The Influence of Technological, Organizational, and Customer Competency on Innovative Performance with Mediating Role of Research and Development

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Abstract

In this digital era, the innovative performance of any industry is vital. The main objective of this research is to investigate the effect of technological, organizational and customer competencies on the innovative performance of the IT industry (Software Houses) in Pakistan. Organizational Management Competency of 287 responses was collected through a questionnaire from Software houses of Pakistan. The Smart PLS has used to analyze the data and draw the results. Technological, organizational and customer competencies found their positive and significant relationship with the innovative performance of software houses in Pakistan. Moreover, the mediating role of R&D is found between organizational management competency, customer competency and innovative performance. However, the findings of the current study suggest that software houses should focus on the allocations of their resources to enhance their technology capabilities, which allow them to remain flexible in business conditions that are always shifting.

Keywords: Innovative performance; technological competency; organizational management competency; customer competency; research and development.

JEL Classification: M51, O32

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1. Introduction

Innovation has been acknowledged as the critical factor that underlies the sustainable performance of any firm. It is considered as the essential element in gaining a competitive advantage (Dougherty & Hardy, 1996; Zirger & Maidique, 1990) To become successful in a competitive environment continuous innovation is essential. Although there are numerous models but very few have discussed innovation in terms of organizational competency. In today's competitive environment multiple core competencies become evident for constant growth (Jalil et al., 2019). Organizations have several competencies but only a few of them can be identified as the core competencies. Several authors have identified technology competency as one of the core dimensions of performance (Pérez-López & Alegre, 2012). The consequence of IT is seen by shifts and revolutions over a decade. The IT industries are very vast. The geographical dispersion of advanced technical resources is now aligned with new development prospects (Que & Cantwell, 2016). The IT industry is one of Pakistan's fast-growing markets, accounting for approximately 1% of Pakistan's GDP, at about USD 3.5 billion. In the last four years, it has doubled, and analysts plan it to rise to $7 billion by another 100% in the next two to four years.

Pakistan's IT Sector Exports Trend 2006 to 2018 increased by 18K to 157K. As of now, more than 2500 IT firms are enrolled with exceedingly gifted and taught professionals in Pakistan. The deals of the IT industry are over $ 2.8 billion, out of which $ 1.6 billion has a place to the send out of software and IT administrations. As per the report, 25 tech incubators, co-working spaces, and quickening agents are in ownership of the Pakistan IT industry. Three OSCAR grants are gotten by Pakistani IT software engineers due to colossal commitment to Life of Pie etc. Actually gifted and Microsoft-certified experts are including esteem to the IT industry and Financial improvement of the nation (Shahzad et al., 2017).

Recently, Pakistan has mostly mislaid out of the worldwide worth chains allotted associate mediocre rank of issuing relatively short cost products or services and being paid allowances from usually low ability hand W.H.O usually go overseas, rather than adding worth reception by contributory within the increasingly interconnected world service economy. Worldwide Development File (GII) 2017 position of Pakistan is 113th available of 127 nations in Universal innovations. Costs on instructions are 2.7 percent of GDP and tertiary registration is 9.9%. Additionally, the state ranked 74th in the field of knowledgeable labor (Dutta et al., 2015). Many organizations generate diverse forms of skills and incorporate the experience into emerging knowledge and innovation (Helmi, 2020).

Organizational innovation is directly proportional to the availability of relevant and accurate information which can be utilized for the process optimization of both service and product (Boadi et al., 2020). Innovative performance has been frequently studied and researched in several scientific disciplines (Hameed & Haq, 2021), so it has varied

understandings in various perspectives from various sources of literature by combining elements of ability and attitude with elements of achieving competency-based results (Sajid & Nouman, 2019; Kosasih, 2019). Theoretically, the study focus on our framework of study to determine the innovative performance of basic three competencies technological competency, organizational management competency, and customer competency, and the mediator is research and development.

The objective of this study is to identify the role of technological advancement on the performance of the organization. It further analyzes the role of organization and customer competency with the mediating effect of research and development.

