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Examining Technology Readiness Constructs: A Validation Study

B. Ali[*], *G. Nawanir*[a], *Y. Nasidi*[b] *and J. A. Bamgbade*[c]

School of Technology Management & Logistics, Universiti Utara Malaysia, 06010 Kedah, Malaysia

[*]*sahibasharatali@gmail.com*, [a]*gsm1410@gmail.com*, [b]*y.nasidi580@gmail.com*, [c]*jibril1717@yahoo.com*

Abstract – *This study validates technology readiness (TR) constructs in the context of public sector higher education institutions (HEIs) of Sultanate of Oman. Using a structured self-ministered questionnaire, the data was duly collected from three hundred and thirty four educationists ranking from assistant lecturers to full professors. While employing PLS-SEM technique, the data was analyzed using Smart-PLS 2.0 M3 software. Results of this study revealed that all the dimensions of technology readiness namely; optimism, innovativeness, discomfort and insecurity were highly relevant. It also established an adequate level of internal consistency reliability, convergent validity and discriminant validity for each of the constructs of the technology readiness. Based on the results, it is suggested that the TR instrument could be useful for measuring all the constructs of technology readiness to study consumers' tendency to adopt innovations or to accept the latest technologies.*

Keywords: optimism, innovativeness, discomfort, insecurity, technology readiness, innovation

1.0 INTRODUCTION

Technology readiness deals with purchaser's tendency to accept the latest technologies for their benefits. It further refers to consumers' optimistic approach, flexibility, apparent lack of control over technology, competence, feeling of being overwhelmed, and sense of haziness towards the technology [12, 21, 52, 60]. As an efficiency enhancer, it is believed to be a key for developing economies [25]. Technologically, developing states have been generally suffering due to the lower level of technology readiness, revealing poorer users' compliance towards the latest technology [36]. Users' level of technology readiness and association with new technologies play an imperative role in the progress of Nations. While, technology readiness may or may not be affected by the cultural diversities, the users are projected to have diverse mind-set towards new ideas or innovations [16] and they may welcome to the technology on the basis of its suitability, competency, usability, relative advantage and compatibility [46, 57]. Notwithstanding technology readiness is said to be the backbone of innovations' development [59], consumers' approach towards latest technologies certainly varies from person to person and place to place [8]. Furthermore, its evaluation helps the respective organizations or countries to revise, review and to update their strategies. The Western cultures, so far, have been the key focus of technology diffusion research [31]. Hence, keeping in view the prime importance of the phenomenon, this study investigates technology readiness level of

educationists, the opinion leaders and the change agents Rogers [57] of Omani society having an enormous technology acceptance potential [7,50,55].

2.0 REVIEW OF THE LITERATURE

Technology readiness has been far and wide studied highlighting innovations, management of latest technologies, their diffusion and adoption [8, 16, 52, 60]. Studies, upheld in the recent past [1, 16, 60] declares technology readiness as a successful model to explore consumers' proclivity towards new ideas and technological innovations. Summak *et al*. [61] and Massey *et al*. [44] employed technology readiness model for their studies on e-insurance, electronic education and telecommunication division. Similarly, Abu-Assi *et al*. [1] and Tan [63] studies the impact of the Internet and electronic commerce (business to consumer) in China revealing that the market had been lagging behind due to the lack of technology readiness along with other factors; and the adoption of online banking in Jordan respectively. Batswana were found facing technology readiness challenges including; access to internet, computer knowledge and internet know-how etc. [65]. Study undertook by Summak *et al*. [61] explored that Turkish government promoted technology readiness within their primary school teacher observing them lacking at it. Lou and Goulding [40] recognized an established link between "people, process, and technology"; whereas Berthon *et al*. [9] explored that customers' confidence in electronic commerce add on to technology readiness level of B2C electronic commerce. Considering that technology readiness has an impact on "satisfaction and behavioral intentions towards self-service technologies", to explore self service technologies (SSTs), Lin and Hsieh [39] explored three findings on the customers' behavior. Firstly, the customers' contentment level of SSTs relies upon their individual intensity of technology readiness. Secondly, the higher level of occurrence of technology readiness results in optimistic behavior customers. Thirdly, the satisfied users are found sharing their positive experiences with their fellow beings. The field of e-HRM is found keenly associated with the level of technology readiness [20]. Ultimately, diverse users' response and the prompt developments in electronic marketplaces instigate the respective businesses to review, revise and upgrade their policies for their better survival in today's competitive environment [11, 15, 30, 41].

