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Study of Creating Awareness for Adoption of Cloud Computing in Business Organizations: A Saudi Arabia Case

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Abstract: ***In last decade or so, modern computing development and convergence of Information Technology and Information System towards internet-basedcomputing platform evolved the concept of cloud computing. This platform is equipped with diversified computing services to enhance the business activity with lesser cost.Modern world has been benefited with this modern technology but developing countries are still far behind to reach that level of computing. Literature review shows that the lack of cloud computing adoption is one of the major concerns in the gulf region in general and Saudi Arabia in particular. Study is planned to observe and recognize theimportant factors which could enhance the adoption of cloud computing in Saudi business organizations. Technology Acceptance Model (TAM3) has been adapted and improved by adding moderating and general significantcausal factors to enhance the adoption level. For this purpose, study has been conducted using a comprehensive survey in different business organizations. Study results show that the technology adaption level and the proposed factors are strongly associated. Hence, research study validates the hypothesis that proposed factors contribute the adoption positively. The study findings will help business gurusto enhance the business productivity and cloud developers to improve the cloud computing services for the business users.***

Keywords: Technology Acceptance Model, Information Technology, Information System, cloud computing etc

1. Introduction

Information system is known as the key aspect of any business organization as business operations are mostly depending upon the IS performance and efficiency (1). This kind of performance-based experience requires an enterprise strategy, which is influenced by the socio-economic, legislative and technology changes in the region as per the business demands and requirements. Therefore, modern businesses must be well equipped with innovative tools to deal with the important strategic level changes at business platforms worldwide and in terms of getting proper business share from the globalized business spectrum to achieve the appropriate set of business practices and standards. This is possible when the business organizations will opt the right and most suitable cloud platform as it is becoming the key tool of business strategy for most of business organizations in the world(2).

Traditionally, IT based networks used to run the ISs in business organizations locally through the Local Area Network. With the emergence of the modernization business needs to access the application from anywhere at any time. This is area, where cloud computing has played its role that it bridged that gap of bringing the distance closer to the customer where users can access the data from any cloud at any time and saves lots of time and resources. Cloud computing was initially thought, when business started growing because people wanted to have better calculating and counting equipment, right from the personal level to, small-medium size to enterprise level business organizations. Computing technologies and business operations have been evolved and require innovative ways and means to run as per the international standards like, traditional trading has been transformed into e-business and e-trading, stock exchanges, traveling and real estate. Cloud computing is defined as under:

> "*A large pool of easily usable and accessible virtualized resources (such as hardware, development platforms and/or services). These resources can be dynamically reconfigured to adjust to a variable load (scale), allowing also for an optimum resource utilization. This pool of resources is typically exploited by a pay-per-use model in which guarantees are offered by the Infrastructure Provider by means of customized Service-Level Agreements (SLAs)*"(3).

2. Cloud Computing Components

Cloud computing is based on following service platforms, first typically based on the cloud delivery, consists of a front-end platform like thick and thin clients and mobile device and second the back-end platforms like servers and storage over a network i.e. Internet, Intranet, Inter-cloud. Following are main cloud components:

2.1 Cloud Clients

Cloud customers use computing devices to access resources utilizing the cloud computing facilities. Customers are additionally classified into three categories, THIN, and THICK kind of users (4). Thin clients are without capacity

drives sand users so they just show data by utilizing least equipment and lessen IT cost and expanded security, creating less communication and power utilization (5).

2.2 Cloud Data Center

Data center is a facility equipped with physical or virtual server computer and some other network components, like tele-com and storage systems that host cloud service applications (6).

2.3 Cloud Distributed Servers

Distributed computing contains computers in geographically dispersed locations connected to collaborate on computer-intensive tasks. *Distributed servers* are more than one servers spread over an extensive terrestrial location (7).

