

AN EMPIRICAL INVESTIGATION OF THE EFFECTIVENESS OF ERP QUALITY: EVIDENCE FROM CORPORATE SECTOR OF PAKISTAN

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ABSTRACT

The aim of this study was to find the impact of Enterprise Resource Planning (ERP) system on individual performance. D&M theory of IS success with the integration of TAM model was used to measure the effectiveness of ERP system in Pakistani organizations. Survey research method was applied and structured questionnaires were used for the collection of quantitative data from 320 ERP end users. Data was analyzed through partial least square – structural equation modeling (PLS-SEM) technique. The results from the study were reported in various dimensions. Findings of the study suggested that performance of employees can be optimized through high quality of ERP usage. This study explained a vivid description of ERP armored organizations that how ERP system assures the performance and growth of their employees which ultimately increases the operational performance of the organization. The study also suggested many implications and future directions.

Keywords: ERP System, D&M Theory, Technology Acceptance, PLS-SEM

1) INTRODUCTION

Organizations have been rapidly growing towards a most consistent path to keep their business processes more fluent and persistent. ERP system since its induction in the business process is assisting all the business processes in a customized manner. It integrates all the departments in an organization and provide possible solutions and assists departments to ensure and enhance the performance of different activities.

In country like Pakistan where a lot of development in business prospects are done and many developments have been under way, ERP is also a new development providing better ways to all the processes of a business. However, many organizations have not implemented ERP systems such as

SAP or Oracle to integrate and automate their business process. Such organizations are satisfied with some application software or customized enterprise solutions.

It has been widely viewed and analyzed that firms without an ERP system, are usually less efficient in doing their business activities, while on the other side, firms having ERP system are more efficient. Therefore, an ERP is an important tool for every business to robust it's all business processes.

This study will assist organizations that how they can improve the performance of their employees by implementing quality of ERP system. ERP system implementation consist of three stages: pre-implementation, implementation, and post-implementation. This present study is purely related to post-implementation stage of ERP system implementation for measuring the effectiveness of ERP system at individual level. The aim of this study is to determine the relationship of quality dimensions of ERP system (e.g., system quality, information quality, and service quality) with perceived usefulness and ERP usage and to investigate the effect of ERP usage on individual performance in corporate sector of Pakistan.

2) OBJECTIVES OF THE STUDY

The specific objectives of the present study are:

- To investigate the relationship of system quality, information quality and service quality on perceived usefulness and ERP system usage.
- To find the impact of perceived usefulness on ERP system usage.
- To find the effect of ERP system usage on individual performance.
- To provide the possible recommendations to increase the effectiveness of ERP system at individual level.

3) LITERATURE SURVEY

In the current era of technological advancement and information, Organizations are facing various challenges to make their processes more fluent and persistent. They are working broadly and impeccably exchanging information through the systems. An explored solution to this hurdle is to implement enterprise resource applications in their systems. These systems provide a plat form for organizations to assimilate, exchange, prosecute and coordinate business processes among all departments and

across the entire organization. Enterprise resource planning allows more flexibility, efficiency, and productivity to organization. According to Fadi, et al (2012), timely information dissemination can boost productivity of employees, and this can be done by using an integrated technology such ERP system.

Victor et al., (2015) investigated that ERP system enables manufacturing organizations to attain competitive advantages in the global market. In their study, they did an experiment of multi-factorial and explore the impact of information presentation and complexity as an aspect of usability while considering factors of human on decision. They used simulated ERP alphanumeric tables to check users' decision quality which was dropped with increasing information complexity while using of poor presentation. Moreover, two aspects of information complexity and compensatory effects by mean of human factors were also revealed. Findings from the study demonstrate the significance of empirical user studies and provide practical implications as well. Especially, user-centered design processes can considerably be furnished through an effective execution and application of complex IS, such as ERP systems.

Christy, et al (2015) found that complicated information systems like ERP aim to unify and assimilate the data available in different department of an organization. Implementing ERP is not an easy task as it contains various types of users. They proposed a conceptual model to testify the factors revolving technological, individual and organizational factors on ERP usage and effect on the end user. The result showed a positive impact of computer self-efficacy, firm support & training, and compatibility on ERP usage which significantly influences panoptic empowerment and individual performance.

Chang, et al. (2011) conducted a field survey in Taiwanese organizations. They collected data from 659 ERP users to find the impact of ERP system on individual performance, learning, satisfaction, and productivity. They found that ERP system increases user satisfaction and usages within the organization. They study clearly indicated that ERP system is useful for the organization. Organization could enjoy different benefits in term of improved satisfaction level of their employees and system usage and performance outcomes.

