



Do Personality Traits Work as Moderator on the Intention to Purchase Mobile Applications Work? - A Pilot Study

Charnsak Srisawatsakul, Gerald Quirchmayr, Borworn Papasratorn

► To cite this version:

Charnsak Srisawatsakul, Gerald Quirchmayr, Borworn Papasratorn. Do Personality Traits Work as Moderator on the Intention to Purchase Mobile Applications Work? - A Pilot Study. David Hutchison; Takeo Kanade; Bernhard Steffen; Demetri Terzopoulos; Doug Tygar; Gerhard Weikum; Linawati; Made Sudiana Mahendra; Erich J. Neuhold; A Min Tjoa; Ilsun You; Josef Kittler; Jon M. Kleinberg; Alfred Kobsa; Friedemann Mattern; John C. Mitchell; Moni Naor; Oscar Nierstrasz; C. Pandu Rangan. 2nd Information and Communication Technology - EurAsia Conference (ICT-EurAsia), Apr 2014, Bali, Indonesia. Springer, Lecture Notes in Computer Science, LNCS-8407, pp.56-65, 2014, Information and Communication Technology.

HAL Id: hal-01397144

<https://hal.inria.fr/hal-01397144>

Submitted on 15 Nov 2016

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.



Distributed under a Creative Commons Attribution 4.0 International License

Do Personality Traits as Moderator on Intention to Purchase Mobile Applications Work? - A Pilot Study.

Charnsak Srisawatsakul^{1,*}, Gerald Quirchmayr², and Borworn Papasratorn¹

¹ Requirement Engineering Laboratory, School Of Information Technology
King Mongkut's University of Technology Thonburi, Bangkok, Thailand
charnsak.sri@st.sit.kmutt.ac.th
borworn@sit.kmutt.ac.th

² Faculty of Computer Science, University of Vienna, Vienna, Austria
gerald.quirchmayr@univie.ac.at

Abstract. Mobile application markets are now transforming into a multibillion-dollar business. Understanding the consumer's intention to purchase them and the moderating factors of individual differences – personality traits – allowed us to know more about consumers. The objectives of this research are to determine whether personality traits have any moderating effect with the consumer's intention to purchase mobile application. Our preliminary data for the pilot study consists of 147 participants, who are office workers and students who use smart devices and live in Bangkok, Thailand. Hierarchical multiple regression was used to analyze the data. The results from our pilot study indicate that personality traits did not show a significant moderating effect. However, the result supported the original Theory Reasoned Action. It demonstrates that there are differences in attitudes toward the purchase of mobile applications between office workers and students. Therefore, this research has thrown up many questions in need of further investigation. As the initial data was only 147 respondents, a more extensive study will have to follow up our preliminary results.

Keywords: Intention to Purchase, Mobile Applications, Personality traits, Theory of Reasoned Action

1 Introduction

Recently, the mobile apps (short for applications) market has been growing rapidly. According to ABI Research, the overall market value of mobile apps will reach \$27 billion [1]. Furthermore, the prices of those devices have dropped dramatically, which makes them affordable to average consumers while becoming increasingly powerful in terms of computation, sensing, and interaction capabilities. Gartner has forecast that by the end of 2013 the worldwide device shipment of smartphones and tablets will reach 181 and 18 billion [2], respectively. Mobile apps in the market were acquired from two dominant stores. First, Apple have their ecosystem for iOS users called Apple App Store, which holds more than 850,000 apps [3] to download. Se-

cond, Google has more than 700,000 apps on their Play Store for Android users. There is evidence suggesting that personality play a role in determining the satisfaction [4] and usages preference of mobile apps [5, 6]. This paper tries to inspect the moderating effect of the individual differences on the purchase intention of mobile apps. Our model is based on the Theory of Reasoned Action (TRA) [7] which we use to predict the intention to purchase mobile apps. We use the big five-personality traits [8, 9] to categorize the individual differences. It measured by the Mini International Personality Item Pool (Mini-IPIP) questionnaires instrument [10].