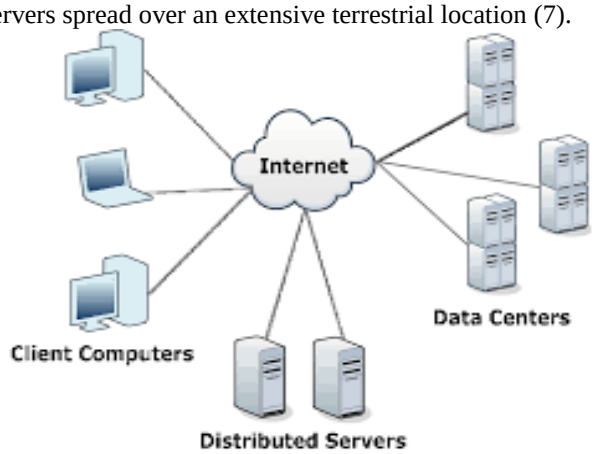

Figure 1: Components of cloud computing (8)

3. Fundamentals of Cloud Computing

Rapid growth in cloud computing is increasing the demand in the recent past. Therefore, it is very hard to pin point something price. However, National Institute of Standards and Technology – NIST has defined five basic level cloud computing (9). Most of cloud computing characteristics are discussed in detail:

3.3.1 *On-Demand Self-Service*

Cloud resources are available and can be easily requested and accessed without knowing the physical site of the cloud provider. Access can be granted based on the on-demand basis, whenever required as per the configuration rules and regulations (10).

3.3.2 *Efficient Resource Pooling*

Cloud resources are placed in pool so it can be used by multiple consumers concurrently from anywhere using a multi-tenant model (11). Because users are not aware of the physical site of cloud resources and they do not have enough control on the location of the cloud server (12).

3.3.3 *Rapid Elasticity*

Cloud services are easily accessible and the capacity of the resources delivery can be inevitably mounted upward or downward. Additionally, a consumer can use the cloud resource by adding new or removing any existing resource as per the business requirements (13).

3.3.4 Measured Service

As cloud resources are located on remote server, so the resources are supervised and managed and used for communication purposes for better optimization, to balance the work load over different servers and to automate the process of allocation of resources as per business needs (16).

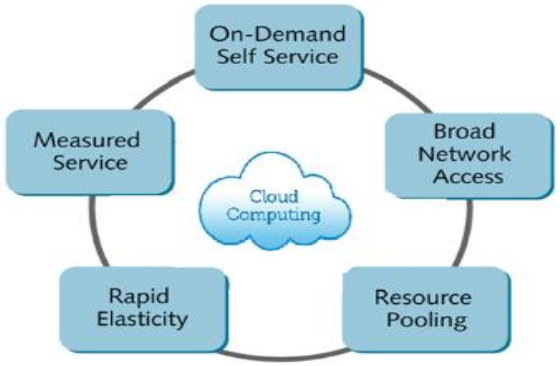

Figure 2: Showing Cloud Computing Fundamental Characteristics

A comparative examination of various cloud models in terms of cloud deployment, scope of cloud services, owned by, managed by, security level and location of the cloud platform. In the light of their administration scope, possession, administration, security level and area is illustrated on next page:

Table 1: Comparison Of Cloud Deployment Models In Business Organizations(2)

Comparison of Cloud Deployment Models in Business Organizations					
Models	Scope of Services	Owned by	Managed by	Security Level	Location
Public	General Public and Enterprise Businesses	Cloud Service Provider (CSP)	Cloud Service Provider (CSP)	Low Level	Out of Business Premises
Community	Organizations having the same business mission, policy and security requirements	Several Businesses	Several Organizations or Cloud Service Provider	High Level	Out and On Business Premises
Private	Single Business Organization	Single Organization	Single Organization or Cloud Service Provider	High Level	Out and On Business Premises
Hybrid	Organizations and General Public	Organizations and Cloud Service Provider	Organizations and Cloud Service Provider	Medium Level	Out and On Business Premises

Figure below explains the decision-making process using cloud-computing platform:

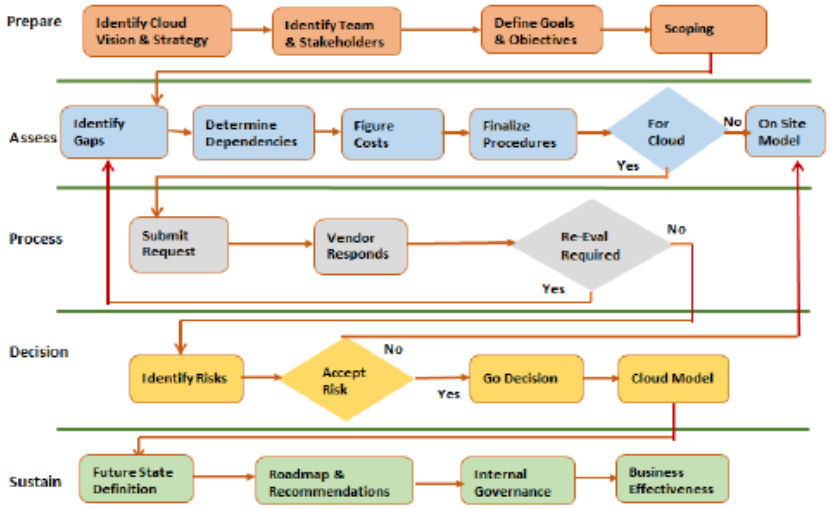

Figure 3: Cloud Decision Making Stages of Business Organizations Srinivas(19)