On the executer's side, effectively use of ERP system is significant for developing employee's knowledge and skills. Therefore, right after ERP implementation and execution in organizational processes, the requirement to explore the roles that post-implementation learning plays a prominent role in ERP usage, boosting individual performance seem to be crucial. The current study aims to identify the role that PU plays in expediting ERP usage and testing the impact of ERP usage on individual performance.

The upgraded D&M model was extended by (Chiplunkar et al. 2003), to investigate the success ratio and model in ERP systems, further to determine those factors which truly providing higher quality ERP systems, Benefit of use and the maximum values of ERP system end-user. 204 ERP users participated in the survey through questionnaires from three high profiled technological organizations. The results highlighted the significance of System Quality and Information Quality variables on Benefit of Use. In fact, dimension of System Quality performs a prominent role than Information Quality in term of ERP Benefit of Use and User Satisfaction (Ramayah and Lo2007).

Joseph K. Nwankpa (2015) developed a theoretical model in his study, he examined the effect of ERP system usage as a mediator on ERP benefits. Furthermore, the study also highlighted the factors which serve as predecessor of ERP system use. They tested a model by analysing 157 responses of ERP system end-users across US. Results suggested that ERP system usage has a direct relationship with ERP benefit. While, this relationship can be moderated through degree of knowledge integration mechanism. Adding further, results revealed that the key drivers of ERP system usage includes technical resources, organizational fit and the extent of ERP implementation. This research enhances our knowledge regarding ERP usage and realizing maximum ERP benefits.

Chung Che et al. (2016) attempted to examine whether the network centrality will affect the user participation in ERP system post-implementation. In aspects of network centrality, they used degree, closeness, between and eigenvector as indicators to investigate the relationships between individual network centrality and user participation. They further explored the impact of user participation on System Use and User Satisfaction. They adopted ERP post-implementation of TSC Company as an example. The sample data consist of 211 questionnaires. Their empirical results showed that network centrality has positive impact on

three dimensions of user participation; hands-on activity and communication activity positively affect system use; user's relationship, hands-on activity, and communication activity positively affect user satisfaction. Through the lens of social network, they argued that ERP user network plays an important role to influence user participation in post-implementation period, which is critical for system use and user satisfaction.

Pei et al. (2015) investigated that how well different qualities of an ERP system affect its post-implementation success from the user side. They refined D&M IS success model to test the relative importance of ERP System Quality, Information Quality, and Service Quality to post-implementation success, along with User Satisfaction, users' individual benefits and a critical variable i.e, users' extended use of ERP system, as an outcome variable. Data from 151 ERP users was based for research model. Their results indicated that Service Quality in occurrence with System Quality and Information Quality, significantly affects ERP post-implementation success for user. Moreover, Service Quality was significantly interacting with Information Quality and System Quality to encourage an ERP system's post-implementation success through promoting employees' extended use.

Ignatio Madanhire et al. (2016) investigated the horizons of advancing operational efficiency in a manufacturing system through ERP. It could achieve with the help of effective communication among departments to attain scheduled delivery dates. To ease all the process they provided an ERP tool on the shop floor to reduce work in progress and good inventory control. To lessen working capital they suggested some pillars including the Inter connectivity of firm's activities, organizational communication and wide range of collaboration. Material or energy wastages and inventory defects were eliminated for effectiveness of results. To reduce the product cycle time they lowered the delays and machine maintenance and enhancing the space for better utilizations of workers, equipment and workstations. He further analyzed that ERP increases the operation efficiency not only to the firm but the individual as well.

Sun et al (2011) examined several factors of ERP roles, in which compatibility of work, perceived usefulness, perceived ease of use, performance and intended use on the performance of ERP users and how the tested factors shape ERP use. The study suggested that mentioned factors, considered significance for the user performance, depicting a significant effect on organizational outcomes. The results also described the

importance of integrating several models in information system, including the TTF model and TAM, to find the impact on the ERP systems. As there has been criticism on models of individual information systems for being too simple.

4) RESEARCH MODEL OF THE STUDY

Based on DeLone &McLean Information System Success Model, the proposed model of the present study is shown in Figure 1. In the model, the impact of ERP Information Quality, ERP System Quality and ERP Service Quality on Individual Performance through ERP usefulness and ERP system use is proposed.