The major outcome of our pilot examination enhances understanding of the moderating effect between personality traits and mobile apps purchase intention. It also expectantly eagerly is a great starting indication and will subsequently be used for empirical research in the future.

2 Literature Review

2.1 Theory of Reasoned Action

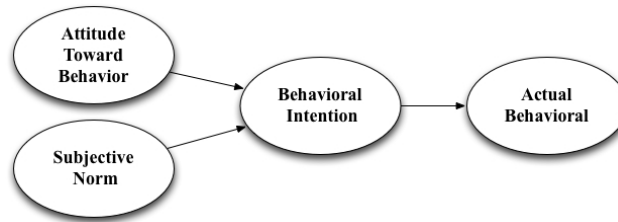


Fig. 1. Original Theory of Reasoned Action [7]

Fishbein and Ajzen [7] introduced TRA in 1975. The conceptual model of TRA is shown in figure 1. It proposed fundamental and influential factors to understand the behavioral intention. According to the TRA, attitude toward the behavior and subjective norm (or, social influence) are two factors that mainly determine a person's behavioral intention to perform a specified behavior. Moreover, behavioral intention will lead to actual performance of that behavior. "The stronger the intention, the more likely the performance of behavior" [7]. Attitude toward behavior is defined as "an individual's positive or negative feelings (evaluative affect) about performing the target behavior" [7]. Subjective norm can be explained as "the person's perception that most people who are important to him think he should or should not perform the behavior in question" [7]. TRA have been applied for predicting a wide range of behaviors. For example, it has been used to understand behavioral intention in context of mobile marketing including Thailand [11, 12]. The theories also seem suited for the purpose of investigating and predicting consumer purchase intentions of mobile apps.

2.2 Personality traits

The conceptualization of the Big Five personality traits, based on enduring characteristics of the individual that summarize trans-situational consistencies in characteristic styles of responding to the environment [8], proposes a framework that organized personality into 5 groups known as Big Five traits (Neuroticism, Extraversion, Openness, Conscientiousness, and Agreeableness), which explain much of the shared variance of human personality. There is a number of free and commercial scales designed questionnaires to measure Big Five personality traits. One of the most famous inventories is the International Personality Item Pool (IPIP). It is a free construct items for questionnaires, proposed by Goldberg et al [13] in 1996. It consists of 50 and 100 items. Many researchers studied on reducing the number of questionnaires from using an extremely brief measure of the Big-Five personality dimensions to 100 items. To illustrate this, the revised NEO Five-Factor Inventory is a 60 items questionnaire proposed by Costa et al [14]; Donnellan [10] proposed 20 questions items called Mini-IPIP, 40 items Mini Markers of Big Five [15], 44-item Big Five Inventory [16], 75 items Traits Personality Questionnaire 5 (TPQue5) [17].

In this study, Mini-IPIP 20 questions scale was used to measure the personality traits of the participants. There are 5 reasons that support the use of Mini-IPIP. First of all, the most limiting disadvantage of the IPIP are the huge questionnaires items [10]. Participants may respond carelessly due to annoyance with the length of assessment. Second, the result from studies conclude that Mini-IPIP is a psychometrically acceptable and practically useful short measure of the Big Five personality traits in the term of reliability and validity and comparable to IPIP [10, 18]. Third, Mini-IPIP is not the shortest instrument for investigate the Big Five personality traits. There are shorter version such as 5 items [19–21] and 10 items [22] inventories. However, the shorter instrument is not the better. The use of very short instruments of personality traits may significantly affect the validity and reliability [23]. Besides, Baldasaro et al [24] argued that the result from TIPI is not adequately reliable. Moreover, the items are having a relatively high correlation between each other. Fourth, Shafer [25] proposed a 30 items inventory for measuring the personality traits. However, the results suggested that the 30 items have lower or equal validity scores than Mini-IPIP. Finally, many studies discovered that Mini-IPIP shows the reliability and validity as well as the 50 items IPIP [10, 18, 23, 24]. For those reasons, Mini-IPIP was used as an instrument to measure the Big Five personality traits in this study.