2. Literature Review

Thus, literature reviews concentrate on the value of three competencies (technological, organizational, and customer) that impact and improve IT industries' creative output.

2.1 Innovative Performance (IP)

Innovation has been considered the critical element of success in the current business environment (Shahzad et al., 2017). The dependent variable (DV) of this study is Innovative performance (IP). Industries must not only evolve in order to produce positively but also thrive and overcome the existing competition (Cefis & Marsili, 2006; Hassan & Hashmi, 2020). In previous studies, the creative success of the industry has been the target of research (Roberts & Amit, 2003; Berchicci, 2013). The current study treats the IP success of the IT sectors as incorporated into its innovation phase in the different components of competencies and highlights innovative performance by research and development in three fields.

2.2 Technological Competency

Technological Competence is vital for human development (Burke & Ornstein, 1995; White Jr, 1962). The research describes the first independent variable (IV) as technological competency (TC) Technological competencies include practical and theoretical information and techniques, ex-service, and devices required for the production of new goods and form part of technology skills (Wang et al., 2004). An industry with strong technological expertise can rapidly improve products and processes which bargain different assistances and generate worth for consumers using their scientific expertise.

Hypothesis 1: The technology competency (TC) has a positive relationship and does influence the Innovative performance (IP).

2.3 Organizational management competency

The term competency can be defined as the potential and willingness of an individual to perform a given task (Hemani & Rashidi, 2016). The second independent variable (IV) used in this research is organizational management competency (OMC). Organizational management competency (OMC) to achieve first, early, and higher innovates operational expertise (Roberts & Amit, 2003). Some scholars find that the deduction of organizational management competency (OMC) from insufficient change is greater than those of excessive change (Zajac et al., 2000). Business sense, client communication, and customer response are organizational management competencies (OMC) relevant to the implementation of customer coordination. Market sensing is the company's capacity to detect patterns before rivals and to predict market occurrences.

Hypothesis 2: The organizational management competency (OMC) has a positive relationship and influences the Innovative performance (IP)

2.4 Customer Competency

The third and last independent variable (IV) used in the research is customer competency (CC). Those agencies with well-advanced consumer competencies (CC) are flourishing caution of customer demands and they are accomplished fee development on all factors of a product or service which might be crucial to the consumers (Day, 1994). Customer competence (CC) supports product feature choices in the realistic growth process. The promotion of products, including identification of main consumers and locations, demand evaluations, and research, typically plays a primary role in product testing. Customer plans, advertising, and delivery of goods are activities involving marketing experience in the marketing stage of the product (Swink & Song, 2007; Hafeez et al., 2002).

Hypothesis 3: Customer competency (CC) does influence and has a positive relation with innovative performance IP.

2.5 Research and Development (R&D) as a mediator

The R&D is an overarching attempt to increase the expertise of the industry. This may involve scientific, individual, cultural, or even social awareness. The application of this expertise is concerned with the creation of new goods. The organization's durability relies on emerging consumer technologies due to rapid developments in technology, which can lead to competition (Fiaz et al., 2011).

In those years R&D has been rising steadily due to cautious and gradual technical developments, high production expense, increasing difficulty due to rapidly increasing technological capabilities, and competitive advantages (Finne, 2003). Large companies earn high profits through the production of more inventions (Hameed & Irfan, 2019) with more R&D.

As per published studies technology competency is crucial for higher innovative performance in any organization (Bolívar-Ramos et al., 2012; Dahms et al.,2020). However, some researchers stressed that the direct role of technology competency is not clear yet how it is increasing the level of innovation performance of the organization (Swink, 2000; Swink & Song, 2007). Thus, the current is proposing the following hypothesis that R&D can play the mediating role to clarify the link between technology competency and innovative performance.

Hypothesis 4: The mediating effect of R&D is associated between technological competency (TC) and innovative performance.

