Tayyaba Arshad*, Beenish Malik**, Abdul Basit Mujahid***

State Of Being Perplexed: The Application of TAM on Latex Usage among the Researchers of Academia

Abstract:

This study integrates the theories of Technology Acceptance Model (TAM), and Technology Readiness Index (TRI) in usage of LATEX by faculty members of university of Balochistan (UOB). We applied Structural Equation Model (SEM) for path analysis. Results explained that TAM and TRI were the significant instrument for predicting the intentions and usage of LATEX among the researchers of academia. Path analysis specified that optimism, innovativeness, insecurity and discomfort, were determinants of Perceived Usefulness (PU) and Perceived Ease of Use (PEOU) that anticipated the usage intention of LATEX. The implications of these findings will improve their academic writing skill according to international standards and applied interventions for emerging technology of LATEX by researchers.

Key words: LATEX, Technology Readiness Index, Technology Acceptance Model, Perceived Usefulness.

INTRODUCTION:

Use of technology in academic writing is emergent at a fast stride. Likewise, academicians are dealing with different software and technologies that are progressively more sophisticated in context of technological standpoint. Most of academicians' believed that integration of technology in academia frequently depends on researcher's technological readiness and intention to use that technology. This study is focused on University of Balochistan (UOB) which is the oldest public sector University of Balochistan. Unfortunately, Balochistan is quite deprived province in terms of resources and technological advancements.

The main objective of the study was to recognize the potential outcomes of LATEX usage. In order to match the technological advancements and standards with global universities, there was a need to explore the interest of researchers of UOB to incorporate the latest technologies like LATEX into their research practices.

The construct of this research was based upon the perception of TRI (Parasuraman, 2001) which was composition of enablers and inhibitors with TAM (Davis, 1989). This technological orientation allowed researchers to improve acceptance of their research internationally.

LITERATURE REVIEW:

The desirability of the research about the acceptance of technology has evident through the enormous practices by academicians with the advancement of technology. Two main beliefs which were the postulates PU and PEOU of TAM (Davis, 1989) determined the acceptance of users regarding the particular technology. Multiple Applications and replications had established that TAM as quite robust model (Chin & Todd 1995; Davi, 1989; Davis & Venkatesh, 1996; Igbaria, Malik, Karim, & Bibi ,2015; Schiffman, & Wieckowski, 1994). This study described the relationships between the Optimism, Innovativeness ,Insecurity and Discomfort with PU , PEOU and Intentions to use (Morris & Dillon, 1997); Subramanian,1994; Taylor & Todd ,1995;Venkatesh & Davis ,1996).

PU AND PEOU:

Earlier work on technology acceptance theory has measured the effect of PU on different technologies (Blomstermo, Eriksson, Lindstrand, & Sharma, 2004; Igbaria et al., 1994; Lim & Benbasat, 2000). Therefore, the current study recommends applicability of TAM by investigating the LATEX usage. PU refers to "the degree to which a person believes that using a particular system would enhance his or her job performance" (Davis, 1989). PEOU was termed as "degree to which a person believes that using the system will be free from effort" (Davis,1989). In this context PU and PEOU were considered as the degree of belief of research scholars that using the LATEX would improve their performance in academic writing(Davis, Bagozzi, &Warshaw ,1989).PU and PEOU has been considered as a significant constructs that enhance performance of individuals (Mathwick, Malhotra, & Rigdon, 2001). Findings of earlier studies specified that PU and PEOU were significant constructs for predicting intentions (Hess, McNab, & Basoglu, 2014; Ranzijn, Keeves, Luszcz, & Feather, 1998; Shen, Laffey, Lin, & Huang, 2006).

The effect of PU and PEOU on acceptance of different technologies had been studied (Calisir & Calisir, 2004; Fenech, 1998; Henderson & Divett, 2003; Horst, Kuttschreuter, & Gutteling, 2007). However, the effect of PU and PEOU on LATEX usage through applying SEM) has not been measured yet. The study would assist not only to measure the current intention to use LATEX but also to visualize the future intention for LATEX usage.

