attitude. It also confirmed that the big five personal traits are determinants of personal attitude towards digital entrepreneurship intention.

The results have several also implications for policymakers, economy planners and educators in higher education that more efforts are needed to shape the personal traits of the graduates since this will have an effect on their personal attitude and ultimately on digital entrepreneurship intention. Attention should be paid to the big five personal traits: extroversion, agreeableness, openness to experience, conscientiousness and neuroticism. This could be done by integrating a new section or part about positive traits for entrepre-

neurship in the “principals of entrepreneurship” course, which recently added to the crucial of higher education students in KSA. More training and development programs can also be provided to higher education to promote the positive personal attitude since it has a great effect on digital entrepreneurship intention of senior university student. Hence, investment should also be directed to today’s student, digital natives, attitudes towards useful adoption of internet and technology in digital entrepreneurship intention.

6. Limitations of the Study

This study was concerned with senior students’ personal traits and its association with their personal attitudes and hence their digital entrepreneurship intention. The study was conducted on a sample of senior students at public universities in KSA. Therefore, caution should be considered during the generalization of the results to the whole private universities or universities in other countries. The study only examined the meditating role of personal attitude as a major construct in the TPB, albeit did not examine the role of subjective norms nor the role of perceived behavioural control, which could be an opportunity for future studies on this topic. Another good research opportunity could be to examine the moderating role of students’ demographics, i.e., gender or age, or the type of university specialization and study on the link between personal trait and digital entrepreneurship intention. Further research opportunities could include undertaking qualitative research approach using focus groups and interviews and observation methods to obtain a more rigorous understanding of this topic.

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