Furthermore, Peeters and Van Pottelsberghe (2003) stated that effective organizational management competency influences the organization's innovative performance positively. One more study also stressed that innovation in any company cannot be achieved without active organizational management competency (Waheed et al., 2019). Anyway, the way forward without the role of R&D strategy, the organization also cannot the achieve the higher innovation performance (Peeters & Van Pottelsberghe, 2003). Thus, R&D can play the bridging role between organizational management competency and innovative performance.

Hypothesis 5: The mediating effect of R&D is associated between organizational management competency (OMC) and Innovative performance (IP).

Always innovation demand comes from the customer side, the firm which has a strong link with the customer they have the more innovative product in the market (Stanko & Bonner, 2013). In other words, customer competency increases the innovative performance of companies. Besides, the past research suggested that organizations cannot neglect the R&D process's role in customers' higher demand for innovative products or services in the market (Ernst et al., 2011; Wind & Mahajan, 1997). The continued process of research and development only can give the solution or meet the customer demands (Vendrell-Herrero et al., 2021). Hence, based on past studies the current study proposes the following hypothesis.

Hypothesis 6: The mediating effect of R&D is associated between customer competency (CC) and Innovative performance (IP).

The framework of the variable is described as follows. In this framework, every variable is directly linked with one another.

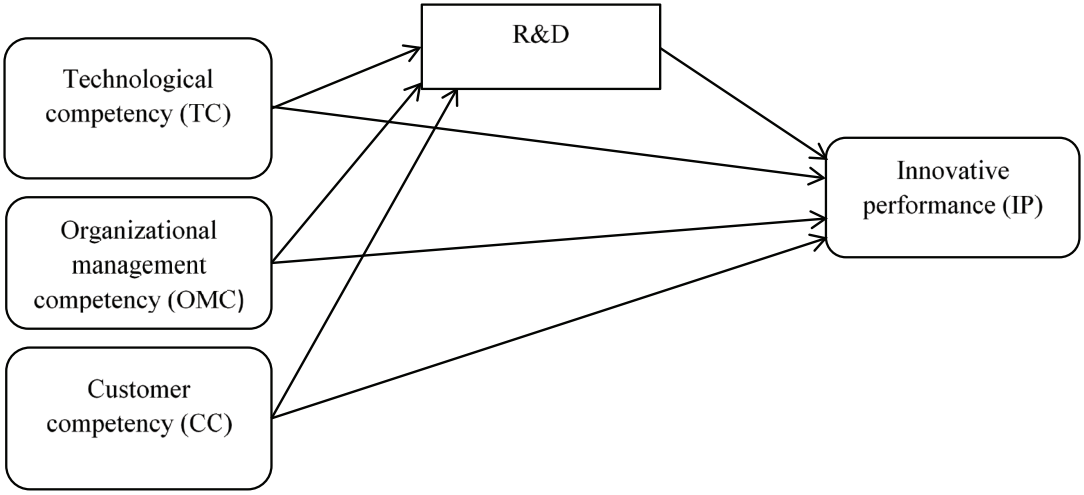

Figure 1: Research Framework

3. Methodology

The above discussion provides a general idea of the appropriate literature concerning IP, TC, OMC, CC, and R&D. This section is seized toward making clear the research methodology and the techniques engaged in the way to attain the research purposes. In specific, this section includes the research population, the size of the studied sample, the sampling method, and the method or techniques concerning data collection and data analysis.

3.1 Population

Our main population of the data collection is the software houses of Pakistan. A total of 1169 software firms are registered on the software export board of Pakistan. A total of 287 respondents are taken for this study (Krejcie & Morgan, 1970). The data has been collected from respondents through a structured questionnaire with a seven-point Liker scale. The manager of software houses was taken as respondents of the study. The random sampling technique was used to distribute the questionnaire to respondents. Table-1 has been used to target the software houses all over Pakistan through e-mail.