TECHNOLOGY READINESS INDEX (TRI):

TRI was used to identify theextent of belief and person's considerations towards the usage of technology. TRI distinguished aperson on the basis of technology user or non-user. Parasuraman, (2000) described TRI as "individual's propensity to embrace and use new technologies to accomplish goals in home life and at work"(p.308).Positive and negative

beliefs combined together to form intentions towards technology. Among every individual the context of believes vary .In addition to this, coexistent beliefs determined the will of a person to interact with the new technology (Parasuraman, 2000).

TRI concept was based on four dimensions, optimism and innovativeness were enablers of technology readiness however discomfort and insecurity were inhibitors.

Optimism:

Optimism is defined as "a positive view of technology. confidence in improved control, flexibility, and helpfulness in life due to technology"(Walczuch, Lemmink, & Streukens, 2007).

Optimism develops the perceptions related to usage (Erdoğmuş & Esen, 2011; Godoe & Johansen, 2012). Optimism, as an emotional dimension which develops the fairness in perception of positive features of life (Dember, Martin, Hummer, Howe, & Melton, 1989).Hence, this develops the attitude towards the usefulness and ease in using a particular technology.

H1a: Optimism will have a significant positive influence on PU of LATEX.

H1b: Optimism will have a significant positive influence on PEOU of LATEX.

Innovativeness

The concept of Innovativeness had received extensive consideration from researchers because innovativeness was a new variable in the technology acceptance literature. It has been observed that very few studies had focused on the relation between technology innovativeness and acceptances of new technology. Therefore, The majority of research on innovativeness were in the field of entrepreneurship, reactiveness and risk-taking (Joshi, Das, & Mouri, 2015). This study considered the practical significance of technology innovativeness as a construct in the process of acceptance of new technology like LATEX.

Different researchers defined innovativeness as an individual's motivation to use any modern information technology (Agarwal & Prasad, 1998). Innovativeness was an individual's interest for new experience (Craig & Ginter, 1975; Joseph & Vyas, 1984). Adoption of an innovation by an individual before other members of the society was considered as innovativeness (Rogers & Shoemaker, 1971). Organizational features of adopters and market dynamics were the determinants of adoption of technological innovation (Joseph & Vyas, 1984). However, more recent research considered technological innovativeness as a variable that related to the extent of technology innovation in new products as the boundaries of the scale (Gatignon, Tushman, Smith, & Anderson, 2002; Green, Gavin, & Aiman-Smith, 1995). Innovativeness was considered as the degree of inventiveness in the design process of new product (Sethi, Smith, & Park, 2001).

Earlier researches suggested that the innovativeness effect adoption behavior (Craig & Ginter, 1975; Joseph & Vyas, 1984). According to (Midgley & Dowling, 1978) innovativeness was related to individuals' characteristics to influence acceptance behavior.

The relationship between innovativeness and PU had been very little studied. This was a dire need toinvestigate the relationship of innovativeness with PU. Innovativeness was a construct that affected PU (Agarwal & Prasad, 1998). The attitude of more innovative Individuals should be more positive about new technology. Innovativeness was defined as the " tendency to be the first using innovative technologies" (Walczuch et al., 2007). In earlier studies innovativeness had been found as a key factor in PU and PEOU of information technology (Fagan, Kilmon, & Pandey, 2012). Innovativeness strongly influenced PEOU and PU of wireless internet services (Erdoğmuş & Esen, 2011; Godoe & Johansen, 2012; Kishore & McLean, 2001; Lu, Yao, & Yu, 2005). It has been considered that individuals with high innovativeness develop positive perception about usefulness and PEOU of LATEX. For that reason we hypothesized that,

H2a: Technological innovativeness significantly related to PU of LATEX.

H2b: Technological innovativeness significantly related to PEOU of LATEX.