An attention grabbing study by Ferreira *et al*. [21] found out that users' cognitive judgments with regards to the novel technologies gets influenced by technology readiness. Indeed, all the developing nations are keenly necessitated to educate themselves to compete in the fast growing era of the fast growing economies, keeping in consideration that this move will help them progress and not only the investment in the fields of information and communication [38]. Aladwani [3] endorsed that an added technology related research is required in the perspective on Arab states, in particular and other developing states, in general.

2.1 Dimensions and Operationalization of Technology Readiness

Parasuraman [52] on the basis broader study on users' responses towards technology, developed technology readiness index (TRI) to explore consumers' innovative mind-set and conduct. TRI has been incorporated with the construct of technology readiness supported with the actual thoughts and real conceptualization. Believing the constructs impactful towards consumers' level of technological readiness, Parasuraman [52] described TR in four dimensions namely; "optimism, innovativeness, discomfort and insecurity". Technology users are seen being benefitted as well as frustrated with the proliferation of technology-based surroundings [12, 52, 60]. Accordingly, the four dimensions including two drivers and two inhibitors look at 1) consumers' positive observation about the technology with user's better

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control, power and impact, 2) inclination of innovations' manager and founders, 3) a hypothetical need of power towards innovations and a feeling of being besieged by the newer ideas and technology, and 4) untrustworthiness and doubt towards novel technologies [1, 16, 44, 52, 64]. Broadly, the aforesaid technology readiness constructs have been duly studied at diverse levels to investigate different importance subjects for example; "the influence of technology readiness on satisfaction and behavioral intentions toward self- service technologies", TR for pioneers of high-tech manufactured goods and the consumers' perception and adoption of the latest technologies, taxonomy of customers based on technology readiness, the influence of TR on contentment and behavioral intentions toward SSTs, students' level of TR its influence on the cultural aptitude [8, 16, 19,39 ,52, 61]. TR can also be seen as a general psychological state as an outcome of opus of mental enablers and inhibitors those equally settle on users' inclination towards most recent technologies [16, 39].

Lin and Hsieh [39] empirically analyzed that the TR had no impact on the "customer satisfaction and behavioral intention" with regards to the SSTs; whereas a study upheld by Parasuraman [52] reveled that users' perception towards technology based services was very much dissimilar across the SSTs studied. By combining two models i.e. TRI and TAM, Parasuraman and Colby [53] and Walczuch *et al*. [71] analyzed the correlation between the personality traits of TRI and the cognitive constructs of the TAM model. The findings revealed that personality traits had projected impact on consumers'' perceptions, however unpredictably correlation between "innovativeness and usefulness" was calculated as insignificant. Past studies established positively significant relationships between "perceived ease of use" and "perceived usefulness" [68, 69]. Similarly, relationship between "optimism" and "perceived usefulness" of the technology was analyzed as notably positive, whilst a significantly negative relationship was found between "innovativeness" and "perceived usefulness" by Walczuch *et al*. [71]. With significant inconsistencies between men and women, the study found noteworthy diversities between the two constructs namely; optimism and innovativeness, whereas, there was minute differences were analyzed measuring "discomfort and insecurity" [61]. A study on the repurchase behaviors of Korean customers had found a significantly dissimilar influence on each of dimensions of technology readiness [60]. Pioneers and explorers of the technology, professional accountants were observed having neutral and techno-resistant attitude towards novel technologies [37]. Similarly, South African users were observed as hesitant comparing to their American fellows in doing banking through automated teller [8]. While analyzing the TR level of two student communities i.e. Chinese and Americans, the formers fellows were observed with more discomfort and insecurity and lower level of optimism and innovativeness unlike their fellow community [19, 52]. Since people bear dissimilar characteristics, their perspectives on TR also differs; while the effectiveness of every element shows individuals' sincerity and agreement with technology. It is worthy to note that the TR framework has been helping in investigating users' confidence in technology, and not their capabilities [52, 57]. On one hand, while looking at the dissimilarities of the past results, TR is found playing a key positive role in developing the diffusion process diffusing of innovations [16, 18, 19, 37, 44]. On the other hand, the relationship between TR and diffusion of innovations is analyzed as insignificant or negative [8, 61, 71]. It has been also found that cultural multiplicities may or may not influence the level of TR in a particular set of system. Keeping in view the inconsistent results, an empirical study addressing a different culture is highly suggested as a future recommendation [16].

