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Enterprise Systems in the Post-Implementation Phase: An Emergent Organizational Perspective*

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Abstract

Enterprise system (ES) reflects a significant IT commitment to achieve corporate goals and satisfy its thrust toward a sustainable competitive advantage. This research investigates the required ES architecture, the value of a well-planned ES, and the human factor capabilities that drive the effective implementation of ES from a management perception. This paper examined the critical factors shaping the business systems' performance, architecture readiness, experts' readiness, and enterprise systems planning. Based on an extensive literature review, the attributes of factors mentioned earlier were identified, classified and then statistically examined using the author's' proposed conceptual structural model. This study employs a quantitative research methodology, with a random sampling technique. This paper has used the data collected from 510 respondents working in service, engineering and health sectors in OMAN. The study model analysis utilized both exploratory and confirmatory factor analysis, followed by a structural equation modeling using SPSS 25 and EQS6.3 statistical tools. The results unveil a piece of remarkable and robust evidence suggesting that ES planning is the most significant aspect of influencing performance, followed by IT personnel, staff and consumers expertise, and architecture readiness.

Keywords: Enterprise Systems, Enterprise Architecture, IT Planning, Confirmatory Factor Analysis, Sultanate of Oman

JEL Classification Code: M14, M15, L21, O14, O15

1. Introduction

The role of enterprise systems (ES) is to ensure that data and information flow smoothly to intended individuals in the correct form to enable accurate, efficient, and effective decisions (Martono et al., 2020). Although the global success ratio of implementing ES is 49%, it is considered one of the most potent tools affecting the organization's output (Mahmud et al., 2017). To investigate further, ES must-have factors critical to its success to be able to reflect on all business processes to accomplish the anticipated goals, improve business performance, increase the achievement degrees, and to develop outputs value (Ingsih et al., 2020; Khan et al., 2020; Zhong & Seddon, 2009).

Various officialdoms still view IT as an expense rather than an investment and a way to enhance performance and increase efficiency and productivity (Rezvani et al., 2017). Laudon and Laudon (2016) demonstrate that numerous corporations today rely on information systems to operate their businesses, drive expansion, achieve success, and maximize profitability.

Claybaugh et al. (2017) said that integrating business functions into a single coherent system is absolutely essential to respond to the ever-changing business environment where enterprises have felt that need. Such solutions are called enterprise systems, which lead to the utilization of information technology efficiently and facilitating the internal sharing of data and information to supporting the required communication with vendors and customers. Davenport (2000) claimed that enterprise systems now are the focal point of integrating business functions, bridging the entire

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enterprise and facilitating the needed flow of information business processes as they navigate the departmental boundaries by using both unified and centralized interfaces and databases (Vandaie, 2008).

An enterprise system is used to gain a competitive or strategic advantage (Baltzan & Phillips, 2008) to develop products, services, and employ competencies that give the organization significant powers over the market's competitive forces (Bounabat, 2005). Creating such strategic systems requires a comprehensive understanding of the entire organization and its interactions with external agents in the business environment, such as suppliers, consumers, workers, and rivals (Leonard & Higson, 2014; Luftman et al., 2004).

Enterprise system (ES) is defined as the integration of the vital business processes of the entire organization into a single application system to allow information to flow seamlessly right through the organization (Bounabat, 2005), where "system" is crucial to reduce costs and improve overall company performance as indicated by (Wu & Wang, 2007; Khan et al., 2020).

Comparing to complete isolated functional systems (Baltzan & Phillips, 2008); ES is seen now as a crucial and critical tool to manage activities, decisions, and information across the firm's different platforms, tasks, and business units, and is based on a unified single principal data repository to deliver an aggregate and unique view to all employees, customers, suppliers, and vendors, and also to eliminate redundancy and replication of information and business processes (Fui-Hoon et al., 2001) and (Bounabat, 2005) by modelling these processes (Rosemann et al., 2001). It enables coordination and integration of daily activities, responds efficiently to customer needs, channels the needed imperative data to facilitate the executive works on decision making (Ho & Lin 2004), and diminishes associated time and costs and creates an efficiency thrust in organizational procedures as argued by (Arinze & Anandarajan 2003).

One cannot forget the embedding challenges facing ES, such as the high development and implementation cost (King & Burgess, 2006). In addition to the required fundamental technological, organizational changes like what (Davenport et al., 2004; Plaza & Rohlf, 2008) indicated.