Insecurity:

Intention to use LATEX while writing research papers the faculty members needs to feel secure about their privacy protection measures and data loss (Parasuraman, 2000). Thus, we conceptualize the construct of insecurity with the context of usage of technology pledge negative feelings .Hence, we hypothesized:

H3a. Technological insecurity has negative association with PU.

H3b: Technological insecurity has negative association PEOU.

Discomfort:

In addition, results of different studies showed the context of beliefs characterized into four facets: innovativeness, optimism, insecurity and discomfort (Parasuraman, 2000). In our study we have used only one dimension which is much relevant to our study.

According to Parasuraman & Colby (2001)"a perceived lack of control over technology and a feeling of being overwhelmed by it" (p.41).This facets measures the concerns and fears experience individuals when defying technology.

The discomfort of technology, natural disposition of an individual to be edgy, fretful, emotionally tensioned or eagerly desirous in using a technology have anxious feelings about the use of technology, this concept is quite similar with the usage of computer cause a negative impression on PEOU of individuals (Venkatesh,2000). On the basis of literature, we expanded model to propose a link between the technological discomfort and the perceived PEOUof LATEX.

Though, a relationship that has not been demonstrated in the previous research. every individual look forward to judge the worth of a technology despite of the fact how they going to handle it. Moreover, the discomfort is probable to influence the perceived use of LATEX. An unmanageable system is expected to be a system that is hostile. On the basis of this assumption we hypothesize:

H4a. Discomfort has a negative association with PU.

H4b. Discomfort has a negative association with PEOU.

Intentionto Use (INTUSE):
Intentions to use (INTUSE) a new technology discovered that user`s state of mind varied in terms of their opinions about the several decisions. Dabholkar (1996) found a positive relation between individual`s feelings and INTUSE. Most important element of INTUSE a new technology is (PU). The next important factor of is (PEOU). Technology of acceptance model (TAM) suggested that a technology can be more useful if it is easier to use (Davis, 1989).The mediating effect of PEOU and PU on INTUSE was proposed by TAM (Davis, 1993). A number of studies found positives influence of PEOU and PU on INTUSE a new technology (Bigne-Alcaniz, Ruiz-Mafé, Aldas-Manzano, & Sanz-Blas, 2008; Kuo, Liu, & Ma, 2013; Shin, 2010). Hence, the succeeding hypotheses in the context of LATEX usage have been proposed by the study:
H5a: PU of LATEX has a significant positive influence on future behavioral INTUSE the LATEX.
H5b: Perceived PEOU of LATEX has a significant positive influence on future behavioral INTUSE the LATEX.
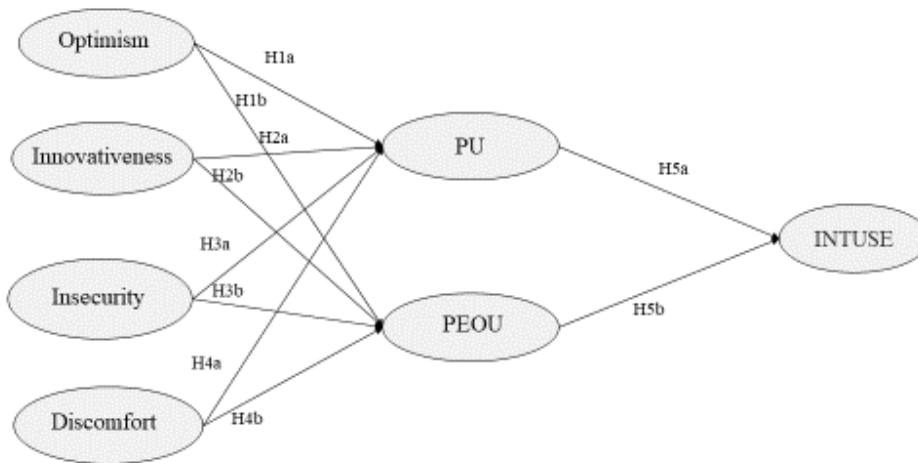**Conceptual Model:**