2.3 Purchasing of Mobile Apps

Mobile apps can be classified into 3 sub-categories, content-, marketing-, or service-oriented [26]. There are 3 monetizing options for B2C apps [26]. First of all, developers sell the apps as one-time loyalty free. Consumers can download re-install and update it for free after purchase through the ecosystem of their platform. Second, freemium applications allow consumers to download and use their apps for free with limitation such as a permit to use its full features for 15 days. Moreover, developers may allow users to use their “lite” versions, which have only basic feature available.

Also, they can make money from advertising space in their apps; if consumers need more advance functionality or don't want to see the advertising, they can purchase an upgrade it directly from in-app purchase. Third, developers focus on offering premium content inside the apps. For example, users could buy new tool in a game; they can subscribe to their favorite magazine, newspaper or books.

3 Approach

3.1 Model-based investigations

The conceptual model in this study shows in figure 2. The model is based on TRA. The Big five personality traits have been added to investigate the moderating effect within the TRA factors. We now try to answer the following questions:

Question 1: Do the Big Five Personality traits have a moderating effect between the attitude toward purchase of mobile applications and the intention to purchase mobile applications in office workers and students in Bangkok, Thailand?

Question 2: Do Big Five Personality traits have a moderating effect between Subjective Norm and the intention to purchase mobile applications in office workers and students in Bangkok, Thailand?

Question 3: Do Big Five Personality traits have a moderating effect between the intention to purchase mobile applications and an Actual Purchase of Mobile Applications in office workers and students in Bangkok, Thailand?

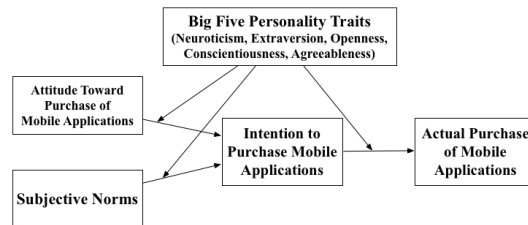


Fig. 2. Proposed model for measuring the moderating effect of personality traits.

3.2 Initial data used in a first test of the model

The pilot study was conducted on a sample of 149 participants (n=149) who live in Bangkok, Thailand, 62 and 87 of them are students and office workers, respectively. Of these, 59.7% were female and 39.6% were male (0.7% of the participants chose not to answer this question). Participants use a diversity of mobile operating systems. Specifically, Apple iOS for 47.5%, Android for 42.1%, Microsoft Windows Phone for 4.4%, Black Berry for 4.4% and other operating system for 1.6%. Data was collected using self-report web-based and paper-based questionnaires. The design of the questionnaires items was based on questions developed by TRA [7] and Mini-IPIP [10]. Participants indicate their level of agreement with each item on a 5 point Likert scale

(1 = strongly disagree, 5 = strongly agree). The Cronbach's Alpha of over all questions in TRA and Mini-IPIP question is 0.92 and 0.61, respectively.

4 Preliminary results

The correlation matrix of variables is demonstration in Table.1. (ATT=Attitude Toward Purchase of Mobile Apps, SUB=Subjective Norm, INT=Intention To Purchase, EXT=Extraversion, AGR=Agreeableness, CONS=Consciousness, NEU=Neuroticism, OPEN=Openness to Experience). Attitude toward purchase of mobile apps and subjective norm are significantly correlated with intention to purchase ($r = 0.74$ and $r = 0.47$, $p < 0.01$). Moreover, Intention to purchase is highly correlated with actual purchase ($r = 0.81$, $p < 0.01$). Hence, this confirms the original conclusions of TRA. The Big Five personality traits did not show a significant correlation with our predictor's variables. Openness to experience was positively correlated with extraversion ($r = 0.29$, $p < 0.01$), agreeableness($r = 0.48$, $p < 0.01$), consciousness($r = 0.26$, $p < 0.01$) and negative correlated with neuroticism ($r = -0.19$, $p < 0.01$).

Table 1. Correlation matrix of all variables.