2. Literature Review

2.1. Enterprise Systems' Success Factors

Grant & Chen (2005) believed that the enterprise system is a valuable organizational resource with a strategic impact as a dynamic capability (Appelbaum et al., 2017). Several factors affect the successful implementation of enterprise systems. Bounabat (2005) claimed that such factors contain the support of top management (Liang et al., 2007), effective organizational change management policy, efficient project management, team composition, comprehensive business process re-engineering, and user involvement and participation (Hasan et al., 2018; Robey et al., 2002). Moreover, Plaza & Rohlf, (2008) proved several technological factors in reaching IT successful systems implementation, such as architecture readiness, ES planning, and ES experts' staff and users' readiness, as illustrated from a managerial perspective.

2.2. Enterprise Systems' Architecture Readiness

Weil & Broadbent (1998) claimed that it was vital for organizations to make valid justifications related to architecture investments to reach organizational goals. These investments are affected by the way the managerial level views the architecture, as a factor that supports business plans and processes, or as an enablement tool to meet strategic goals (Tuan et al., 2018); by having an explicit architecture that can adapt with organizational goals changes, or giving the capability to the organizations to change (McNurlin, & Sprague, 2006; Weil & Broadbent, 1998) to achieve the service-oriented architecture (Haag & Cummings, 2008), which means a high level of assimilation of new services. Additionally, Marlin & Benson (1998) stated that information system architecture should be aligned with the business plans and strategy, and vice versa; as information technology opportunities can impact the business plans and strategy of the organization and Architecture, which should be built to drive IT as in (Drnevich, 2006). Information technology architecture provides a platform that a system is based on (Laudon & Laudon, 2016), so there are many reasons firms give much interest to the readiness of its Architecture, such as running their businesses more efficiently (Alzhanova et al., 2020). IT architecture refers to sets of physical IT assets and skills, including computer hardware, communication networks, databases, business applications, and IT human resources (Grant & Chen, 2005), and it is a source of competitive advantage, so IT architecture investment is a crucial decision to obtain benefits in future from growth and flexibility (Weill et al., 2002; Seddon et al., 2010).

The demands of new business initiatives are immediate, but building a tailored strategy-enabling architecture often takes considerable time and knowledge, and pinpointing these needs is not easy (Hammami et al., 2015; Khan et al., 2020). Consequently, organizations need to make valid justifications to architecture investments, which should be accurate in defining the IT portfolio's tangible and intangible benefits (Weill & Broadbent, 1998; McNurlin & Sprague, 2006). It is essential to make sure that architecture is a staunch supporter of business services and products and to view IT architecture in business terms (Weill et al., 2002; Monk & Wagner, 2006), as technology is a need, enabler, and service. Besides, IT architecture investment includes market demand for a firm's services, a firm's business strategy, a firm's IT strategy, Architecture,

cost, information technology assessment in comparison to competitor firm facilities, and competitor firm IT architecture investments (Luftman et al., 2004), so there is a need to increase the efficiency of the architecture, effectiveness, and flexibility. In summary, IT architecture's primary characteristics are flexibility, availability, scalability, reliability, and performance (Baltzan & Phillips, 2008).

- Flexibility is the organization's ability to respond to sudden and planned changes like what was discussed by (Fink & Neumann, 2009; Baltzan & Phillips, 2008; Wu & Wang, 2007; Kovacs & Paganelli, 2003).
- Scalability is the capacity to adapt to more increased demands as the organization grows and expands to serve a more significant number of users as what was mentioned by (Laudon & Laudon, 2016; Baltzan & Phillips, 2008; McNurlin & Sprague, 2006; Kovacs & Paganelli, 2003; Weill et al., 2002; Rao, 2000).
- Reliability is when all systems provide the required intended information and functioning as planned for according to (Baltzan & Phillips, 2008; Weill et al., 2002; Wu & Wang, 2007; Rao, 2000).
- Availability means that the system is always accessible 24/7/365 and can be accessed without fail, so it is 100% operational (Laudon & Laudon, 2016; Baltzan & Phillips, 2008; Kovacs & Paganelli, 2003; Weill et al., 2002; Rao, 2000).
- Performance reflects the effectiveness and efficiency of specific processes and transactions, as indicated by (Baltzan & Phillips, 2008; Kovacs & Paganelli, 2003; Rao, 2000).

