

Nexus between integrating technology readiness 2.0 index and students' e-library services adoption amid the COVID-19 challenges: Implications based on the theory of planned behavior

Taufik Edi Rahmat

Fakultas Ekonomi dan Bisnis, Department of Economic and Business, Universitas Sultan Ageng Tirtayasa, Serang, Indonesia

Saqlain Raza

SZABIST

Hasan Zahid

Iqra University

Jaffar Abbas (✉ dr.abbas.jaffar@outlook.com)

Shanghai jiao Tong University

Fatimah Azzahraa Mohd Sobri

Universiti Utara Malaysia

Shehla Najib Sidiki

SZABIST

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Abstract

Background

The advent of the pandemic COVID-19 has resulted in a global crisis that resulted in the closure of universities and educational institutions worldwide. This study aims to explore the determinants of students' intention towards e-library services usage amid the challenging time of the COVID-19 pandemic. This paper reviews the technology-oriented individual attitude based on four dimensions of the technology readiness 2.0 index factors, which affect medical students' perspectives.

Materials and methods

The authors provided a self-administered questionnaire to medical students to investigate their e-library adoption attitude during the COVID-19 crisis. The authors distributed 542 questionnaires, received 361 complete responses and analyzed the data through path modeling/partial least squares structural equations modeling technique (PLS-SEM) with the smart PLS software version 3.3.3. The structural equation-modelling tool permits the estimation of results.

Results

The main finding revealed that medical students have a positive and explicit approach to use the services available at the e-library. Technology use and online services helped students continue their educational needs in the advent of the current pandemic COVID-19. Attitude and subjective norms have significant influence and are strong predictors of intention. However, due to inadequate support for the government side, the perceived behavioural control has an insignificant impact on intention. This paper indicated one of the pioneers investigating the determinants of e-library adoption among medical students based on technology-oriented personality traits, employing the four dimensions of the technology readiness 2.0 index during the challenges of the COVID-19 outbreak.

Conclusion

The study's findings provide useful insight that offers valuable insights to implement specific strategies from the government officials to address medical students' uncertainties and increase the technology adoption amid the COVID-19 pandemic in medical education for developing nations.

Introduction

The appearance of the contagious viral disease COVID-19 posed challenges in providing education at campuses, and pandemic caused disruptions to deliver face-to-face education worldwide. The COVID-19 outbreak has massively damaged many sectors, including the educational industry [1, 21]. Educationists and experts have looked into new dynamics to embrace the innovative shift in the educational system, ranging from educational activities delivery mode to shift on new online digital solutions. This study analyses the problems, barriers, challenges and success parameters by using online digital service in Pakistan and examining the determinants of students' intention to adopt e-library services and online content choice amid the pandemic COVID-19 [2, 21, 38]. Although the exact origin of the virus COVID-19 dangerous disease is unknown, the health experts identified the first patient with the COVID-19 disease in Wuhan in late December 2019. There were confirmed cases of the COVID-19 disease over 180.863 million with deaths 3.935

million worldwide. However, over 166.143 million infected people recovered from the infectious virus, COVID-19, as of June 27, 2021, around the world [3, 41].

The learning process describes how to acquire new knowledge [1-4], creative understanding, skills, attitudes, preferences, and behaviors [5-9]. It is explained that learning has attained a central position in the competitive world of academia and research. [10-12] Human learns and accumulates knowledge during normal and crises [13-15], social skills, and facts of the natural world through different approaches that make our lives better [16-18]. It is essential for learners since it is evident from our practical work that learning affects people's daily lives. [19] There is a surfeit of options for learning, such as, libraries, experiences, discussions, and practices; however, in today's electronic world, [13,20,21] the e-learning (computer-based learning) ecosystem is assimilating all stakeholders with procedures and the latest technology. [22-26] Consistent with the e-learning approach, electronic-library is gaining attention in the current era, allowing all users to access well-managed knowledge repositories [27-32].