4. Research Method

Research requires a practical platform in which data collection and analysis could be practically performed to test the research proposed model and to contribute to the knowledge. For this purpose, simple random data sampling technique is used for the research and a survey was conducted. Population sample was selected randomly from the large sampling frame. One of key advantage of this that it includes ease of use and its accurate representation of the larger population for the research study.

4.1 Hypothesis Development

Hypothesis were developed according to the findings of prior literature and accordingly TAM3 basic structure is used for the study. In consistence with the basic research objectives:

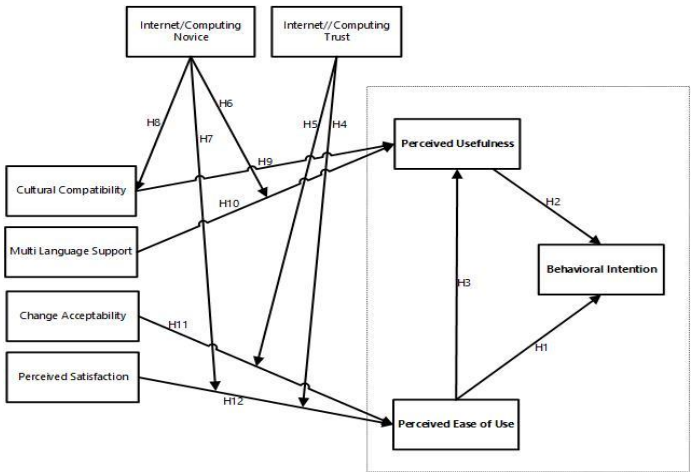

Figure 4: Proposed Model for Research Study

5. Quantitative Data Analysis

Firstly, the Partial Least Squares-Structural Equation Modeling (PLS-SEM) measurement model is selected and applied to assess and evaluate item based internal consistency and reliability, convergent validity and discriminant validity and at the end, detail results of structural model are presented for proving the significance of the path coefficients. Following is the detail:

5.1 Results of Analysis

Based on the factor analysis, the entire items on each factor relationship on the hypothesis are correctly loaded to their constructs. The content validity of the measures is presented in Table 5. It is evident from the table, that the items loaded significantly to their respective constructs and the measures of content validity are confirmed (20).

5.2 The Convergent Validity Analysis

The entire items loadings were examined and confirmed to be above 0.70 by (15). The factor loadings were all significant with 0.01 level of significance, shown in table 2. For this study, the Cronbach Alpha values fall well above the threshold value while composite reliability values fall between 0.881-0.956 indicating that the latter values exceeded the recommended value of 0.70 given by Fornell and Larcker‘s (1981) (21). Hence, the results confirm the outer model’s convergent validity. Average Variance Extracted (AVE) values were further tested to confirm the outer model’s convergent validity. Results shows the group of items AVE in relation to the variance shared with

measurement errors. If AVE value is 0.5, set of items are believed to have sufficient convergence in measuring construct (20).

Table 2: Table Composite Reliability Coefficient

First Order	Items	Loadings	AVE	CR	Cronbach's α
Behavioral Intention	BI1	0.7583	0.5046	0.7532	0.5138
	BI2	0.7662			
	BI3	0.7424			
Perceived Usefulness	PU1	0.7101	0.5401	0.8732	0.8541
	PU2	0.7201			
	PU3	0.8012			
Perceived Eases of Use	PEU1	0.7223	0.5743	0.8542	0.8432
	PEU2	0.7341			
	PEU3	0.8101			
Cultural Compatibility	CC1	0.8196	0.5321	0.7351	0.7121
	CC22	0.7858			
	CC33	0.7735			
Multi Language Support	MLS1	0.7229	0.5069	0.8037	0.6758
	MLS2	0.7399			
	MLS3	0.6896			
Change Acceptability	CA1	0.8044	0.6611	0.854	0.7452
	CA2	0.7922			
	CA3	0.8419			
Perceived Satisfaction	PS1	0.7858	0.5649	0.8537	0.8412
	PS2	0.7735			
	PS3	0.7623			