	1	2	3	4	5	6	7	8	9
1.ATT	1	.37**	.74**	.69**	0.06	.175	0.10	0.08	0.07
2.SUB	.37**	1	.47**	.39**	.17	.189	0.08	0.09	0.06
3.INT	.74**	.47**	1	.81**	0.05	.162	0.14	-0.05	0.11
4.ACT	.69**	.39**	.81**	1	0.04	.161	0.14	0.05	0.05
5.EXT	0.06	.17	0.05	0.04	1	.37**	.30**	0.10	.29**
6.AGR	.18	.19	.16	.16	.37**	1	.44**	-0.14	.48**
7.CON	0.10	0.08	0.14	0.14	.30**	.44**	1	-0.06	.26**
8.NEU	0.08	0.09	-0.05	0.05	0.10	-0.14	-0.06	1	-.19**
9.OPEN	0.07	0.06	0.11	0.05	.29**	.48**	.26**	-.19**	1

** Correlation is significant at the 0.01 level (2-tailed).

4.1 Moderating role of personality traits

To investigate the prediction that personality traits moderate intention to purchase and actual purchase, 2 hierarchical multiple regression models were established. First, in step 1, Intention to purchase served as dependent variable. It was tested by attitude toward purchase of mobile apps and subjective norms as predictors. In step 2, personality traits were entered as interaction effect with attitude toward purchase of mobile apps and subjective norms. For the second model, in step 1 we added actual purchase as dependent variable along with intention to purchase as predictor. Also, the interaction between personality traits and intention to purchase were entered in step 2. We separate data from participants based on their occupation into 2 groups "Office Worker" and "Student". All predictors' variables were centered by mean to reduce multicollinearity effects. The results of model 1 and 2 show in table 2 and 3, respectively.

The cumulative percentage of explained variance of attitude toward purchase of mobile apps in office workers is 66% (adjusted R square = 0.66); Student is 41%

(adjusted R square = 0.41). For the subjective norms, it can explain variance of 28% (adjusted R square = 0.28); for office workers and 26% (adjusted R square = 0.26); for students. In Table 2, show the value of standardized coefficient (β) and R square change of the model that have intention to purchase as dependent variable.

Table 2. Hierarchical regression result of “Attitude Toward Purchase of Mobile Apps“ and “Subjective Norm” as predictors to Intention to purchase

		Office Worker		Student	
		INT		INT	
		ΔR^2	β	ΔR^2	β
Attitude Toward Purchase of Mobile Apps					
<i>Step 1:</i>	ATT	0.67*	0.81*	0.42*	0.66*
	EXT		0.023		-0.12
<i>Step 2:</i>	ATT X EXT	0	-0.14	0.01	-0.14
<i>Step 1:</i>	ATT	0.67*	0.80*	0.42*	0.66*
	AGR		0.66		-0.42
<i>Step 2:</i>	ATT X AGR	0	0.15	0	0.14
<i>Step 1:</i>	ATT	0.67*	0.81*	0.45*	0.62*
	OPEN		0.03		0.16
<i>Step 2:</i>	ATT X OPEN	0.01	0.154	0.15	-0.287
<i>Step 1:</i>	ATT	0.67*	0.80*	0.42*	0.62*
	CON		0.7		-0.06
<i>Step 2:</i>	ATT X CON	0.005	0.78	0.02	-1.1
<i>Step 1:</i>	ATT	0.67*	0.81*	0.50*	0.70*
	NEU		-0.05		-0.29*
<i>Step 2:</i>	ATT X NEU	0	0.11	0	-0.133
Subjective Norm					
<i>Step 1:</i>	SUB	0.30*	0.54*	0.29*	0.52*
	EXT		-0.01		-0.06
<i>Step 2:</i>	SUB X EXT	0.01	0.27	0.03	-1.35
<i>Step 1:</i>	SUB	0.30*	0.50*	0.29*	0.52*
	AGR		0.11		0.1
<i>Step 2:</i>	SUB X AGR	0.01	0.5	0.01	0.61
<i>Step 1:</i>	SUB	0.30*	0.54*	0.33*	0.52*
	OPEN		0.13		0.24*
<i>Step 2:</i>	SUB X OPEN	0.01	-0.43	0.01	-0.3
<i>Step 1:</i>	SUB	0.32*	0.54*	0.29*	0.52*
	CON		0.16		-0.075
<i>Step 2:</i>	SUB X CON	0.01	0.44	0.02	1.72
<i>Step 1:</i>	SUB	0.34*	0.57*	0.33*	0.55*
	NEU		-0.22		-0.21*
<i>Step 2:</i>	SUB X NEU	0	-0.64	0.02	-0.78