Figure 1: Conceptual Model
Methodology:
Target population for this study was the faculty members of UOB. Convenience sampling and Snowball sampling techniques were utilized for the collection of data. Constructs were measured by using Technology Acceptance Model (TAM) developed by (Davis, 1989), and Technology Readiness Index (TRI) developed by (Parasuraman& Colby, 2001).Three factors of TAM i.e. PU, PEOU and INTUSE along with four factors of TRI Optimism (7 items), innovativeness (4 Items), discomfort (4 Items), and insecurity (5 Items) were considered in developing the hypothesized model. All items were measured on 5 point

Likert scale. Total no of 242 questionnaires were distributed among the faculty members of UOB participants and 208 were responded. Confirmatory factor analysis (CFA) was utilized to verify the structure of factors.

RESULTS:

The use of LATEX diversified across different departments. Overall intentions of usage rates of LATEX was (52%) beyond expectation. Age of Respondents were between 27 to 56 years with 68% of the respondents were male and 32 % were female. All respondents were full time faculty members. Highest qualification of respondents was Ph.D. AMOS 23 version was utilized to test the path model (Arbuckle &Wothke, 1999) with maximum likelihood estimation (MLE) method. All the Values proved the good model fit.

The fit indexes showed the acceptable level, with df 4; CMIN/df (1.24), RMSEA (0.02) CFI (0.99); TLI (0.99); GFI (0.99). Standardized regression coefficients values were significant except discomfort (Table 2). PEOU and PU were predicted by the four constructs i.e. optimism, innovativeness, insecurity and discomfort. The path estimates between the optimism and PU was ($\beta = .10$, $p < .001$) supported our hypothesis 1a; the relationship between Optimism & PEOU ($\beta = .25$, $p < .001$) provided the significant relationship which supported hypothesis 1b.Innovativeness & PU ($\beta = .52$, $p < .001$) confirmed our hypothesis 2a; Innovativeness & PEOU ($\beta = .29$, $p < .001$) caused the acceptance of hypothesis 2b. Insecurity & Perceived Usefulness ($\beta = -.14$, $p < .001$) provided the statistical support to our hypothesis 3a ; insecurity & PEOU ($\beta = -.39$, $p < .001$) suggested the significant effect among these variables which supported hypothesis 3b; ; discomfort and PU ($\beta = -.17$, $p < .001$) confirmed hypothesis 4a; discomfort & PEOU ($\beta = .08$, $p < .31$) did not support hypothesis 4b; PU & intention to use ($\beta = .70$, $p < .001$) showed the significant relationship .Hence, our hypothesis 5a was accepted; the positive relationship between PEOU & intention to use ($\beta = .18$, $p < .001$) suggested the acceptance of hypothesis 5b.
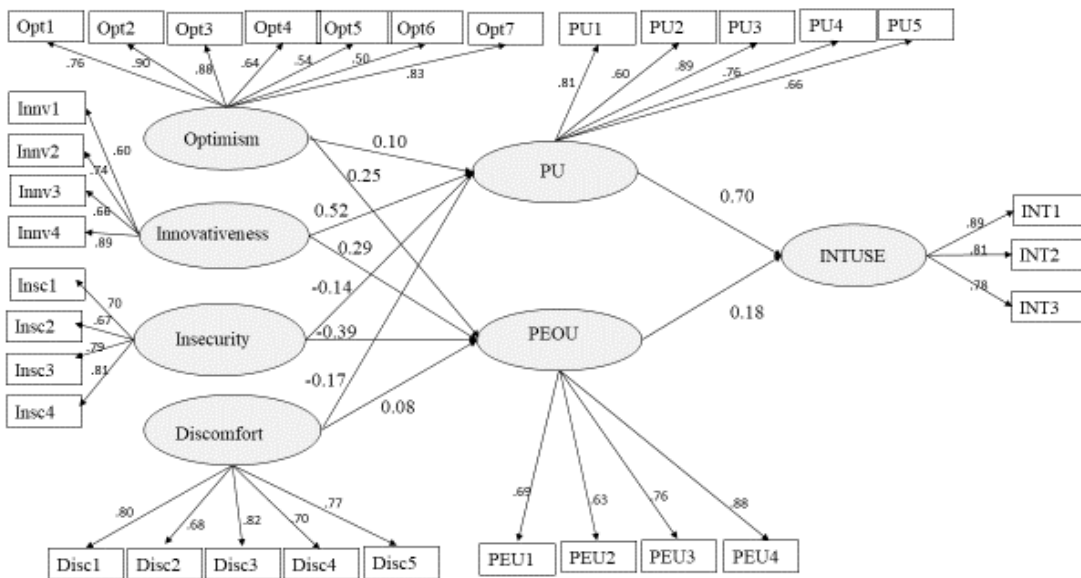