2.3. Enterprise Systems' Planning

Organizations currently consider enterprise systems as an appropriate IT investment tool, as most CIO/CTOs, moreover, CEOs and leading functional managers, positively expect a progressive ROI due to the organization (Sedera et al., 2004). Soto-Acosta & O'Cerdan's, (2009) research confirmed a positive relationship between planned robust business strategies and performance for IT system, and, more specifically, E.S. Chofreh et al., (2018) argued that sensible planning of the enterprise system could be seen as a critical success factor to be considered, where it is seen as a valuable resource of the organization (Dwivedi et al., 2015).

This notion was also confirmed by (Brown, 2006), where he called for the adoption of strategic information systems planning, as it would achieve success for the enterprise. Furthermore, McNurlin & Sprague (2006) suggested that business enterprises must practice the sense and respond strategy, as he viewed it as the right answer to address an ever-changing, unstable environment. Moreover, the organizational planning needs are cooperative synergies among all organizations' stakeholders, while careful ES planning of the enterprise system must be the driver for success (Beard & Sumner, 2004). Consequently, it was noted by Laudon & Laudon (2016) that IT investment is a complicated question, and IT-related expenditures can represent a significant return on investment for the firm, so it requires much care in planning investment decisions (Sumner, 1999). Also, Laudon & Laudon (2016) claimed that understanding the link between investments in technologies and planning business performance was vital to make wise Information technology investments and assure that IT investments align with business strategies (Drnevich et al., 2006).

2.3.1. Enterprise Systems' Planning Pillars

Corporate strategy and IS strategy should always complement one another exclusively to ensure a successful information systems acquisition and deployment of information technology and organizational competitiveness, as seen in the works of (Grovera & Segarsb, 2005; Baets, 1992; Henderson & Venkatraman, 1999; Das et al., 1991; Lederer & Sethi, 1988; Henderson et al., 1987; Bowman et al., 1983; King, 1988). Also, understanding the functionality and process of ES developers' internal functional operations is essential and reflects the development importance, implementation plans, and managerial responsibilities to ensure a degree of collaboration achieved. Teamwork is also crucial to decrease the likelihood of misconception that may risk IS plans' application, as argued by (Grovera & Segarsb, 2005; Lederer & Sethi, 1988; Boynton & Zmud, 1987; Scott & Vessey, 2002; Henderson & Venkatraman, 1999). Adequate planning will be enhanced, as IT projects roles are considered necessary competence to empower the organization, and its effect will be seen as an improvement in the organization's overall effectiveness (Alkhaldi et al., 2017; Hammami, & Alkhaldi, 2012).

2.4. Enterprise Systems' Experts Readiness

As the organization becomes multifarious due to the management hierarchy changes and the required coordination across departments. Each staff role and management layer has different information needs and requirements (Motiwalla & Thompson, 2012). A people-oriented business approach is an appreciated objective of the most contemporary organizations (Luftman et al., 2004; Rao, 2000), where the focal point of enterprise system success is established where knowledge workers, IT professionals, and experts exist. They indicated that IT professionals must possess many essential skills, such as teamwork, valuing and comprehending business vision and concerns, the ability to self-motivation and development, and the ability to acquire knowledge from the assignments and ventures. IT Human Resource performs various crucial roles, such as systems development and resource planning (Grant &

Chen, 2005). The "people" dimension in the enterprise system's perspective is recognized in this research as three key players: vendors, consultants, and clients (Plaza & Rohlf, 2008).

Avison & Fitzgerald (2006) suggested developing a comprehensive information system to reflect the organization's primary functions rather than enhancing the utilization of all organizational capabilities and resources. Most importantly, enterprise systems need solid planning and vision because IT should be viewed as the means and not the desired end and, importantly, it should match the culture, values, and needs of the organization; also, one of the essential benchmarks is the user engagement in the project (Hwang & Thorn, 1999; Hammami, & Alkhaldi, 2012).