Note: * = $p < 0.05$

We analyzed all the variables and interaction term in our study. The R square changes in all steps are relatively low. Significant effects were only found for step 1 model (without interaction). Moreover, personality traits only show a few significant effects in both office workers and students. Neuroticism shows a negative coefficient in both subjective norm ($\beta = -0.21$) and attitude toward purchase of mobile apps ($\beta = -0.29$). Openness to experience indicates significant on subjective norms ($\beta = 0.24$). There are no significant in any interaction term between attitude toward purchase of mobile apps and personality traits or subjective norms and personality traits. The standardized coefficients of attitude toward purchase of mobile apps are different between office workers and students. The office workers ($\beta = 0.81$) has higher beta values more than students ($\beta = 0.66$) that mean the attitude toward purchase of mobile apps of office worker has more impact on the intention to purchase mobile apps.

Table 3. Hierarchical regression result of Intention To Purchase as predictor to Actual Purchase

		Office Worker		Student	
		ACT		ACT	
		ΔR^2	β	ΔR^2	β
Intention To Purchase					
<i>Step 1:</i>	INT	0.73*	0.86*	0.55*	0.73*
	EXT		0.06		0.08
<i>Step 2:</i>	INT X EXT	0	0.11	0.01	-0.61
<i>Step 1:</i>	INT	0.73*	0.85*	0.55*	0.73*
	AGR		-0.03		0.067
<i>Step 2:</i>	INT X AGR	0	0.36	0.01	-0.478
<i>Step 1:</i>	INT	0.73*	0.85*	0.55*	0.75*
	OPEN		0.02		-0.34
<i>Step 2:</i>	INT X OPEN	0	0.03	0.01	0.711
<i>Step 1:</i>	INT	0.73*	0.85*	0.55*	0.73*
	CON		0.01		0.05
<i>Step 2:</i>	INT X CON	0	0.1	0	-0.86
<i>Step 1:</i>	INT	0.73*	0.86*	0.55*	0.75*
	NEU		0.06		0.1
<i>Step 2:</i>	INT X NEU	0	0.11	0.01	0.56

Note: * = $p < 0.05$

In the Table 3, Actual purchase were used as dependent variable. It was predicted by intention to purchase. Personality traits were served as moderator for their relationship. The finding supports previous research into this brain area which the relationship between intention and actual perform of behavior which have high level of coefficient standardized value for both office worker ($\beta = 0.86$) and student ($\beta = 0.73$). The adjusted R square of those 2 groups also can explain 71% (adjusted R square = 0.71) of variance of office worker and 53% of student (adjusted R square = 0.53). However, there are no significant of coefficient standardized value of the interaction, Moreover, the R Square change are very low. Figure 3 and 4 shows the statistical summarize from our research model.

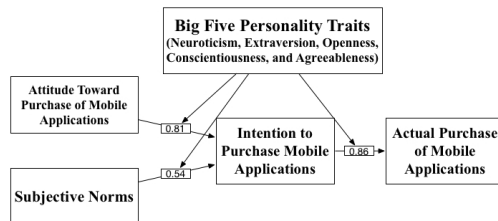


Fig. 3. Results from office workers.

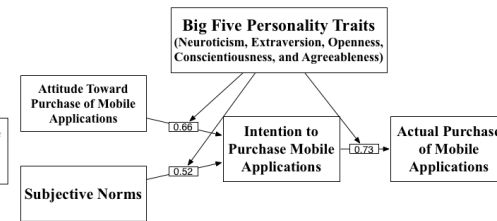


Fig. 4. Results from students.