*Figure 2:*Tested Model

CONCLUSION AND DISCUSSION:

It can be inferred from the findings that optimism, innovativeness, insecurity, discomfort have an influential relation on PU. However, the association among technology discomfort and PEOU was not significant. The other relations of PEOU with optimism, innovativeness, insecurity were significant. The estimates of relations comprised the significance of direct paths from PU and PEOU to INTUSE of LATEX.

This research was based on the model of Parasuraman's (2000) TRI covering the usage of LATEX in academia. In research contexts the applicability and validity was checked .The positive constructs of TRI (optimism and innovativeness)

enhanced researcher's interest to use LATEX in their research. The negative constructs (discomfort and insecurity) hinders researcher's intention to use technology.

The results of the paper displayed that TRI had influenced PU and PEOU. Results were in line with previous research (Walczuch et al., 2007). Precisely optimism and innovativeness and positively related with PU and PEOU (Kuo et al., 2013). While, User's discomfort had no significant effect onP EOU of LATEX usage. These findings were not expected and were contrary to previous research (Walczuch et al., 2007).Insecurity had a negative relation with PU and PEOU.

The relationship between PU and PEOU with intention to use was significant. The results supported earlier studies (Lin et al., 2005). Hence, findings indicated that the perception of researchers about the usefulness and easiness of in the usage of LATEX had a positive inclination towards the technology. It was suggested that TRI depicted the TAM was supported by previous studies (Mathieson, 1991).

Limitations and Directions for Future Research

First limitation of the study was limited to single   university of the city. Cross sectional research design and convenience sampling was another limitation of our study. Further longitudinal studies can express the better understanding regarding this model. The effects of TRI on TAM were investigated in research writing. Future research should investigate the Facets of TRI in diversehigher education institutions by employing more sophisticated models (Malik, Ahmed, Arshad, & Gilani (2019). The findings revealed that discomfort facet wasnot according to expectations of previous research directions. Thus, the facets of discomfort should be further investigated.

REFERENCES:

Agarwal, R., & Prasad, J. (1998). A conceptual and operational definition of personal innovativeness in the domain of information technology. *Information systems research, 9*(2), 204-215.

Arbuckle, J. L., & Wothke, W. (1999). Amos 4.0 user's guide. Chicago: SmallWaters. Bearden, W. O., Sharma, S., & Teel, J. R. (1982). Sample size effects on chi-square and other statistics used in evaluating causal models. Journal of Marketing Research, 19, 425–430.

Bigne-Alcaniz, E., Ruiz-Mafé, C., Aldás-Manzano, J., & Sanz-Blas, S. (2008). Influence of online shopping information dependency and innovativeness on internet shopping adoption. *Online Information Review*, *32*(5), 648-667.

Blomstermo, A., Eriksson, K., Lindstrand, A., & Sharma, D. D. (2004). The PU of network experiential knowledge in the internationalizing firm. *Journal of International Management, 10*(3), 355-373.

Calisir, F., & Calisir, F. (2004). The relation of interface usability characteristics, PU, and perceived PEOU to end-user satisfaction with enterprise resource planning (ERP) systems. *Computers in human behavior, 20*(4), 505-515.