3.0 RESEARCH METHOD

3.1 Population and Data Collection Procedure

This study aimed Omani academic faculties from HEIs as the target respondents. According to the information collected from the Ministry of higher education (MoHE) of Sultanate of Oman [47], the total teaching faculties were 733. With respect to the sample size, it is recommended as "bigger is always better" [34]. It is widely accepted that that the bigger sample size improves the power and reduces the estimation error [66]. Likewise it is believed that "a markedly larger sample size is needed despite the inclusion of highly reliable indicators in the model", in particular partial lease square (PLS) demands bigger sample size to attain power in PLS based approximations to guarantee power in complex modeling [2,43]. In this regard, GPower 3.1 was employed to acquire better sample size [24]. According to the result obtained from GPower statistics, the suitable sample size of 330 was measured having power (1-β err prob. = 0.999). Moreover, according to Sekaran [58], the ideal sample would be in between 30 and 500. In the light of aforementioned discussion, the study managed to get response from 334 respondent, whereas the survey was self-administered that is the most suitable approach if the survey is limited to locality where potential respondents can be approached.

3.2 Sampling Technique

While taking care of an important factor of "heterogeneity of sample, number of variables used in the study and intended statistical tool to be used for the data analysis [33,48] this study opted proportionate stratified random sampling. Proportionate sampling approach is more appropriate, easier, simpler, and affordable to collect from one or more strata, comparing too other sampling techniques [58]. Keeping in view the total numbers of eligible respondents in every stratum i.e. the academicians in HEIs of Sultanate of Oman, the sample was randomly chosen. In total, there 15 HEIs in Oman located in Muscat, Ibri, Sur, Salalah, Rustaq, and Sohar [42, 47].

3.3 Instrument

This study validates technology readiness (TR) constructs in the context of public sector higher education institutions of Sultanate of Oman. Using a structured self-ministered questionnaire, the data was duly collected from three hundred and thirty four educationists ranking from assistant lecturers to professors. Keeping in view the prime importance of the phenomenon, this study investigates technology readiness level of educationists, the opinion leaders and the change agents of Omani society having an enormous technology acceptance potential [7, 50, 55, 57].

TRI has been successfully employed in conducting diffusion of technologies or innovations related empirical studies [8, 16, 18, 19, 37, 44, 52, 71]. A clear divide among results instigate toward further validation of the construct as suggested by Demirci and Ersoy [16]. It is worthy to note that technology readiness may or may not be influenced by the cultural diversities Demirci and Ersoy [16] and so far the Western cultures have been the main focus of technology readiness related studies [31, 69]. Hence the validation study in the perspective of Sultanate of Oman, a practicing Muslim dominated country, would be of immense help [16].

3.4 Demographic profile

The respondents' demography is provided in table 1. In term of genders categorization, 169 (50.5%) were females and 165 (49.5%) were males out of the total 334. In term of age, 201 (60.2 %) aged between 31-40 years, 29.3% aged in the age group of 18-30 years, 9.9% of the respondents belongs the age bracket of 41-50 and 2 of the respondents aged 61 years. Education wise, out of 334, there were 154 (46.1%) master degrees, 90 (26.9%) claimed bachelors, (40, 12.0%) held PhDs and (34, 10.2%) held diplomas.

Table 1: Demographics

	Frequency	**Percent**
AGE		
18 to 30 years	98	29.3
31 to 40 years	201	60.2
41 to 50 years	33	09.9
61 years and above	02	00.6
EDUCATION		
Diploma	34	10.2
Bachelors	90	26.9
Masters	154	46.1
Doctorate	40	12.0
Others	16	04.8
GENDER		
Male	165	49.4
Female	169	50.6
INCOME		
Below 500 OMR	09	02.7
500 to 1000 OMR	124	37.1
1001 to 1500 OMR	86	25.7
1501 to 2000 OMR	69	20.7
Above 2000 OMR	46	13.8

According to the information collected the respondents' monthly income showed that 124 (37.1%) were earning between 500-1000 OMR, 86 (25.7%) got 1001-1500 OMR. There were 69 (20.7%) respondents with 1501-2000 OMR followed by 46 (13.8%) and 9 (2.7%) earning 2000 OMR and below 500 OMR respectively.