Generally, terms such as an electronic library, digital library, and virtual library are interchangeable in a sense. [33-37] E-library is an essential source for gathering valuable information on preferred topics [38-40]. Besides, the users can access an e-library with some resources such as e-books, e-journals, and educational websites. These services are accessible for the users [41-44] to embrace and acquire the knowledge related to their concerned topics [45-47]. Comparing the traditional library pattern with an e-library, usually, human capital, enough space, and operational resources are required for conventional libraries. Nevertheless, e-learning offers an open-ended and individualized approach to learn, attracts more students, and drops the price of learning and the cost of operational resources [48-51].

During the COVID-19 pandemic, the educational intuitions have actively practiced the online mode of education, which has affected education provision at institutions in many ways [52-54]. The quality of knowledge transfer is being questioned when past literature exhibited [55] that millions of learners encounter difficulties in learning process [56-59]. Knowledge sharing is a vital step in the learning process [60, 61]. If the quality of knowledge transfer is at stake, how to address the situation is crucial [62]. Huynh [63] suggests that, under extraordinary circumstances, e-library systems have become the need of the hour for a strategic and technical benefit to meet the educational requirements of, especially, medical students. E-library resolves the problem by providing the additional best learning option, consulting e-libraries databases such as e-books, e-journals, and online educational content [64].

In 2003, the higher education commission initiated corporate social responsibility with the National Digital Library Program established the first national e-library of Pakistan to contribute to society [34, 65-68]. It provides enormous opportunities for all students to access almost 75,000 e-books and 20,000 e-journals. [69-71] The Pakistan Information Technology Board (PITB) has taken an incredible initiative to establish e-libraries across Punjab province, where thousands of individuals have access to 50,000 e-books, e-journals, e-lectures, and webinars. PITB (2018) mentions that around 60,000 students enjoyed free access to the e-library in the area. The COVID-19 outbreak has massively affected the learning process; however, educational institutions adopted protective measures for safety purposes [72-75]. From a focus on the future perspective, the higher education commission of Pakistan is uninterruptedly striving to offer access to e-libraries in the main cities of Pakistan to prevail the culture of e-learning [38]. It intends to stimulate ease of access to ample content in a well-managed structure.

In line with previous arguments, the adoption of e-library among medical students is central, but the influencing factors toward its adoption have yet to be deduced. Therefore, the study has employed the planned behavior theory (TPB) to explore students' intentions and determinants to avail of the e-library service. [76] These services and facilities are vital for students' e-learning environment. This study postulates the behavioral beliefs' attitude decomposed by technology

readiness 2.0 index', normative beliefs based on "subjective norms" and control beliefs "perceived behavioral control" that lead to the e-library adoption. This investigation enables the authorities and policymakers in Pakistan to understand the medical students' acceptance of e-learning technology. See Figure 1 for details.

Materials And Methods

This present study used a self-administered questionnaire to the target population of medical students to examine their e-library services adoption attitude in the advent of the pandemic COVID-19 in Pakistan. The investigators authors distributed 542 questionnaires through online survey from September to November 2020, and received 361 complete and valid feedback forms from the participants with response rate of 66.61% ($361/542 = 66.61\%$). the investigators eliminated incomplete responses and included only 361 valid and complete forms. The path modeling/partial least squares structural equations modeling technique (PLS-SEM) with the smart PLS software version 3.3.3 was used for analysis. The structural equation-modelling tool permits the estimation of results. Based on the research as mentioned above framework, the study hypothesized the following guiding objectives of the research:

- The study provides empirical evidence of how technology readiness' optimism, innovativeness, insecurity, and discomfort' affect attitude
- The study empirically examines the research model of how attitude, subjective norms, and perceived behavioral control affect intention to use e-library.

Study design

This study is based on a deductive approach, it uses a self-administered questionnaire to collect data from the respondents, medical colleges, and university students by using online survey^[77-79] Social sciences and business management studies follow these procedures to draw the results^[80-82].