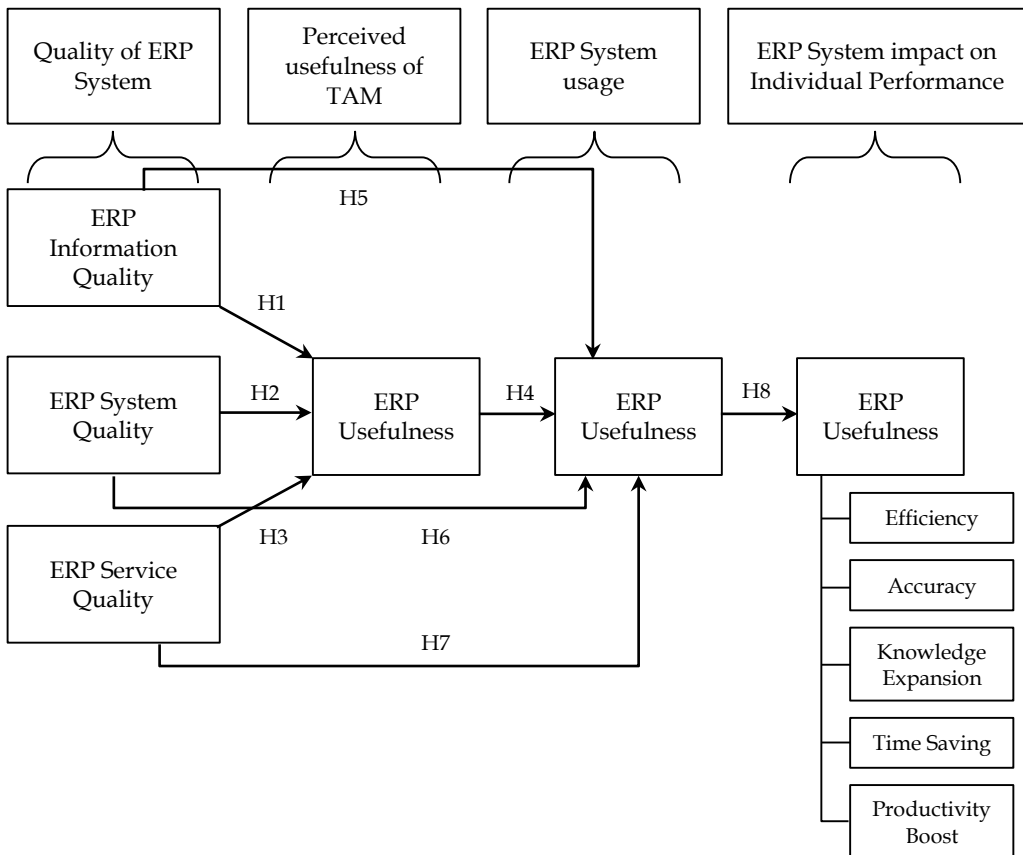


Figure 1: Research Model

- H1: There is a positive relationship between ERP Information quality and Perceived usefulness.*
- H2: There is a positive relationship between ERP System quality and Perceived usefulness.*
- H3: There is a positive relationship between ERP Service quality and Perceived usefulness.*
- H4: There is a positive relationship between ERP Information quality and ERP System Use.*
- H5: There is a positive relationship between ERP Information quality and ERP System Use.*
- H6: There is a Positive relationship between ERP System quality and System Use.*
- H7: There is a positive relationship between ERP Service quality and ERP System Use.*
- H8: There is a positive relationship between ERP System Use and Individual performance.*

5) RESEARCH DESIGN AND METHODOLOGY

5.1) Research Context

This study was carried out in Pakistani organizations who have successfully implemented ERP. The hypotheses were tested empirically through the field survey. Data was collected through questionnaire from users of ERP systems in those organizations. The organizations were selected based on two criteria: (1) based in Pakistan; and (2) the informant of the study worked on ERP system for more than one.

5.2) Sample Size and Data Collection

The study applied convenient sampling technique. Data was collected from 320 ERP users through structured questionnaire.

5.3) Data Analysis


















Data was analyzed through Partial Least Square - Structural Equation Modeling (PLS-SEM) technique using SmartPLS 3 program. Basic descriptive statistics and frequency distributions were generated. The results from the study were reported after the data analysis.

6) FINDINGS OF THE STUDY

6.1) Descriptive Statistics

Seven questions were mainly used for the descriptive/ demographic data in this survey questionnaire. Table 1 shows information concerning Type of Business, ERP System, Position, Gender, Experience, Education Level, Tenure of ERP usage.