4.0 ANALYSIS & RESULTS

In order to validate the TRI in the perspective HEIs academicians of Sultanate of Oman, this study employed PLS path modelling to investigate the data by using Smart-PLS 2.0 [56]. PLS-SEM, equally good in analyzing statistical framework and for better forecast, is a well known second generation structural equation modelling technique [56, 72]. As an appropriate and

useful tool to analyze real time applications and complex models, PLS path modelling allows developing and validating complex models [2, 22, 32]. Furthermore, PLS calculates error model, allows use of multiple outcomes variables at the same time, and direct incorporation and computation of moderator into a model [35]. It accepts non-normal data [13] one of the common issues in social science studies [51]. Tabachnick and Fidel [6] endorse SEM one of the most trustworthy statistical tools for social and behavioural sciences that allows users to investigate more than one relationship simultaneously. While following the analysis mood and objectives to validate TR constructs, this study employs measurement model approach (figure 1). It validates items' individual reliability, internal consistency, convergent validity and discriminant validity by looking at three values: outer loading, average variance extracted and the composite reliability [29]. Fornell and Larcker [23], Barclay *et al.* [6], Hulland [32] and Wong [73] suggests that value of AVE and outer loadings should be greater than 0.5 each. Composite Reliability, according to Bagozzi *et al.* [5], Wong *et al.* [73], Nunnally *et al.* [49], Chin [13], and Hair *et al.* [27], should be greater than 0.7. Hulland [32] recommended that items with loading values of less than 0.4 should be deleted.