Participants and sample size

The study has employed an online cross-sectional survey to a targeted population of medical students enrolled in three major cities of Punjab, namely, Lahore, Multan, and Rawalpindi. There are twenty e-libraries have been established across Punjab (the focus cluster) of Pakistan. The study used the data collected from enrolled medical students in three major cities of Punjab for analysis purposes. The sample size of this study is 361 complete and valid responses of the medical students selected in this survey to draw the results.

Survey tool

The questionnaire consists of two parts, A and B. Part A consists of the respondent demographics such as age, gender, education level, and living area.^[83] Similarly, part B consists of 33 items regarding the issues under investigation.^[84] The construct of the technology readiness 2.0 index (16 items) has been adapted from the study of Parasuraman and Colby^[85]. In contrast, the constructs of attitude (four items), subjective norm (four items), perceived behavioral control (four items), and intention (five items) have been adapted from Zahid and Haji Din. All items are measured on a seven-point (7) Likert scale^[86-89].

Results

In the pursuit of testing the theoretical model, this research applied the partial least squares structural equation modeling (PLS-SEM) method to analyze the data. The study examined and tested the hypotheses through the PLS-SEM technique. Scholars typically apply this tool in the areas of management sciences, ^[90-92] social sciences, and others Henseler *et al.* ^[94], Hair *et al.* ^[86-89]. See Figure 1 and Table 2 below.

Measurement model

In social sciences research, validity and reliability have been used for testing the integrity of measures ^[93]. Therefore, both (Cronbach's alpha and composite reliability) are reported here and met the threshold of 0.60, as recommended by (Hair *et al.* 1998). See Table 1 below.

Tables 1. Factor loadings and reliability

Items	Factor loadings and reliability			
	Cronbach's Alpha	RHP_A	CR	AVE
Attitude	0.808	0.82	0.873	0.634
Discomfort	0.814	0.932	0.873	0.633
Innovativeness	0.716	0.717	0.818	0.529
Insecurity	0.774	0.806	0.851	0.589
Intention	0.701	0.712	0.817	0.528
Optimism	0.733	0.733	0.833	0.558
Perceived behavioural control	0.866	0.885	0.894	0.681
Subjective norm	0.714	0.727	0.822	0.536

Note. CR=Composite reliability, AVE=Average variance extracted

Besides, the study examined the validity. The Heterotrait-Monotrait ratio was determined to test the validity within the context of the study. See Figure 3 and Table 2 for more details.

Table 2. Heterotrait-Monotrait Ratio

Variables	Attitude	Discomfort	Innovativeness	Insecurity	Intention	Optimism	PBC	SN
Attitude	-							
Discomfort	0.155							
Innovativeness	0.599	0.063						
Insecurity	0.178	0.47	0.114					
Intention	0.718	0.15	0.682	0.171				
Optimism	0.313	0.073	0.491	0.056	0.363			
PBC	0.061	0.279	0.132	0.358	0.081	0.071		
SN	0.416	0.074	0.473	0.135	0.517	0.302	0.082	-

Note. PBC = Perceived behavioural control, SN = Subjective norm

Structural model

As per the above discussion, once the measurement model of the current study was established, considered reliable, and valid, the next step is to evaluate the structural model. In the structural assessment of the model, the techniques indicating “significance of path co-efficient R^2 , effect size (f^2), and predictive relevance (Q^2)” proposed by a past study [86] are utilized. See Table 3.