5.3 *The Discriminant Validity Analysis*

Discriminant Validity refers to the level in which items can differentiated among different constructs to check the overlapping and measure the shared variance between each individual construct (23). In this study, discriminant validity was established using Fornell and Larcker's (1981) method, as the square root of AVE for all constructs was replaced at diagonal elements of correlation matrix given below:

Table 3: Discriminant Validity Analysis

Construct/Variable	**BI**	**PU**	**PEU**	**CC**	**MLS**	**CA**	**PS**
Behavioral Intention (BI)	**0.76**						
Perceived Usefulness (PU)	0.23	**0.77**					
Perceived Ease of Use (PEU)	0.35	0.26	**0.83**				
Cultural Compatibility (CC)	0.41	0.37	0.31	**0.71**			
Multi Language Support (MLS)	0.33	0.34	0.37	0.23	**0.78**		
Change Acceptability (CA)	0.23	-0.07	0.32	0.42	0.18	**0.75**	
Perceived Satisfaction (PS)	0.24	0.17	0.34	0.42	0.27	0.27	**0.76**

5.4 Significance Assessment of the Structural Model

Once reliability and validity of the measurement model is recognized and established, then the results of the structural model are shown. In current study, a bootstrap resampling method has been applied to assess the significance of the path coefficients (25), (22). Table 3 proved and presented the complete and comprehensive estimates of the entire structural model, which also integrated the moderating variables of the research model.

5.5 Inner Model Assessment and Hypotheses Testing Procedures

After the confirmation of the goodness of the outer model, the next phase involves the testing of hypotheses relationships among the variables with the help of PLS Algorithm (Smart PLS). Hypothesis testing in the context of PLS-SEM is usually conducted through the calculation of a probability value '*p*' for each path coefficient, where '*p*' value may be one-tailed or two-tailed depending upon the researcher's prior knowledge about the direction of the path and the indication of its associated coefficient (26). The table 7 shows the factor loading relations with each item of the survey questionnaire as per the study model, it also shows the hypothesis of each factor, it shows the statement of item which was asked to the participant at the time of data collection. Then it shows the beta (β) values for each relationship including the t-statistical values.

Finally, it gives the status of each hypothesis relation, weather it is supported or non-supported as per the research model and analysis. The path coefficients statistical significance can be determined by bootstrapping methods in Smart PLS3. In this regard, the t-values of each path coefficient were produced through such method and p-values were eventually obtained. Further detail is presented in the following table:

Table 4: Significance of the Structural Model

Relations	Hypothesis	Statement	Beta	t-Statistics	Decision
PEU->BI	H1	PEU has direct and positive impact to BI.	0.246	4.971	Supported
PU->BI	H2	PU has direct and positive impact to BI.	-0.195	2.128	Supported
PEU->PU	H3	PEU has indirect and positive impact to BI through PU	-0.203	2.774	Supported
TR->PS->PEU	H4	Trust has moderating impact to PEU through PS.	0.281	3.767	Supported
TR->CA->PEU	H5	Trust has moderating impact to PEU through CA.	0.287	3.963	Supported
NV->MLS->PU	H6	Novice has moderating impact to PU through MLS.	0.214	2.963	Supported
NV->PS->PEU	H7	Novice has no moderating impact to PEU through PS.	0.012	0.104	Not Supported
NV->CC->PU	H8	Novice has moderating impact to PU through CC.	0.201	3.103	Supported
CC->PU	H9	CC has direct positive impact to PU.	0.321	3.012	Supported
NV->MLS->PU	H10	MLS has direct and positive impact to PU.	0.327	4.219	Supported
CA->PEU	H11	CA has das no direct impact to PEU.	0.013	0.133	Not Supported
PS->PEU	H12	PS has direct and positive impact to PEU.	0.223	2.301	Supported

5.6 Interaction of Moderating Effect

Moderating effect results of interaction effects is used to test the extent of moderation on the relationship a hierarchical multiple regression analysis. Independent variables were first to be included in step 1, followed by the moderator variable in step 2 and the interaction terms in step 3 of the regression model. Hypothesis predicted that computing Novice moderates the relationship between Multi Language Support (MLS), Change Acceptability (CA), Perceived Satisfaction (PS) and Perceived Usefulness (PU). Meanwhile, other hypothesis predicted that computing Trust moderates the relationship between PS, CA and Perceived Ease of Use.