Chin, W. W., & Todd, P. A. (1995). On the use, usefulness, and ease of use of structural equation modeling in MIS research: a note of caution. *MIS quarterly*, 237-246

Craig, C. S., & Ginter, J. L. (1975). An empirical test of a scale for innovativeness. *ACR North American Advances*.

Davis, F. D. (1989). PU, perceived PEOU, and user acceptance of information technology. *MIS quarterly*, 319-340.

Davis, F. D. (1993). User acceptance of information technology: system characteristics, user perceptions and behavioral impacts. *International journal of man-machine studies, 38*(3), 475-487.

Davis, F. D., Bagozzi, R. P., &Warshaw, P. R. (1989). User acceptance of computer technology: a comparison of two theoretical models. Management Science, 35(8), 982-1003.

Davis, F. D., &Venkatesh, V. (1996). A critical assessment of potential measurement biases in the technology acceptance model: three experiments. *International journal of human-computer studies*, *45*(1), 19-45.

Dember, W. N., Martin, S. H., Hummer, M. K., Howe, S. R., & Melton, R. S. (1989). The measurement of optimism and pessimism. *Current Psychology*, *8*(2), 102-119.

Erdoğmuş, N., &Esen, M. (2011). An investigation of the effects of technology readiness on technology acceptance in e-HRM. *Procedia-Social and Behavioral Sciences*, *24*, 487-495

Fagan, M., Kilmon, C., & Pandey, V. (2012). Exploring the adoption of a virtual reality simulation: The role of perceived ease of use, perceived usefulness and personal innovativeness. *Campus-Wide Information Systems*, *29*(2), 117-127.

Fenech, T. (1998). Using perceived PEOU and PU to predict acceptance of the World Wide Web. *Computer Networks and ISDN Systems, 30*(1-7), 629-630.

Gatignon, H., Tushman, M. L., Smith, W., & Anderson, P. (2002). A structural approach to assessing innovation: Construct development of innovation locus, type, and characteristics. *Management science, 48*(9), 1103-1122.

Godoe, P., & Johansen, T. (2012). Understanding adoption of new technologies: Technology readiness and technology acceptance as an integrated concept. *Journal of European psychology students, 3*(1).

Green, S. G., Gavin, M. B., & Aiman-Smith, L. (1995). Assessing a multidimensional measure of radical technological innovation. *IEEE transactions on engineering management, 42*(3), 203-214.

Hackbarth G, Grover V, Yi MY. Computer playfulness and anxiety: positive and negative mediators of the system experience effect on perceived PEOU. Inform Manag. 2003;40(3):221–232.

Henderson, R., & Divett, M. J. (2003). PU, PEOU and electronic supermarket use. *International Journal of Human-Computer Studies, 59*(3), 383-395.

Hess, T. J., McNab, A. L., & Basoglu, K. A. (2014). Reliability Generalization of Perceived PEOU, PU, and Behavioral Intentions. *MIS quarterly, 38*(1).

Horst, M., Kuttschreuter, M., & Gutteling, J. M. (2007). PU, personal experiences, risk perception and trust as determinants of adoption of e-government services in The Netherlands. *Computers in human behavior, 23*(4), 1838-1852.

Igbaria, M., Schiffman, S. J., & Wieckowski, T. J. (1994). The respective roles of PU and perceived fun in the acceptance of microcomputer technology. *Behaviour & Information Technology, 13*(6), 349-361.

Joseph, B., & Vyas, S. J. (1984). Concurrent validity of a measure of innovative cognitive style. *Journal of the Academy of Marketing Science, 12*(2), 159-175.

Joshi, M. P., Das, S. R., & Mouri, N. (2015). Antecedents of Innovativeness in Technology- Based Services (TBS): Peering into the Black Box of Entrepreneurial Orientation. *Decision Sciences, 46*(2), 367-402.