Table 1
Detail of IT industries in Pakistan

Sr no.	City/ Location	No. of IT industries	Total
1	Islamabad	268	268
2	Karachi	411	679
3	Lahore	315	994
4	Rawalpindi	112	1106
5	Peshawar	45	1151
6	Other	18	1169

Source: http://www.psed.org.pk/company

3.2 Research instrument

This study is carried out via a questionnaire-based survey. The instrument is used to designate a 7-point Likert scale 1-7 ("strongly disagree to strongly agree"). The questionnaires are distributed among the managers of the IT Industries of Pakistan. The scale of technological competency, organizational management competency, and customer competency was adopted from the study of Lokshin et al. (2009). Moreover, the scale of research and development was taken from the study of Jantunen (2005) and the scale of innovative performance was acquired from the study of Dogbe et al. (2020).

4. Results

This analysis contained the validation of the variables discussed in the research model. A questionnaire survey has directed the result of which have been analyzed over Smart PLS-SEM (Weissman et al., 2005) and PLS graph (Chin et al., 2003). Three analysis techniques were run in the software, the first one in PLS algorithms is Cronbach's Alpha and the second one is Fornell and Larcker criteria.

Reliability is a quantity to signify the range to which a measuring instrument is appropriate or error-free and therefore reliable and stable crossways phase and also numerous items in scale (Sekaran & Bougie, 2016). The most common test of inter-item consistency is the Cronbach's alpha Coefficient. In this research, Cronbach's alpha Coefficient consistency is applied to study the inner stability of the variables.

Cronbach's alpha technique is used for assessing the reliability and is priceless due to its strength to overwhelm the matters. Cronbach's alphas pragmatism has been the dictating force behind its use, mostly in the playing field management sciences. This research engaged

Cronbach's alpha coefficient to test the measurements' reliability. Here method shows the item's consistency when measuring the same construct by indicating that they display the top consistency and share the top tendency to measure it (Nunnally, 1994).

Table 2
Cronbach's Alpha

Constructs	Cronbach's Alpha	rho_A	Composite Reliability	Average Variance Extracted (AVE)
Customer competency	0.849	0.85	0.898	0.689
Innovative performance	0.865	0.869	0.908	0.713
Organizational management competency	0.912	0.912	0.93	0.653
R&D	0.855	0.856	0.912	0.776
Technological competency	0.889	0.89	0.919	0.693

4.1 Discriminant Validity

Here Fornell-Larcker method is used to demonstrate the discriminant validity of the construct. In the Fornell-Larcker validity assumption if the square root of AVE is greater than the latent variable correlations then the assumption of the discriminant validity among the construct is supported. The Table depicts that the square root of AVE (upper diagonal values) is enough greater than all the correlation values in their row and columns. Hence, the discriminant validity is established.

Table 3
Fornell and Larcker

Constructs	Customer competency	Innovative performance	Organizational management competency	R&D	Technological competency
Customer competency	0.827				
Innovative performance	0.829	0.845			
Organizational management competency	0.844	0.855	0.808		
R&D	0.856	0.776	0.832	0.86	
Technological competency	0.883	0.866	0.861	0.89	0.833

4.2 Structural Equation Model (SEM)

The structural equation model is used to examine the relationship among constructs as well as the predictive abilities of the outer model. Structural Equation Modeling (SEM) is implied to test the hypotheses. The SEM is based on regression tools. According to (Hornsey et al., 2018), regression analysis is a statistical valuation to analyze or estimate the relationship between the independent and dependent variable(s). Generally, the regression analysis is run to estimate the causal effect of a variable on another variable.

Discussion of the direct relationship between technology competency, organizational management competency, customer competency, and innovative performance. Here below mentioned Table shows the decision-making of hypothesis testing (direct effects of IVs on DV), whether they are supported or not. According to Table 4.9, the results of H1 show that there is a positive effect of Technological Competency on innovative performance OMC, and this effect is statistically significant (β=0.22; t=2.88; p=0.00); hence H1 is supported. Moving on to the results of H2 shows that Organizational management competency positively affects the Innovative Performance and this effect is statistically significant (β= 0.36; t=4.29; p=0.00); hence H2 is accepted. About H3, the proposed results show that there is a significant positive relationship between Customer Competency with Innovative Performance (β= 0.37; t=4.05; p=0.00); so H3 is also accepted and supported.