Table 1: Profile of Respondents

Measures	Frequencies	Percentage	Graph
Industry/Org Type			
Manufacturing	166	59.71	
Services	112	40.29	
Industry/Org Type			
SAP	130	46.76	
ORACLE	148	53.23	
Position in the Company			
Top Level	20	7.19	
Mid-Level	190	68.34	
Lower Level	68	24.46	
Gender			
Female	57	22.10	
Male	201	77.90	
ERP Working Experience			
Less than 1 Year	52	18.70	
1-3 Years	102	36.69	
3-5 Years	60	21.58	
More than 5 Years	64	23.02	
Educational Level			
Intermediate	19	6.83	
Graduation	93	33.45	
Masters	138	49.64	
M.Phil/PhD	28	10.07	

Measures	Frequencies	Percentage	Graph
Company Using ERP			
Less than 1 Year	14	5.03	
1-3 Years	86	30.93	
3-5 Years	52	18.70	
More than 5 Years	126	45.23	

6.2) Convergent Validity (CV)

Convergent Validity (CV) refers to the degree to which indicators that reflect a construct converge in comparison to items measuring other constructs (Urbach & Ahlemann, 2010). Two measures assess convergent validity, one is known as Average Variance Extracted (AVE), introduced by Fornell and Larcker (1981) while the other one is Item inter reliability or Factor loading values. The AVE values for a construct if above than 0.5 will demonstrate acceptable degree of convergent validity while Factor Loading values if above than 0.6 will demonstrate the acceptable limit of convergent validity. Table 2 illustrates the Factor Loading Values and Table 3 shows AVE values for the measurement model.

Table 2: Factor Loading

	IP	IQ	PU	SERVQUAL	SQ	SU
IP1	0.743					
IP2	0.796					
IP3	0.809					
IP4	0.839					
IP5	0.816					
IP6	0.771					
IQ1		0.74				
IQ2		0.817				
IQ3		0.758				
IQ4		0.827				
IQ5		0.813				
IQ6		0.803				
IQ7		0.776				

	IP	IQ	PU	SERVQUAL	SQ	SU
PU1			0.778			
PU2			0.844			
PU3			0.809			
PU4			0.886			
PU5			0.813			
PU6			0.776			
SERVQ1				0.727		
SERVQ2				0.783		
SERVQ3				0.834		
SERVQ5				0.78		
SEVRQ4				0.849		
SQ1					0.657	
SQ10					0.707	
SQ11					0.729	
SQ2					0.752	
SQ3					0.723	
SQ4					0.74	
SQ5					0.726	
SQ6					0.741	
SQ7					0.786	
SQ8					0.755	
SQ9					0.759	
SU1						0.719
SU2						0.787
SU3						0.782
SU4						0.837
SU5						0.8
SU6						0.795

Table 3: AVE Values

Construct	AVE
Individual Performance	0.634
Information Quality	0.626
Perceived Usefulness	0.67
Service Quality	0.633
System Quality	0.54
System Use	0.62

As shown in Table (2) and (3), the AVE values for the constructs are above the minimum accepted value of 0.60 and 0.50 respectively which shows that the proposed model demonstrates convergent validity.

6.3) Discriminant Validity

Discriminant Validity evaluates the degree to which the indicators of latent variables (LVs) are also different from each other (Urbach & Ahlemann, 2010). Discriminant validity validates whether an indicator of a certain construct is also measuring another construct or not. In the PLS SEM approach, two criteria can measure discriminant validity: cross-loadings and the Fornell-Larcker criterion (Fornell & Larcker, 1981). Discriminant Validity of the measurement model can be determined by comparing the factor loadings and cross loadings of all the indicators to their respective LVs. To obtain cross-loadings, the score of each construct is correlated with all other indicators (Chin, 1998). Discriminant Validity can be checked and inferred when an indicator's loading values are higher against its own measured construct than to any other construct and each construct entails highest values with its assigned indicator. Table 4 explaining the Fornell-Larcker Criterion of the model in this study.

Table 4: Fornell-Larcker Criterion

	Individual Performance	Information Quality	Perceived Usefulness	Service Quality	System Quality	System Use
Individual Performance	0.796					
Information Quality	0.622	0.791				
Perceived Usefulness	0.651	0.686	0.818			
Service Quality	0.605	0.613	0.585	0.796		
System Quality	0.673	0.814	0.687	0.666	0.735	
System Use	0.775	0.628	0.651	0.564	0.699	0.788

As depicted in Table 4, the values located in the table diagonals are greater than the values located in their corresponding column and row except ERP System Quality. This shows that the discriminant validity of the measurement model in the proposed model except one construct.