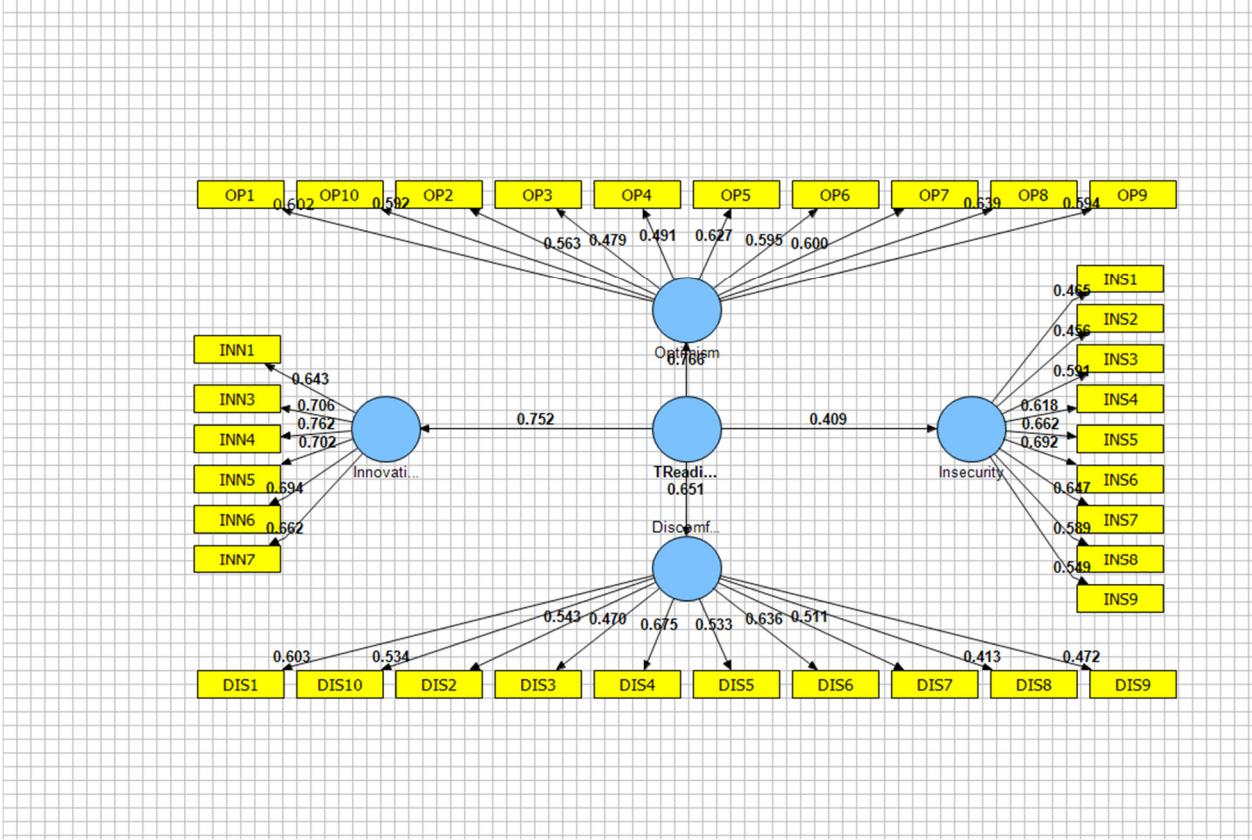

Figure 1: Measurement Model

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Table 2: Results of the confirmatory factor analysis for Technology Readiness

Code	Indicators	1	2	3	4
OP1	Technology gives me more control of my daily life	0.60			
OP2	The newest technologies are convenient to use	0.56			
OP3	I like the idea buying using technologies	0.47			
OP4	I prefer the use of the most advanced technology	0.49			
OP5	I like computer programs that allow me to shape things, suitable to my needs	0.62			
OP6	Technology makes me more efficient in my job	0.59			
OP7	I find new technologies to be motivating	0.60			
OP8	Technology gives me the freedom to move	0.63			
OP9	Learning about technology can be as rewarding as the technology itself	0.59			
OP10	I feel confident about machines' results	0.59			
INN1	People come to me for advice on new technologies		0.64		
INN3	In my circle of friends , generally I am among the first one to adopt new technology		0.70		
INN4	I can figure out new high-tech products without seeking help		0.76		
INN5	I keep myself updated with the latest technological developments		0.70		
INN6	I enjoy the challenges of figuring out how high-tech devices work		0.69		
INN7	I find fewer problems in making the technology work for me		0.66		
DIS1	Technical support is not helpful as being not user friendly			0.60	
DIS2	Sometimes, I think that technology is not designed for use by ordinary people			0.54	
DIS3	Technology manual are not easy to understand			0.47	
DIS4	When I get technical support, I feel as if I am being taken advantage by someone			0.67	
DIS5	I prefer basic models, while buying a high-tech product or service			0.53	
DIS6	It is embarrassing having trouble with a high-tech device			0.63	
DIS7	There should be caution in replacing important people-tasks with technology because new technology can break down or get disconnected			0.51	
DIS8	Many new technologies have health or safety risks that are not discovered until after people have used them			0.41	
DIS9	New technology makes it too easy for governments and companies to spy on people			0.47	
DIS10	Technology always seems to fail at the moment it is most required			0.53	
INS1	Human touch is very important when doing business with a company				0.46
INS3	If I provide information over the Internet, I can never be sure it really gets to the right place				0.45
INS4	I do not consider it safe giving out a credit card number over a internet				0.59
INS5	I do not consider it safe to do any kind of financial business online				0.61
INS6	I worry that information I send over the Internet will be seen by other people				0.66
INS7	I do not feel confident doing business with a place that can only be reached online				0.69
INS8	Any business transaction I do electronically should be confirmed later with something in writing				0.64
INS9	If automated, I need to check carefully that the machine or computer is not making mistakes				0.58
	Average Variance Extracted (AVE)	0.53	0.58	0.60	0.52
	Composite Reliability (CR)	0.70	0.72	0.70	0.71

4.1 Individual Item Reliability

To confirm individual reliability component, it was essential to look into the reliability of each item of TR scale. Individual item reliability was assessed through outer. Generally, the outer loading value of 0.4 and above is considered to validate individual item reliability [17, 26].

Further the standardized loadings for all the 36 items were observed; 29 items associated with optimism, discomfort and insecurity were found greater than standard the cut-off i.e. above 0.4, whereas one item (INN2) from "innovativeness" was removed due to the lower value. The details of the deleted item (INN2) have been provided in Appendix-A. In total, 35 loadings, ranged between 0.413 and 0.762, were kept. This made sure that all the maintained items sufficiently met the acceptable criterion set for individual item reliability.