Table 3. Summary of structural model

Hypotheses	Relationships	Path coefficient	S.E.	t-test	p-value	Supported	R^2	Q^2	f^2
H1	Attitude >> intention	0.476	0.040	12.015	0.000	Yes	0.348	0.178	0.309
H1a	Optimism >> attitude	0.087	0.045	1.899	0.028	Yes			0.009
H1b	Innovativeness >> attitude	0.455	0.045	10.065	0.000	Yes			0.246
H1c	Insecurity >> Attitude	-0.073	0.043	1.692	0.047	Yes			0.006
H1d	Discomfort >> attitude	-0.090	0.042	2.190	0.016	Yes	0.269	0.159	0.010
H2	Subjective norm >> intention	0.221	0.047	4.999	0.000	Yes			0.067
H3	Perceived behavioural control >> intention	0.033	0.052	0.643	0.262	No			0.002

Note. SE=Standard error

Next, the value of R^2 determines the explanatory power of the proposed model [94]. The outputs of the study have shown a substantial variance of $R^2 = 0.348$. Furthermore, Stone-Geisser's Q^2 was calculated using the blindfolding procedure to evaluate the predictive power of the structural model [94], and the interpretation of the PLS path model of the study possessed sufficient predictive power [94, 95].

Discussion

The advent of the ongoing pandemic coronavirus has developed severe challenges for educational institutions in the environment of teachers-students and teaching learning, which caused changes to shift on online education through technology adoption to meet students' needs at higher and elementary educational institutions worldwide. The crisis has dramatically influenced the learning process between students and teachers at schools, colleges, and universities worldwide. Because of this abnormal and challenging situation, schools, colleges and universities encountered enormous challenges to provide physical education at campuses. The government closed educational institutions to reduce the virus spread. As a result, educational institutions, including universities, started their academic operations through online delivery using technological tools [96]. The spread of this deadly virus has posed disruptions for face-to-face educational activities due to its severity to infect other people, and hospitals reported the first infected patient on December 16, 2019, in Wuhan city [97].

The WHO office in China received a group of patients' data suffering from pneumonia symptoms in Wuhan on December 30, 2019 [98]. The infectious virus still remains disastrous and continues to cause a fatal severity worldwide that led to the closure of colleges and universities due to the COVID-19 crisis. The disaster raised an inevitable demand for technological applications in the institutions for educational needs amid the COVID-19 to provide online classes and educational activities worldwide [99-101]. Accordingly, colleges and universities have initiated e-learning and online mode of education with the involvement of technology and media integration to fulfil students' needs in receiving lectures and educational content in the emergence of the COVID-19 crisis for the communication process to maintain educational activities. Universities and other educational institutions have launched e-services through innovative technology, social media forums, and higher education platforms to offer computer-mediated classes and online e-learning [102].

The study has empirically tested the direct effect of attitude (decomposed by technology readiness 2.0), subjective norm, and perceived behavioral control on intention to avail the e-library services among the medical students. In the study, the attitude was hypothesized to predict intention. The first hypothesis indicated that attitude ($\beta = 0.476$; $p < 0.05$) significantly and positively influenced the intention. Therefore, this finding is consistent with the TPB that the higher the individual attitude, the higher the choice of using the services. In the second hypothesized relationship, the subjective norm would predict intention. The finding of this direct link indicated that subjective standard ($\beta = 0.221$; $p < 0.05$) significantly and positively influences the intention. The result is aligned with the TPB approach.

In the third hypothesized relationship, perceived behavioural control did not lead to the intention. The result revealed that perceived behavioral control insignificantly influences the intention. The results exhibited that perceived behavioral control has an insignificant impact ($\beta = 0.033$; $p > 0.05$) on an intention to avail the e-library services among the medical students. The possible explanation is that information technology knowledge among students is still not at the expected level as in the developed countries.

In this study, technology readiness 2.0's four dimensions were proven to get an inclusive idea of technology among medical students' attitudes toward the e-library services intention. H1a and H1b predicted the positive and known contributor toward the technology. The current findings revealed that optimism ($\beta = 0.087$; $p < 0.05$) and innovativeness

($\beta = 0.455$; $p < 0.05$) have a significant and positive relationship with the Student's attitude toward the adoption of e-library. Similarly, H1c and H1d proposed a negative influence of technology, also known as an inhibitor towards the individual technology adoption. The present results of insecurity ($\beta = -0.073$; $p < 0.05$) and discomfort ($\beta = -0.090$; $p < 0.05$) accepted the proposed hypotheses.