3. Research Model and Hypotheses

According to the literature analysis, the researchers proposed a conceptual research model, as shown in figure 1 and the hypotheses were formed as follows:

H1: *There is a significant belonging relationship between enterprise systems architecture readiness and its components (flexibility, scalability, reliability, availability, and performance).*

H2: *There is a significant belonging relationship between enterprise systems planning and its components (Alignment, Analysis, Cooperation, and Improvement in Capabilities).*

H3: *There is a significant belonging relationship between enterprise systems experts' readiness and its components (HR planning, turnover ratio, rational assignment of IT staff into business, IT and staff capabilities).*

H4: *IT architecture readiness has a positive effect on using the enterprise system's application rate.*

H5: *Proper planning of an enterprise system is positively associated with the enterprise system's application rate.*

H6: *Greater presence of IT experts is positively associated with the enterprise system's application rate.*

H7: *There is a significant belonging relationship between enterprise systems and its components (architecture readiness, planning, and experts' readiness).*

4. The Context

One of the main pillars for Omani 2040's vision is to develop the required sustainable economy is the private sector at the Sultanate of Oman. According to the Ministry of Commerce and Industry annual report 2018, 29.8 percent of 20.4 thousand registered companies have a capital more than $ 150k. An average of 76.8 percent of the total employment is based in the private sector, compared to 10.2 percent in the government sector and only 12.9 percent in the family sector. Besides, males account for around 60.67% of 238,688 private-sector workers in Oman.

Omanis constituted about 84.3 percent of the government sector's total employment during 2017, compared to only 13.7 percent in the private sector. In 2017, Non-oil activity contributed 74.4 percent of GDP compared to 77.3 percent in 2017. Moreover, 2.8 percent increased the total value added of industrial activities in 2017 due to increased value-added mining and quarrying by 15,1 percent, and manufacturing by 11,3 percent. Besides, 3.3 percent was the increase in the total value added of service activities in 2017. Regarding the health sector, more than a quarter (27.6 percent) of hospitals operating in the Sultanate in 2017 belonged to the private sector. The aggregate spending on the healthcare sector in Oman approximates to around 2.7 percent of the GDP (Information and Statistics Department, 2018).

5. Research Methodology

Factor analysis was initially traced to (Galton; 1889; Pearson & Lee; 1903), and it is credited by (Spearman, 1904) when a factor model was developed to reflect the mental abilities structure (Kaplan, 2008). A quantitative approach was used in this study, exploratory and confirmatory factor analysis are used, and they belong to the core set of statistical analysis instruments (Hair et al. 2014) to measure the relationships proposed in the model. The data was acquired using a survey questionnaire technique designed to examine the proposed research model's validity and hypotheses. The questionnaire was distributed to various individuals with different management ranks (employees, seniors, and managers) within organizations in the private sector, with a good working enterprise system and an IT department that manages IT-related works. The questionnaire was distributed to a sample of 565 respondents that met the required testing criteria.

6. Data Analysis

The authors distributed 565 questionnaires to companies working in three different Omani sectors; 510 valid responses were received for analysis with a ratio of 90.0%. The valid sample distributed as follows: Industry and Engineering Companies 37.5%, Health Care Sector 48.4%, Service sector 14.1%; all of these companies use an enterprise system and have IT departments. The sample analysis showed that male constitute 2/3 of the data collected (61% were males and 39 % females). Age distribution comes up to be more harmonized for all age group (20 years up to 55, with 5-year group range) with an average of 16% for each group, except for age group of above 55 that comes last of less than 3%. As for duration (experience) with ES job, results showed that a total of 51% respondents have more than (6–10) years' experience, followed by second group of (1–5) years with less than 30%, the group of more than ten years scored 12%, and the last group of fewer than one years accumulated less than 7%.