5 Discussion and Interpretation of Results

The findings are rather disappointing in that the moderating role of personality traits did not show a significant effect. The interaction terms were found to be non-significant in predicting the overall variance of the model. Thus, the Question 1-3 has been answered. The personality traits did not have any moderating effects in any relationship of TRA. This may lead to conclusion that the ability to buy mobile apps has an overriding influence such as financial status, occupation, major of study, etc.

Nevertheless, this study produced results that corroborate the findings of a great deal of the original TRA. It indicates that intention to purchase mobile apps is highly determined by the joint of attitude toward purchase of mobile apps and subjective norms. Furthermore, the higher level of intention to purchase mobile apps will lead to higher possibility of actual purchase of mobile apps. Office workers show higher significant relationship between attitudes toward purchase of mobile apps and intention to purchase mobile apps, which can describe that the office worker will buy mobile apps more than IT students. Subjective norms indicate nearly the same level of relationship for both office workers and students. Hence, the perceptions of most important people around them toward the intention to purchase mobile apps have the same effect for both office workers and students. However, office workers show a significant increase in the relationship between intention to purchase and actual purchase. This led to the conclusion that office workers purchase more applications based on their attitudes than students.

In conclusion, this study was designed to determine the moderating effect of personality traits in a mobile applications purchasing context. Hierarchical multiple regression analysis revealed that the personality traits did not have a significant effect on the intention to purchase mobile applications. However, the finding of graphical interaction indicates that an interaction coefficient exists in the students meaning that the moderating effects exist but were overridden by the homogeneity of the sample. Therefore, this research has raised some questions that need further investigation. For example, does any moderator exist in this context? Will be overridden by the homogeneity of the samples such as age, sex, occupation, major of education, etc.

6 Limitations of the Study and Future Research

In this paper, there are some limitations and subsequent opportunities for further study. First of all, the questionnaire was a self-evaluation and consists of many items to answer. Hence, it is possible that there will be some common bias. Second, the relatively small size of the sample is a potential threat to the validity of this study. Accordingly, additional work is needed to experiment with a larger samples size. Further investigations are needed in the future to explore the factors that have a moderating effect in the intention to purchase mobile apps context. As the initial data was only 147 respondents, a more extensive study will have to follow up our preliminary results. Relationships between factors not addressed in this paper will be the subject of future works.

Acknowledgements. The authors would like to express their appreciation of the financial support provided by Austrian Federal Ministry for Science and Research (Ernst Mach-ASEA UNINET scholarship) and the infrastructure support of the Faculty of Computer Science at the University of Vienna. Also, the authors would like to thank the reviewers for their valuable suggestions, which have either been incorporated in this paper or will be the subject of current or future research.

References

1. Research, A.B.I.: The Mobile App Market will be Worth \$27 Billion in 2013 as Tablet Revenue Grows, <https://www.abiresearch.com/press/the-mobile-app-market-will-be-worth-27-billion-in->.
2. Gartner: Worldwide PC, Tablet and Mobile Phone Shipments to Grow 4.5 Percent in 2013 as Lower-Priced Devices Drive Growth, <http://www.gartner.com/newsroom/id/2610015>.
3. Apple Press: Apple - Press Info - Apple Reports Fourth Quarter Results, <http://www.apple.com/pr/library/2013/10/28Apple-Reports-Fourth-Quarter-Results.html>.
4. Oliveira, R. De, Cherubini, M., Oliver, N.: Influence of personality on satisfaction with mobile phone services. *ACM Trans. Comput. Interact.* 20, 1–23 (2013).
5. Chittaranjan, G., Blom, J., Gatica-Perez, D.: Who's Who with Big-Five: Analyzing and Classifying Personality Traits with Smartphones. 2011 15th Annu. Int. Symp. Wearable Comput. 29–36 (2011).
6. Lane, W., Manner, C.: The Influence of Personality Traits on Mobile Phone Application Preferences. *J. Econ. Behav. Stud.* 4, 252–260 (2012).
7. Fishbein, M., Ajzen, I.: *Belief, Attitude, Intention, and Behavior: An Introduction to Theory and Research.* Addison-Wesley, Reading, MA (1975).
8. Valentine, C.W.: PERSONALITY—A PSYCHOLOGICAL INTERPRETATION. by Gordon W. Allport. London: Constable, pp. xiv + 588, price 16s.). *Br. J. Educ. Psychol.* 13, 48–50 (1943).
9. McCrae, R.R., John, O.P.: An introduction to the five-factor model and its applications. *J. Pers.* 60, 175–215 (1992).
10. Donnellan, M.B., Oswald, F.L., Baird, B.M., Lucas, R.E.: The mini-IPIP scales: tiny-yet-effective measures of the Big Five factors of personality. *Psychol. Assess.* 18, 192–203 (2006).