Limitation and directions for future research

The study is not beyond limitations though these limitations have addressed the future directions for the upcoming researchers. As an illustration, in the current study, data were collected using a quantitative approach. It will give future researchers a scholarly call to conduct qualitative research or mix-mode studies to get deeper insights into e-learning adoption. The cross-sectional research approach could be supported by the longitudinal research design to understand students' behavior toward e-learning. Finally, the study was conducted in Pakistan. Thus, future studies can be performed in other regions such as South Asian and Middle East countries to understand the phenomenon.

Conclusion

The present study investigated various antecedents of attitude (optimism, innovativeness, insecurity, and discomfort), subjective norms, and perceived behavioral control of e-library intention among the medical students. The conceptual model was formulated using the theory of planned behavior and the technology readiness 2.0 index. Out of seven hypotheses, only one hypothesis was rejected. Data were collected from the medical colleges and universities students used to visit e-library centers. A structural equation modeling technique (PLS-SEM) was used to test the hypotheses. The results indicated that optimism and innovativeness have a positive and insecurity and discomfort have a negative effect on the students' attitude. Besides, attitude and subjective norms significantly and positively influence and are strong predictors of intention, but perceived behavioral control does not significantly influence students' intention toward e-library adoption.

Declarations

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Figures

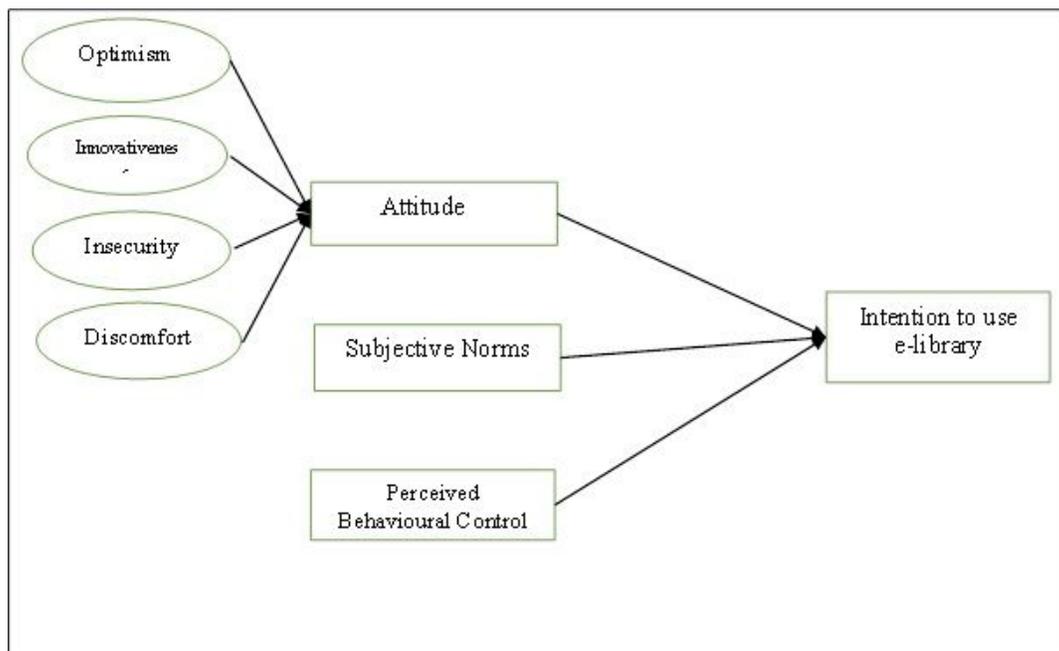


Figure 1

Research Framework. Note. Fig.1 shows the proposed study model with its variables.