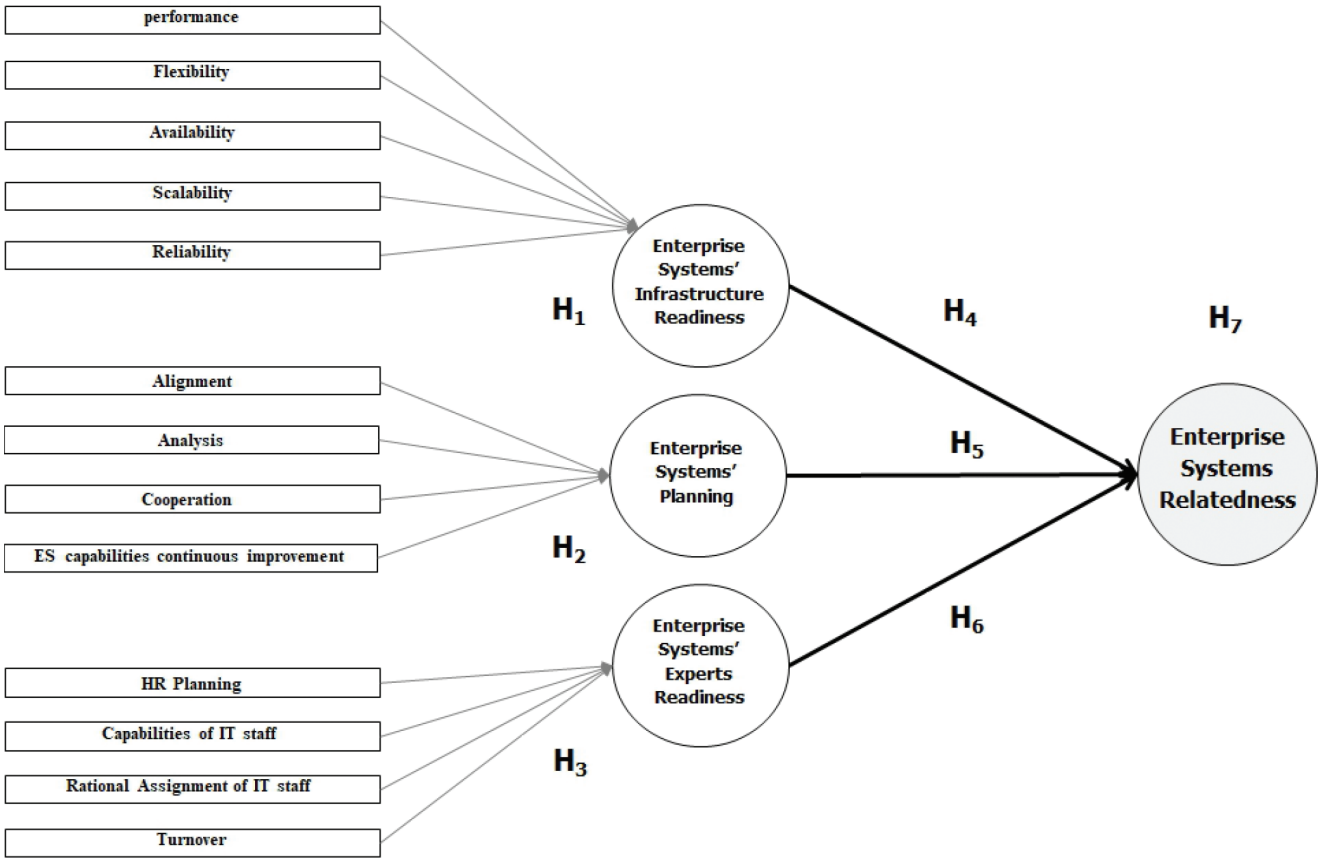

Figure 1: Hypothesized Research Model

6.1. Normality

Normality was tested by examining the degree of the sample distributions data compared to the normal distribution (Gravetter & Wallanau, 1992). Standard deviation (SD), skewness, and kurtosis were used to investigate normality. The statistical results showed that standard division with a maximum score of 1.03, skewness of a maximum score of 1.02, and kurtoses of a maximum score of 1.3, and all of these scores are well below the threshold, accordingly, normality was established. It was also concluded that there is a general agreement between the respondents about the importance of the organization's enterprise systems' architecture readiness as the average equal to 3.80. The respondents' average about the importance of the enterprise systems' planning readiness in the organization equal to 3.47. Therefore, there is a lack of awareness regarding this item. Moreover, there is a lack of awareness between the respondents about the importance of the enterprise system experts' readiness in the organization, with an average of 3.57.

6.2. Enterprise System Constructs

6.2.1. Enterprise System Architecture Construct

Items representing the enterprise system architecture are displayed in Table 1. One item was eliminated (Performance) as it violated the EFA roles in the first run (Loading = 0.431) as recommended by sample size, items that have a loading of less than 0.5 should be removed (Hair et al., 2010), all other variables were accepted. In the second of EFA, run loadings of architecture dimension range from 0.641 to 0.779, showing a clear discriminated validity, which indicates that well-discriminated validity is established among variables and represents one dimension, which is enterprise system architecture to represent the four variables by one dimension as illustrated in Table 1.