11. Bauer, H.H., Reichardt, T., Barnes, S.J., Neumann, M.M.: DRIVING CONSUMER ACCEPTANCE OF MOBILE MARKETING : A THEORETICAL FRAMEWORK AND EMPIRICAL STUDY. 6, 181–192 (2005).
12. Srisawatsakul, C., Papasratom, B.: Factors Affecting Consumer Acceptance Mobile Broadband Services with Add-on Advertising: Thailand Case Study. *Wirel. Pers. Commun.* 69, 1055–1065 (2013).
13. Goldberg, L.R., Johnson, J. a., Eber, H.W., Hogan, R., Ashton, M.C., Cloninger, C.R., Gough, H.G.: The international personality item pool and the future of public-domain personality measures. *J. Res. Pers.* 40, 84–96 (2006).
14. Costa, P.T., MacCrae, R.R., Psychological Assessment Resources, I.: Revised NEO Personality Inventory (NEO PI-R) and NEO Five-Factor Inventory (NEO FFI): Professional Manual. Psychological Assessment Resources (1992).
15. Saucier, G.: Mini-Markers: A Brief Version of Goldberg’s Unipolar Big-Five Markers. *J. Pers. Assess.* 63, 506–516 (1994).
16. John, O.P., Srivastava, S.: The Big Five trait taxonomy: History, measurement, and theoretical perspectives. In: Pervin, L.A. and John, O.P. (eds.) *Handbook of Personality: Theory and Research*. pp. 102–138. Guilford Press, New York (1999).
17. Tsaousis, I., Kerpelis, P.: The Traits Personality Questionnaire 5 (TPQue5). *Eur. J. Psychol. Assess.* 20, 180–191 (2004).
18. Cooper, A.J., Smillie, L.D., Corr, P.J.: A confirmatory factor analysis of the Mini-IPIP five-factor model personality scale. *Pers. Individ. Dif.* 48, 688–691 (2010).
19. Bernard, L., Walsh, R., Mills, M.: Ask once, may tell: Comparative validity of single and multiple item measurement of the Big-Five personality factors. *Couns. Clin. Psychol. J.* 2, 40–57 (2005).
20. Aronson, Z.H., Reilly, R.R., Lynn, G.S.: The impact of leader personality on new product development teamwork and performance: The moderating role of uncertainty. *J. Eng. Technol. Manag.* 23, 221–247 (2006).
21. Woods, S., Hampson, S.: Measuring the Big Five with single items using a bipolar response scale. *Eur. J. Pers.* 390, 373–390 (2005).
22. Gosling, S.D., Rentfrow, P.J., Swann, W.B.: A very brief measure of the Big-Five personality domains. *J. Res. Pers.* 37, 504–528 (2003).
23. Credé, M., Harms, P., Niehorster, S., Gaye-Valentine, A.: An evaluation of the consequences of using short measures of the Big Five personality traits. *J. Pers. Soc. Psychol.* 102, 874–88 (2012).
24. Baldasaro, R.E., Shanahan, M.J., Bauer, D.J.: Psychometric properties of the mini-IPIP in a large, nationally representative sample of young adults. *J. Pers. Assess.* 95, 74–84 (2013).
25. SHAFER, A.B.: BRIEF BIPOLAR MARKERS FOR THE FIVE FACTOR MODEL OF PERSONALITY. *Psychol. Rep.* 84, 1173–1179 (1999).
26. Cortimiglia, M., Ghezzi, A., Renga, F.: Mobile Applications and Their Delivery Platforms. *IT Prof.* 13, 51–56 (2011).