6.4) Internal Consistency Reliability (ICR)

Internal Consistency Reliability (ICR) is normally determined by Cronbach Alpha (CA) and through Composite Reliability Analysis. According to Nunnally and Bernstein (1994), Cronbach Alpha and CR values above 0.7 are adequate for exploratory research and values above 0.8 are desirable for confirmatory research. However, values below 0.6 indicate a lack of Internal Consistency Reliability (Nunnally & Bernstein, 1994). Table 5 explains the values of Cronbach Alpha for the measurement model in this study.

Table 5: Testing Reliability

Construct	No. of items	Cronbach Alpha	Reliability Result
Individual Performance	6	0.90	Good/ Acceptable
Information Quality	7	0.92	Good/ Acceptable
Perceived Usefulness	6	0.93	Good/ Acceptable
Service Quality	4	0.87	Good/ Acceptable
System Quality	11	0.94	Good/ Acceptable
System Use	6	0.86	Good/ Acceptable

As depicted in Table 5, all the constructs have Cronbach's alpha (CA) scores are well above the recommended threshold of 0.70. The scores of the Cronbach Alpha for the constructs confirm the internal consistency for all constructs in the proposed model.

6.5) Testing the Path Model

For testing the study hypotheses path model was develop and executed through Smart PLS 3 to calculate the Beta (β) coefficient values and to find out the P-Value. Beta (β) coefficient is based on the magnitude, significance, and sign. The magnitude of the Beta (β) coefficient represents the strength of the relationship between LVs. The recommended value for Beta (β) coefficient is more than 0.20 to indicate a certain impact within the model. According to Hildebrand (1986) the (β) coefficient values should be more than 0.20. The sign of the Beta (β) coefficient is also important; it should correspond to the proposed hypothesis. In addition, the Beta (β) coefficient should be significant at least at the 0.05 level. According to Neyman-Pearson (1966) the P-values should be less than 0.05. For this study, the bootstrap sample size is equal to the original sample size because of the small sample sizes employed in PLS.

Table 6: Testing Path Model

Constructs and Relationships	Original Sample B	Sample Mean β	Standard Deviation	T Statistics	P Values	Hypothesis
Information Quality -> Perceived Usefulness	0.336	0.329	0.082	4.116	0.000	Accepted
Information Quality -> System Use	0.045	0.044	0.078	0.582	0.561	Rejected
Perceived Usefulness -> System Use	0.287	0.283	0.092	3.110	0.002	Accepted
Service Quality -> Perceived Usefulness	0.186	0.185	0.066	2.810	0.005	Accepted
Service Quality -> System Use	0.105	0.110	0.058	1.823	0.069	Rejected
System Quality -> Perceived Usefulness	0.290	0.297	0.071	4.088	0.000	Accepted
System Quality -> System Use	0.394	0.399	0.080	4.953	0.000	Accepted
System Use -> Individual Performance	0.775	0.774	0.029	26.379	0.000	Accepted

As illustrated in Table 6, the Beta (β) value between Information Quality and Perceived Usefulness is 0.336 while t-statistics value is 4.116 and the P value is 0.00 so the path between these two demonstrates an acceptable value. The

Beta (β) value between Information Quality and System Use is 0.045 while t-statistics value is 0.582 and the P value is 0.56 so the path value between these two variables demonstrates an unacceptable value. The Beta (β) value between Perceived Usefulness and System Use is 0.287 while t-statistics value is 3.110 and the P value is 0.02 so the path between these two demonstrates an acceptable value. The Beta (β) value between Service Quality and Perceived Usefulness is 0.186 while t-statistics value is 2.810 and the P value is 0.005 so the path between these two demonstrates an acceptable value. The Beta (β) value between Service Quality and System Use is 0.105 while t-statistics value is 1.823 and the P value is 0.069 so the path between these two demonstrates an unacceptable value. The Beta (β) value between System Quality and Perceived Usefulness is 0.290 while t-statistics value is 4.088 and the P value is 0.00 so the path between these two demonstrates an accepted value. The Beta (β) value between System Quality and System Use is 0.394 while t-statistics value is 4.953 and the P value is 0.00 so the path between these two demonstrates an accepted value. The Beta (β) value between System Use and Individual Performance is 0.775 while t-statistics value is 26.379 and the P value is 0.00 so the path between these two demonstrates an accepted value.