6.2.2. Enterprise System Planning Construct

The planning construct is the second ordered factor showed a discriminated validity, where loadings range from

Table 1: Explanatory Factor Loading Results

Variable	Loading
Enterprise system Architecture construct (1st run)	
Architecture Flexibility	0.732
Architecture Performance	**0.431**
Architecture Availability	0.712
Architecture Scalability	0.745
Architecture Reliability	0.553
Enterprise System Architecture Construct (2nd run)	
Architecture Flexibility	0.774
Architecture Availability	0.731
Architecture Scalability	0.779
Architecture Reliability	0.641
Enterprise system Planning Construct	
Planning Alignment	0.686
Planning Analysis	0.816
Planning Cooperation	0.830
Planning Improvement in Capabilities	0.674
Enterprise system experts Construct	
Human Resources Planning	0.697
Professional Capabilities the IT Staff	0.805
Rational Assignment of IT Professional	0.732
High Employee Turnover	0.647

0.674 to 0.830; the summed variable was derived from the four items (Planning Alignment, Planning Analysis, Planning Cooperation, Planning Improvement in Capabilities) representing the enterprise system planning construct to represent the planning variable. Thus, the Enterprise System Planning construct is represented in this study by one dimension, enterprise system planning.

6.2.3. Enterprise System Experts' Construct

Factor analysis indicated the existence of a single dimension of ES Experts constructs. All the variables in Table 1 are validated and explained. As recommended by (Hair et al., 2010), the factor analysis showed non-discriminated validity on sample size. Loadings range from 0.647 to 0.805, indicating a non-discriminated efficacy for the high employee turnover item, which means that we need to eliminate this item

6.3. Reliability and the Measurement Model Components

Three independent sub-constructs (indicators) were developed that encompasses the overall proposed model of ES,

Table 2: Structural Equation Modelling Results

Regression Path	(β)	*T* Stat	R^2
Architecture = f (ES)	0.706*	7.34	0.499
Planning = f (ES)	0.967*	7.96	0.936
Experts = f (ES)	0.708*	7.31	0.501

*All Standardized Beta (β) and *t* statistics values are accepted at 0.05 significant level.

- Enterprise System' Architecture (Infrastructure)
- Enterprise System' Planning (Planning)
- Enterprise System' Experts (Experts)

Reliability was confirmed by Cronbach's Alpha measure of the collected data as it scores 0.756, which is acceptable in such studies, KMO stands for the Kaiser-Meyer-Olkin Measure of Sampling Adequacy of the sample and is equal to 0.887, and total variance explained is 62.665%. Chi-Square equals 2318.209 with a degree of freedom of 66 at the significance level of 0.000. Factor loading for the three constructs ranges from 0.866–0.794. All these indicators give the impression that the sample is adequate for analysis, and the results are reliable.

6.4. Model Fitness

The proposed model was analyzed by employing a structural equation modeling method; a robust second-order confirmatory factor analysis modelling technique was used to validate the constructs. The results can be seen in Figure 2. Chi-square was tested significant at 0.05 level, (X_2 = 56.9356, df = 46, P = 0.129), fit measures shows that the measurement is established and adopted for testing the research hypotheses, NFI = 0.963, NNFI = 0.989, MFI = 0.989, IFI = 0.993, CFI = 0.993, while RMSEA = 0.022 (All fitness criteria should exceed 0.90, with RMSEA must score below 0.5, and Chi^2 probability should be more than 0.05), based on the above results the model was accepted and fit to conduct further relationship analysis and testing hypotheses.

The measurement model reflects the research inquiries, which argued a significant relationship between ES and the proposed components (Architecture, Planning, and Experts), to investigate possible significant associations between ES and the three proposed pillars. Standardized significant beta was adopted as the lead indicator to confirm the proposed relationship for this relationship. Table 2 and Figure 2 shows a significant positive correlation between ES and each pillar, as the value of test statistics (*t*-test) exceeds the valid mark of 2.56 at a 0.01 significant level for all three ES factors. The coefficient of determination (R^2) was also used to validate the hypotheses. Based on the CFA measurement model results, all hypotheses were accepted.