However, it gives huge power to test if the model is good like it represents the Quantitative Structure-Activity Relationships (QSAR) and the researcher has picked a realistic and appropriate number of PLS factors, Q^2 can be compared with value of R^2 for creating a comparative outcome of study tests. Next step was to check and compare the R^2 values for the Endogenous variables. Then the R^2 values were checked for the Exogenous constructs as R^2 values shows the predictive capability of the model being proposed and applied. Following values were found as BI (0.736) PEU (0.648) and PU (0.5). As per the relevant literature, Hair et al. states that it is not hard and fast rule for assessing the strength of R^2 but this adds up the strength of the R^2, moreover, they also added that a value of 0.20 might be considered as higher in behavioral studies (21).

The PLS SEM procedure adopted to measure the predictive relevance of the path model with these constructs. This process was done by choosing the endogenous constructs and other to generate the results of predictive relevance. The values of the predictive relevance Q^2 were greater than zero. Consequently, the predictive relevance of the model was confirmed and achieved.

Table 5: Hierarchical Regression Analysis for Moderating Relationships

Variables	*Step 1*	*Step 2*	*Step 3*
Model Variables			
Cultural Compatibility	.084*	.086*	-.643**
Multi Language Support	.141**	.139**	.148
Perceived Satisfaction	.139**	.140**	.556**
Moderator Variable (*Computing Novice*)		.028	-.104
Interaction Terms			
Cultural Compatibility × Computing Novice			-.235
Multi Language Support × Computing Novice			-.105
Perceived Satisfaction × Computing Novice			.872**
R^2	.151	.152	.183
Adjusted R^2	.141	.141	.163
R^2Change	.151	.001	.031
Sig. F Change	.000	.421	.001
Durbin Watson	1.556	1.556	1.556

** $p < 0.05$, ** $p < 0.01$*

Table 5 shows the result of the hierarchical multiple regression analysis using computing Novice as the moderator variable in the relationship between MLS, CA, PS and PU. The set of the independent variables at step 1 accounted for approximately 15.1% of the variance in Perceived Usefulness. All independent variable dimensions had significant effects on the dependent variable. The moderator variable at step 2 accounted for approximately 15.2% of the variance in Perceived Usefulness. Computing Novice was not significantly related to Perceived Usefulness ($\beta = 0.028$, $t = 0.805$, $p = 0.421$). At step 3, when the interaction terms were entered, a 3.1% increase in R^2 was observed. However, only two interactions were significant, thus partially supporting hypothesis.

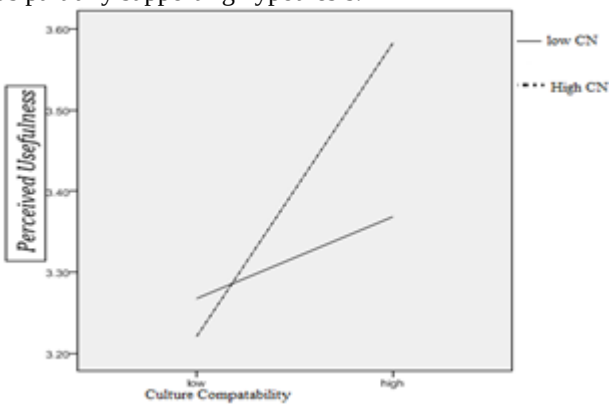

Figure 5: Computing Novice/Beginner Significance

As indicated in Table 5, computing Novice significantly moderated the relationship CA, MLS, PS and Perceived Ease of Use relationships. Figure 3 shows that the relationship between independent variables with dependent variables is strongest in the case of employees with high computing Novice and weakest in the case of employees with low computing Novice. Employees with either high or low computing Novice do not differ much in regards with Perceived Usefulness under condition of low Cultural Compatibility (CC). However, large differences were noted under conditions of high CC where employees that are computing Novice having higher PU.

Similarly, as indicated in Table 6, computing Novice significantly moderated the relationship between PS and PU. Figure 5 shows that the relationship between PS and PU is strongest in the case of employees with high computing Novice and weakest in the case of employees with low computing Novice. Employees with either high or low computing Novice did not differ much in PU under condition of high Perceived Satisfaction. However large differences were noted under conditions of low PS where employees that computing Novice found to be having lower PU. In other words, under conditions of low PS, individuals whom possess computing Novice had better PU than employees with low computing Novice.