4.2 Internal Consistency Reliability

The internal consistency reliability can be defined as "the degree to which every item in an individual scale (or sub scale) measures the same concept" [10, 17]. Two methods i.e. Cronbach's alpha coefficient and composite reliability, have been widely employed to internal consistency reliability [4, 45, 54]. This study, while following the suggestions of Hair *et al.* [27] and Bagozzi and Yi [5] employed composite reliability coefficient for the assessment of internal consistency reliability of technology readiness.

According to Bagozzi *et al.* [5], Wong *et al.* [73], Nunnally *et al.* [49], Chin [13], and Hair *et al.* [27], the composite reliability should be greater than 0.7. The composite reliability coefficients, provided in Table 2, maintained the value ranged between 0.701 and 0.721. The acquired values of coefficient maintained that all the variables of this study confirmed sufficient internal consistency reliability [27].

4.3 Convergent Validity

Convergent validity can be defined as "the degree by which items truly represent the intended latent constructs and correlate with other measures of the same latent construct [28]. The convergent validity was established looking at the average variance extracted (AVE) of the latent constructs obtained. According to Chin [13], the AVE loadings for each of the latent construct should be 0.5 or above. Table 2 shows that the AVE obtained for optimism, innovativeness, discomfort and insecurity were found greater than standard the cut-off i.e. above 0.5 and valued as 0.537, 0.584, 0.601 and 0.521 respectively.

4.4 Discriminant Validity

Discriminant validity defines the level to which a certain item varies from the other one [32]. According to Chin [13], it can be measured by assessing the cross-loadings by following the rule where "the items should have a higher correlation with the latent variable that they are supposed to measure than with any other latent variable in the model". Further, the square root of the AVE for each construct can be used to examine the discriminant validity. According to Fornell and Larcker [23], the square roots of AVE coefficients should be placed in the correlation matrix next to the side of the diagonal. The results are considered confirmed for the discriminant validity, if the squared AVE is found greater than squared correlation estimates, where "the diagonal coefficients or elements must be greater than the off-diagonal coefficients or elements in the corresponding rows and columns" [13, 28]. Keeping in view the above mentioned criterion, table 3 provides the confirmation of discriminant validity.

Table 3: Discriminant Validity

Latent Variable Correlations	1	2	3	4
Discomfort	**0.834**			
Innovativeness	0.254	**0.764**		
Insecurity	0.333	0.066	**0.741**	
Optimism	0.223	0.494	0.063	**0.733**

The boldface values shown in table 3 are square root values of the average variance extracted. Since, all the values of square root of AVE were greater than the correlations, the AVE values shows that all the latent constructs have successfully confirmed sufficient level of the discriminant validity. Hence, it can be concluded that all the measures of the TR have met the discriminant validity requirements.

5.0 DISCUSSION AND CONCLUSION

Parasuraman [52] established a well refined version of technology readiness questionnaire to facilitate researchers in investigating consumers' tendency to adopt the modern technology and to examine users' sanguine approach, evident lack of control over technology, proficiency, feeling of being overwhelmed, and the sense of haziness. A thorough literature review made it obvious that technology readiness have been studied in the perspectives of developed or Western countries. For the reasons, present study investigates technology readiness level in the perspective of Sultanate of Oman, a practicing Muslims state possessing an enormous potential for technology acceptance.

Empirically, technology readiness related studies shows inconsistent results. Although cultural multiplicities may or may not influence the level of TR, an empirical study addressing a different culture is very much suggested in the area. This study validated TR constructs in the context of public sector HEIs of Sultanate of Oman. The target population for this purpose was the Omani academician from HEIs. All the constructs have met the criterion and proved that the technology readiness constructs are appropriate to measure TR in HEIs of Oman. Results of the confirmatory factor analysis, reliability, and validity tests established the appropriateness of TR dimension i.e. optimism, innovativeness, discomfort and insecurity. For the prospect study, the scale can be studied further in the different perspective.

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APPENDIX-A

Items deleted due to lower loadings

INN2	My friends are learning more about the newest technologies than I am