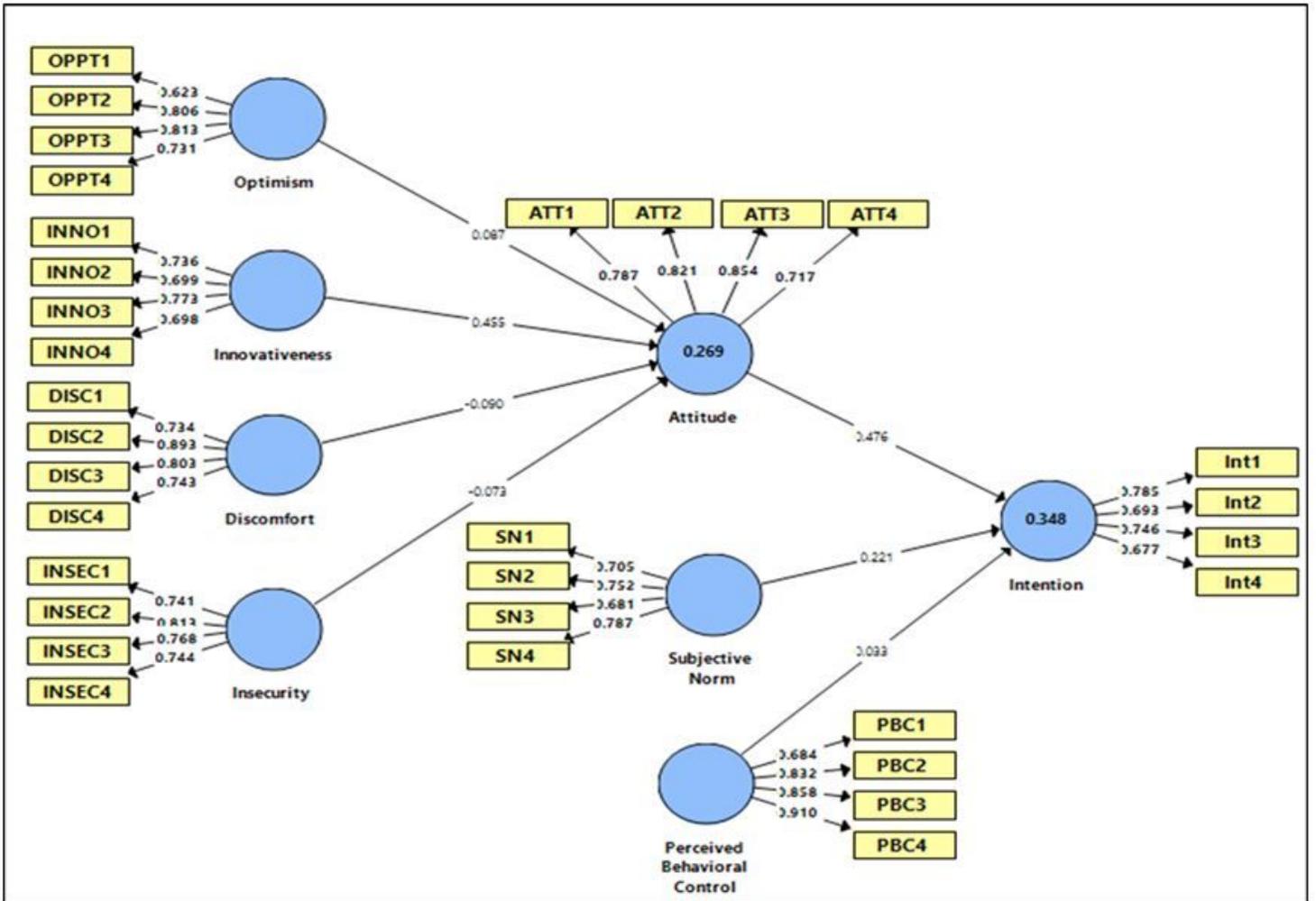


Figure 2

Measurement model