Table 4
Results of direct relationships

Hypothesis	Beta	Standard Deviation	T Statistics	P Values
H1: Technological competency -> Innovative performance	0.23	0.079	2.886	0.004
H2: Organizational management competency -> Innovative performance	0.37	0.086	4.295	0.000
H3: Customer competency -> Innovative performance	0.32	0.078	4.050	0.000

4.3 Discussion of indirect relationships (mediating role of R&D)

Here below mentioned Table shows the decision-making of hypothesis testing (indirect effects of IVs on DV), whether they are supported or not. The results of H4 show that there is an insignificant indirect impact of Technological Competency on Innovative Performance (β=0.008; t=0.473; p=0.637), which indicates that R&D insignificantly mediates the

relation between Technological Competency plus Innovative Performance. Hence, H4 is not supported. The results of H5 show here a significant indirect impact of OMC on IP (β=0.063; t=2.027; p=0.043), which indicates that R&D significantly mediates the relations between OMC and IP. Hence, H5 is supported. While moving towards H6, the outcomes show the significant positive indirect effect of CC on IP (β=0.075; t=2.138; p=0.033). It depicts this R&D significantly mediates the relation between CC on IP. Hence, this hypothesis (H6) is accepted in this study.

Table 5
Results of indirect relationships

Hypothesis	Beta	Mean	S. D	T statistics	P Values
H4: Technological competency -> R&D -> Innovative performance	0.01	0.009	0.02	0.473	0.637
H5: Organizational management competency -> R&D -> Innovative performance	0.06	0.059	0.03	2.027	0.043
H6: Customer competency -> R&D -> Innovative performance	0.08	0.072	0.04	2.138	0.033

4.4 Model Fitness

R square, Standardized root means square residual (SRMR), and Normed Fit Index (NFI) are the important measures for Model Fitness in regression analysis. R square depicts to which extent the independent variables are predicting the response variable. Zero R square value indicates that predicting variables are not explaining the response variable. While R square value greater than 0 or closer to 1 depicts that predicting variable(s) are explaining the response variable to a considerable extent. In this case, the R square values for the response variable Innovative performance and R&D are 0.762 and 0.743 respectively.

Table 6
R square

Constructs	R square	R square adjusted
Innovative performance	0.762	0.759
R&D	0.743	0.74

This indicates that predicting variables are considerably explaining the response variables. SRMR is another important measure of the goodness of the regression model. According to (Sarstedt et al., 2014), a value less than 0.10 or 0.08 is considered good. In this case, the SRMR value is 0.059, which is far away from 0.08. Hence, the alternative hypothesis of model fitness is supported. NFI is another significant measure for the model fitness in Ordinary Least Square regression, (Lohmöller, 1989) stated that the NFI value greater than zero is considerable. The closer the NFI to 1, the better to fit. In this case, the NFI value is 0.804. Hence, the model is fit.

Table 7
Model Fitness

Criteria	Saturated model	Estimated Model
SRMR	0.059	0.059
d_ULS	0.964	0.964
d_G	0.645	0.645
Chi-Square	1,238.55	1,238.55
NFI	0.804	0.804