6.6) Testing the Goodness of Fit

To test the Model Fit, it is also called explanatory power which can be assessed by two criteria: Coefficient of determination (R^2) and standardized root mean square residual (SRMR) values. According to Chin (1998), R^2 value near 0.670 is indicating considerable, value near 0.333 indicates average, and value near 0.190 and lower described as weak. While SRMR values should be greater than 0.05 and less than 0.08 than we can call a model as Fit Model. The values of R^2 are illustrated in Table 7.

Table 7: R-Square Values

Indicators	R-Square
Individual Performance	0.6
Perceived Usefulness	0.539
System Use	0.55

The Values of R^2 for LVs (Individual Performance = 0.60), (Perceived Usefulness = 0.539), (System Use = 0.55). The acceptable values for the

coefficient of determination (R^2) demonstrate the explanatory power. All the LVs values are within the premises of acceptable values as per Chin (1998), which advocates that the model is highly fit. On the other hand, SRMR value is measured in Table 8.

Table 8: SRMR Values

SRMR Test	Original Sample (O) B	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (O/STDEV)	P Values
Saturated Model	0.056	0.042	0.003	18.809	0.000

The Values of standardized root mean square residual (SRMR) are within the premises of acceptable, which advocates that the model is highly fit. The Beta (β) value SRMR on original sample is 0.056 while t-statistics value is 18.809 and the P value is 0.00 so we can conclude that SRMR values advocate goodness of fit test for the measurement model in this study.

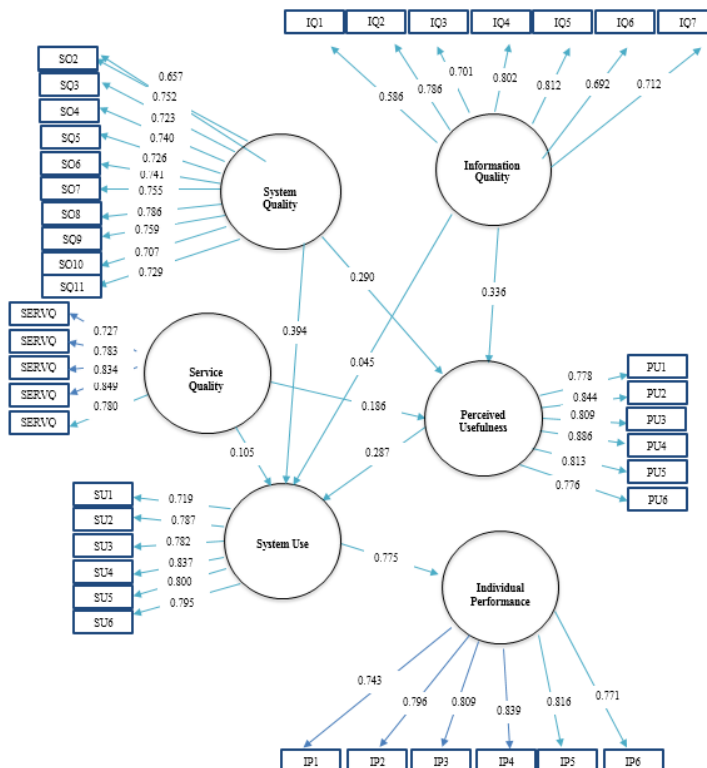


Figure 2: Testing Path Model

7) CONCLUSION

Enterprise resource planning (ERP) is one of a big-time slogan in the current era. Due to technological advancement in every single sector of life, we can see that things are getting closer and processes are becoming shorter and comprehensive. Technology has brought the human being to a single platform where they can communicate boundary less in a blink of eye. Many studies proved that ERP system has enhanced industries and factories processes.

In this study, some useful results occurred in the field of ERP. An extended ERP success model has been introduced with the integration of TAM model construct. The results of this study confirm the findings of DeLone & McLean model from United States, making this model applicable in Pakistan to understand the acceptance of ERP System among various private organizations in Pakistan.

8) LIMITATIONS AND FUTURE DIRECTIONS

- This study did not address the effect of Intention to use and Net Benefits variables presented in the original DeLone and McLean updated model so in future studies these missing variables may be included.
- The future studies may include employees from Public Organizations and Semi-Govt Organizations or NGOs to generalize the proposed model of the study.
- This study also recommends the reflective constructs suggested for more theories.

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