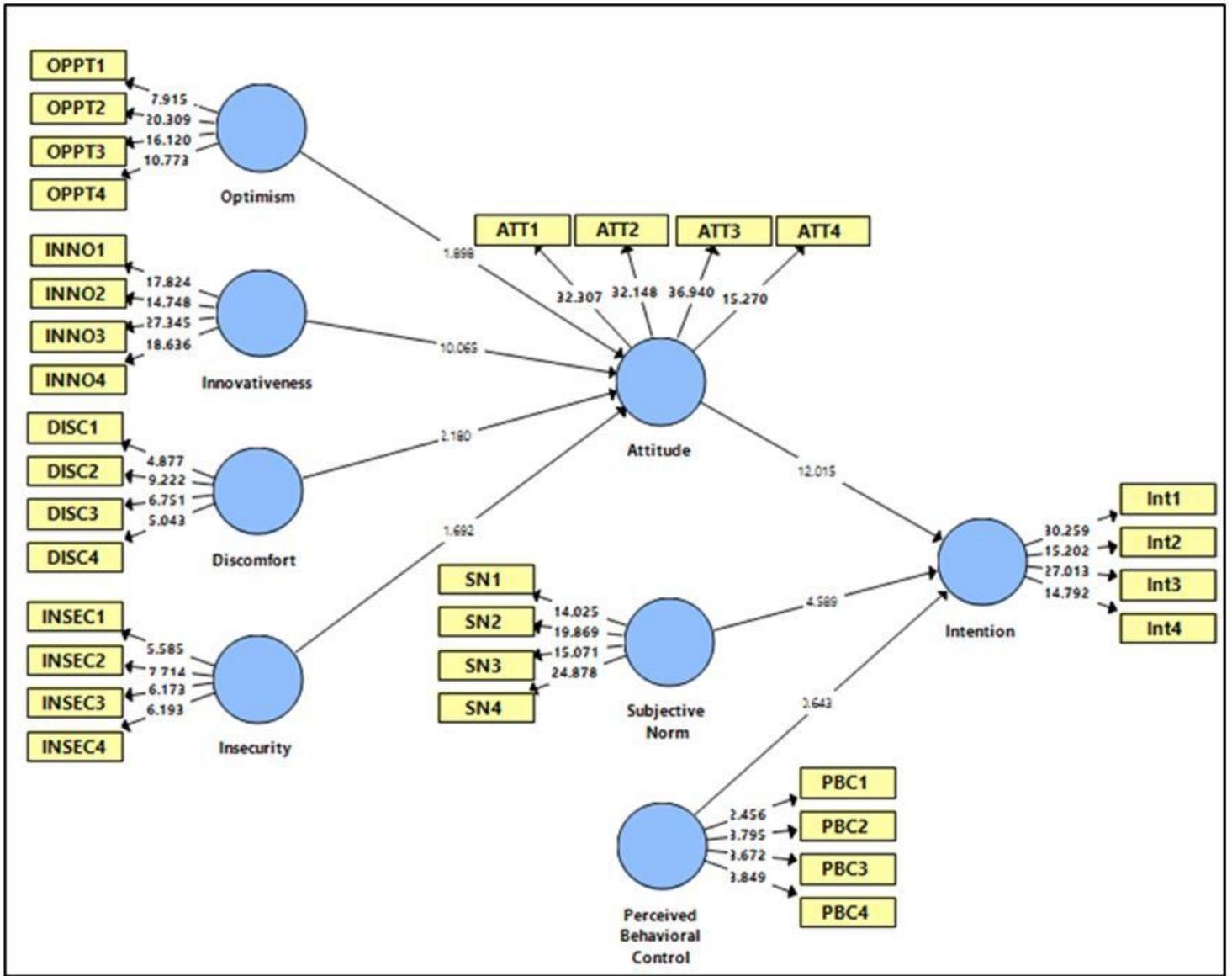


Figure 3

Structural model