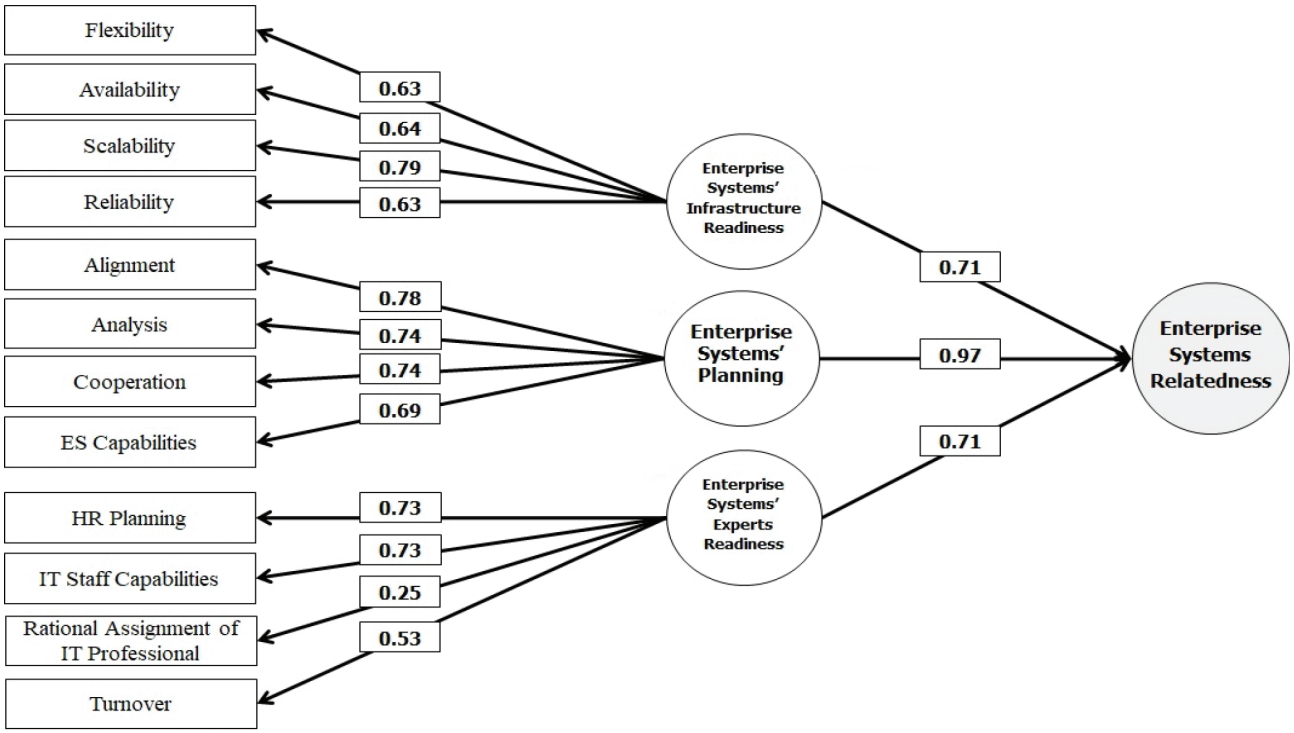

Figure 2: CFA of the Measurement Model with Significant *β* Value

7. Conclusion

Enterprise system planning construct was confirmed and validated as the leading factor that explained over 0.967 on the ES system's total effect. It is recommended that organizations pay more attention, employ and utilize this crucial factor to the organization's success in achieving enterprise system readiness. Organizations also are advised to utilize the power of planning analysis, planning cooperation, and planning improvement in refining organizational capabilities. Enterprise system architecture constructs and enterprise system expert readiness' construct, which came second, are equally important, as the findings showed that scalability is a leading attribute in the architecture domain. Meanwhile, human resources planning and the IT staff's professional capabilities of the expert's construct are equally effective in supporting enterprise system readiness and success.

The findings of this research are limited to the organizations within the scope of this study in a limited time-frame, so researchers are encouraged to validate the proposed model in other environments and apply the model to larger enterprises across the world to provide a more comprehensive understanding of enterprise systems pillars (ES architecture, ES planning, and retaining of ES experts). This research was implemented in the Oman business environment, so further studies need to be conducted to implement these outputs successfully by carrying out this study in larger enterprises elsewhere.

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