Kishore, R., & McLean, E. (2001). The role of personal innovativeness and self-efficacy in information technology acceptance: An extension of TAM with notions of risk. *ICIS 2001 Proceedings*, 57.

Kuo, K.-M., Liu, C.-F., & Ma, C.-C. (2013). An investigation of the effect of nurses'technology readiness on the acceptance of mobile electronic medical record systems. *BMC medical informatics and decision making, 13*(1), 88.

Lim, K. H., & Benbasat, I. (2000). The effect of multimedia on perceived equivocality and PU of information systems. *MIS quarterly*, 449-471.

Lu, J., Yao, J. E., & Yu, C. S. (2005). Personal innovativeness, social influences and adoption of wireless Internet services via mobile technology. *The Journal of Strategic Information Systems*, *14*(3), 245-268.

Malik, B., Karim, J.,& Bibi, Z.(2015).Pakistan Journal of Social Science.35(1), 451-463.

Malik, B., Ahmed, F., Arshad ,T.,& Gilani, U. *Journal of Managerial Sciences*.(2019).13(3),105-118.

Mathieson, K. (1991). Predicting user intentions: comparing the technology acceptance model with the theory of planned behavior. *Information systems research*, *2*(3), 173-191.

Mathwick, C., Malhotra, N., & Rigdon, E. (2001). Experiential value: conceptualization, measurement and application in the catalog and Internet shopping environment☆. *Journal of retailing, 77*(1), 39-56.

Midgley, D. F., & Dowling, G. R. (1978). Innovativeness: The concept and its measurement. *Journal of consumer research, 4*(4), 229-242.
Morris, M. G., & Dillon, A. (1997). How user perceptions influence software use. *IEEE software, 14*(4), 58-65.

Murat, E. S. E. N., & ERDOĞMUŞ, N. (2014). EFFECTS OF TECHNOLOGY READINESS ON TECHNOLOGY ACCEPTANCE IN E-HRM: MEDIATING ROLE OF PERCEIVED USEFULNES. *Bilgi Ekonomisi ve Yönetimi Dergisi*, *9*(1).

Parasuraman A. Technology readiness index (tri): a multiple-item scale to measure readiness to embrace new technologies. J Serv Res. 2000;2(4):307–320.

Parasuraman, A., & Colby, C. L. (2015). An updated and streamlined technology readiness index: TRI 2.0. *Journal of service research*, *18*(1), 59-74.

Ranzijn, R., Keeves, J., Luszcz, M., & Feather, N. (1998). The role of self-PU and competence in the self-esteem of elderly adults: Confirmatory factor analyses of the Bachman revision of Rosenberg's Self-Esteem Scale. *The Journals of Gerontology Series B: Psychological Sciences and Social Sciences, 53*(2), P96-P104.

Rogers, E. M., & Shoemaker, F. F. (1971). Communication of Innovations; A Cross-Cultural Approach.

Sethi, R., Smith, D. C., & Park, C. W. (2001). Cross-functional product development teams, creativity, and the innovativeness of new consumer products. *Journal of marketing research, 38*(1), 73-85.

Shen, D., Laffey, J., Lin, Y., & Huang, X. (2006). Social influence for PU and ease-of-use of course delivery systems. *Journal of Interactive Online Learning, 5*(3), 270-282.

Shin, H.-S. (2010). Moderating effects of personal innovativeness on the relationship between perceived usefulness, subjective norm and intention to use mobile internet. *The Journal of Information Systems, 19*(3), 209-236.

Subramanian, G. H. (1994). A replication of perceived usefulness and perceived ease of use measurement. *Decision sciences*, *25*(5- 6), 863-874.

Taylor, S., & Todd, P. A. (1995). Understanding information technology usage: A test of competing models. *Information systems research*, *6*(2), 144-176.

Walczuch, R., Lemmink, J., & Streukens, S. (2007). The effect of service employees' technology readiness on technology acceptance. *Information & Management, 44*(2), 206-215.