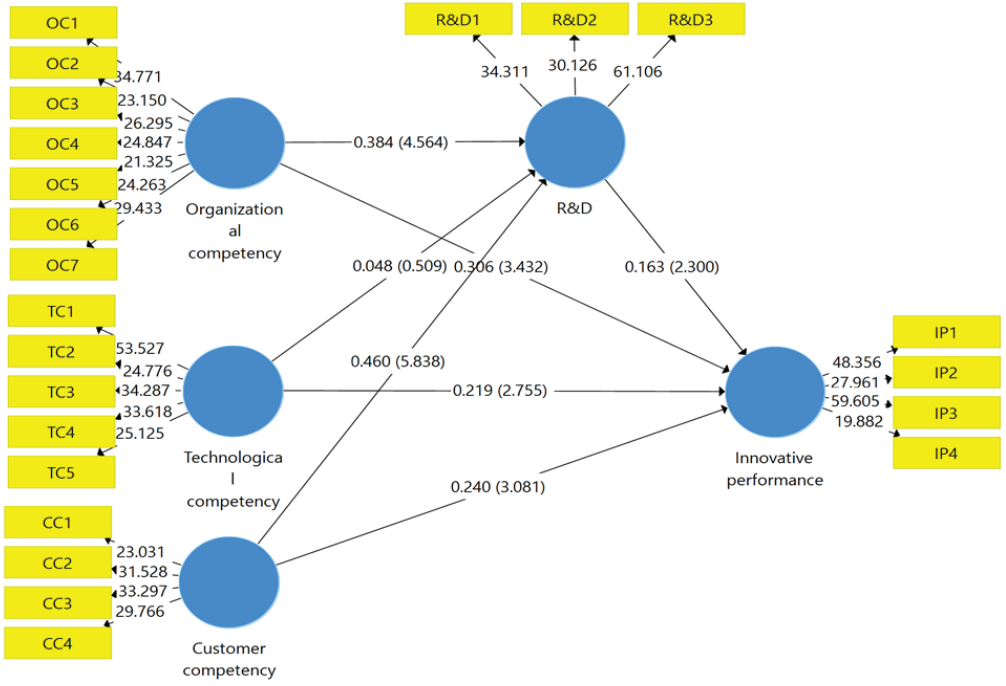

Figure 2: Framework model

5. Discussions and Conclusion

The first objective of the current study is to analyze the impact of technological competency on the innovative performance of the IT industry. The statistical analysis from the present research showed a positive significant influence on the technological competency of the innovative performance. The results of the present study are supporting prior studies e.g. (McEvily et al., 2004). Furthermore, the study concluded that TC is also connected to the creative and innovative achievement in all three disciplines: Technology has a direct and beneficial impact on IP growth because no sector will flourish without research and experimentation in technology (Hafeez et al., 2002).

The second objective of the present research was to observe the impact of organizational management competency on the innovative performance of the IT industry. The empirical evidence from the present study showed a significant positive influence of organizational management competency on the innovative performance. The present findings are agreed with Tian et al. (2020) and Heusinkveld et al. (2009), who argued that organizational management competency signifies the innovative performance with resources and capabilities and has a direct relation with it. Subsequently, the 3rd objective of the present study was to analyze the impact of customer competency happening the innovative performance of the IT industry.

The statistical findings from the present study showed a positive significant influence of customer competency on innovative performance, some of the prior studies by (Jayachandran et al., 2004) concluded the same. The findings imply that an understanding of customers and their needs will allow a company to flourish, regardless of the industry in which it operates. While the fourth and final objective of the present study was to explore the mediating effect of R&D on the relationship between business competencies and innovative performance in the IT Industry. The analyses explained that R&D significantly mediates the relationship between Organizational management competency and Customer Competency with Innovative Performance. The present findings are agreed with Tian et al. (2020) and Acosta-Prado et al. (2021). On the other hand, these findings are against the results from (Helmi, 2020).

5.1 Implications of the study

The study contributed significantly to the literature on innovation performance. Limited studies have investigated the combined effect of technical, management, and customer competencies on innovation performance with mediating role of R&D in software houses. Moreover, the findings of this study can help the higher management of software houses regarding the improvement of innovation in their firms. Furthermore, the managers of software houses can utilize their resources effectively such as technological, managerial, and customer to derive innovative performance. However, this study stressing that how managers can covert intangible resources to create value through higher innovative performance.

5.2 Limitations and future recommendations of the study

The current study has only taken one industry of Pakistan, the future study can take the responses from other industries such as textile, sports, etc. Besides, this study conducting a cross-sectional study, the future study can conduct a longitudinal study approach. Moreover, future studies can also involve other organizational competencies in the current study research framework such as entrepreneurial competency and resilience.

Conflict of interest: The authors do not have any conflict of interest.

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