Table 6: Hierarchical Regression Analysis Internet/Computing Trust

Variables	Step 1	Step 2	Step 3
Model Variables			
Perceived Satisfaction	.133**	.132**	-.174
Change Acceptability	.133**	.133**	.595**
Moderator Variable (*Computing Trust***)**		.041	.377
Interaction Terms			
Computing Trust t × Perceived Satisfaction			.087

Computing Trust × Change Acceptability			-.089
R^2	.147	.149	.173
Adjusted R^2	.138	.138	.153
R^2Change	.147	.002	.024
Sig. F Change	.000	.239	.009
Durbin Watson	1.541	1.541	1.541

* p< 0.05, ** p < 0.01

As indicated in Table 6, computing Trust significantly moderated the relationship between Change Acceptability and Perceived Ease of Use. Figure 6 shows that the relationship between Change Acceptability and Perceived Ease of Use is strongest among the individuals whom display high computing Trust and weakest among the individuals whom display low computing Trust. Individuals whom display either low or high computing trust did not differ much in PEU under condition of high Change Acceptability, but large differences were noted under conditions of low Change Acceptability. In other words, under conditions of low Change Acceptability, employees whom display high computing Trust have better Perceived Ease of Use than those whom display low computing Trust.

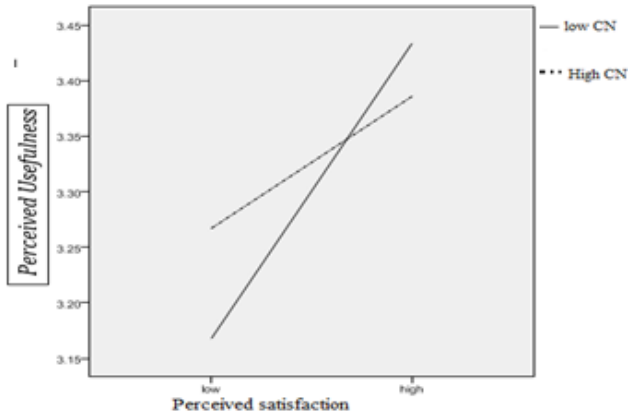

Figure 6: Hierarchical Regression Analysis Computing Trust

As also indicated in Table 6, computing Trust significantly moderated the relationship between Perceived Satisfaction and Perceived Ease of Use. Figure 7 shows that the relationship between Perceived Satisfaction and PEU is strongest among the individuals whom display high computing Trust and weakest among the individuals whom display low computing Trust. In both situations either low or high Perceived Satisfaction individuals displaying high computing Trust if they have better Perceived Ease of Use of the proposed cloud computing technology.

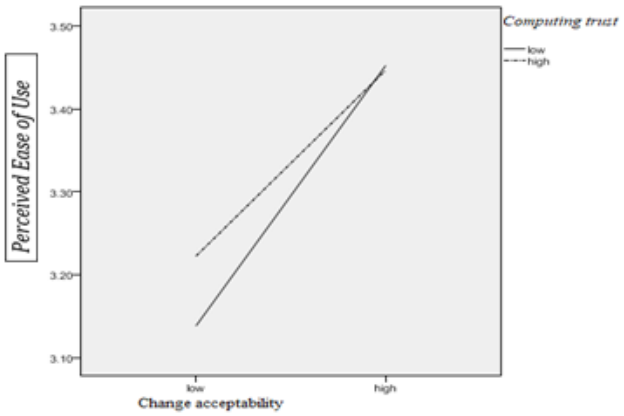

Figure 7: Computing Trust with Change Acceptability Significance

6. Conclusion

The research study has concluded to express that the findings are inimitable in accordance with the proposed model and in the light of extensive research survey and focus group activity, which shows that the Saudi business organizations are in the preliminary to intermediate level in acceptance of cloud technology. However, research study was highly significant and found that Perceived Usefulness (PU) was encouraged by the two proposed variables Cultural Compatibility, Multi-Language Support through moderating variable Novice. The other two proposed variables Change Acceptability and Perceived Satisfaction including a moderating variable Trust have positively influenced the Perceived Ease of Use (PEU) and showed a strong and positive impact on the Behavioral Intention (BI). Hence, adoption of the technology is enhanced in Saudi business organizations and helped the business decision makers to enhance the productivity with better efficiency and by reducing the overall cost. Research has also helps the cloud technology developers to take care of the key concerns of users in this particular region, which will definitely improve the adoption level.

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