An Empirical Investigation of the Information Technology Implementation in Saudi Arabia

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ABSTRACT: *This research paper addresses the issues affecting information technology development and deployment extensively in Saudi Arabia. The issues specified in this paper have addressed the environment in IT implementation processes, especially with regard to the question of the perceptions and difficulties of the implementers at both government and private sectors. This study will provide an exploratory focus on the major problematic issues surrounding IT implementation in the country and how implementers perceive them. The study has identified 16 specific issues under 8 thematic divisions of information technology and studied the difficulties of selected implementers. The implementers were classified into proficient and novice and the significant differences of them are also addressed. Based on the identified problems, effective solutions were also presented for a long term strategic planning and implementation.*

Keywords: IT implementation, IT Governance, IT architecture

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1. Introduction

Information technology has become an essential tool as well as the means for a large sector of users and facilitates the daily lives in every area. It is one of the most prominent resources in the modern era, which many people tend to depend.

The use of computers at the beginning of the evolution of information technology was limited to a few groups of specialists in research centers and scientific laboratories due to the cost and lack of the knowledge of its use. With the lower cost of computers and increased specialists in many sectors, the use of computer has expanded to include many applications in government and private agencies. The applications have potential to process voluminous data and the use becomes widespread and frequent. The availability and use of information systems and technologies has grown almost to the point of being commodity like in nature, becoming nearly as ubiquitous [1].

However, the use of computers in recent years has spread dramatically to become part of the lives of individuals as well. The reason behind the widespread of the computer in recent years is the global networking of computers, “the Internet”. Although we all live in the information age, there is an unequal participation in the societies and countries due to skewed deployment of information technology. The people who use the technology now face a variety of obstacles and issues. Many organizations and countries suffer from several problems in dealing with technology; and, Saudi Arabia is not in isolation from these problems, and it is facing many of them.

2. Extracting efficiencies and synergies in Information Technology

Thus, to promote the application further and to offset many limitations, the difficulties are being now documented at many organizations and countries. As countries differ significantly in terms of the nature and magnitude of the problems, researches studied the difficulties independently.

Even the Information and communication technology (ICT) is flourishing in the Arab world at a rapid pace, the ICT implementation is not going smoothly or without major problems that hinder and slow down the progress in many countries in the area. [2]. With the emergence of an expanding interdependent global economy, information systems (IS) strategists need

to face the challenges of internationalization. The growth of multinational business has led many corporations to support significantly high level of IS operations and IS applications in Arab countries. [3].

The survey by *Tiamiyu* [4] (2009) revealed that in Nigeria due to either lack of computing technologies in most of the agencies or of their ineffective exploitation, the majority of the personnel were, still unaware of, or unimpressed by, the productivity potentials of using computers. There is a considerable pressure on most organizations to make their operational, tactical and strategic process more efficient and effective. [5].

The preceding discussions on information technology problems lead to understand us in two directions. First, is the existence of the problems across countries and second is the variance in the problems among them. This, it is imperative to discuss each country's problem in their own perspective based on empirical data.

3. Information Technology Architecture

Huber [6] suggests that Information Technology (IT) is a variable that can be used to enhance the quality and timeliness of organizational intelligence and decision making thus promotes organizational performance. However, Huber's analysis was offered at a time when IT was making its first major inroads into organizational life and subsequently the researchers have extended and updated Huber's research. It was applied to the examination of organizational functioning by describing the impact of IT on a broader array of organizational characteristics than was addressed in Huber's work. [7].

The information technology measurement framework was proposed by many researchers such as, *Markless* and *Streatfield,* [8], *Mendonca et al.,* [9] and *Kaplan* and *Norton* [10, 11, 12]. These initial frameworks need to be assessed and implemented. Keeping in view of the localization and its influence, we believe the significance of generating local framework to address the national characteristics. In order to offer a more encompassing view of IT and organizational functioning, we examine IT as a moderator of the relationship between organizational characteristics and several organizational outcomes, most importantly, efficiency and innovation (See Figure 1). The characteristics and capabilities of countries can be determined by the two levels of Technology extraction, viz., high and low. It is tangible to conclude that the high extraction leads to higher degree of efficiency, knowledge codification and innovation. On the other hand, failure of extraction will have a bearing on the execution of technology.

The framework proposed will enable to draw a plan of understanding the IT implementation in nations such as Saudi Arabia.

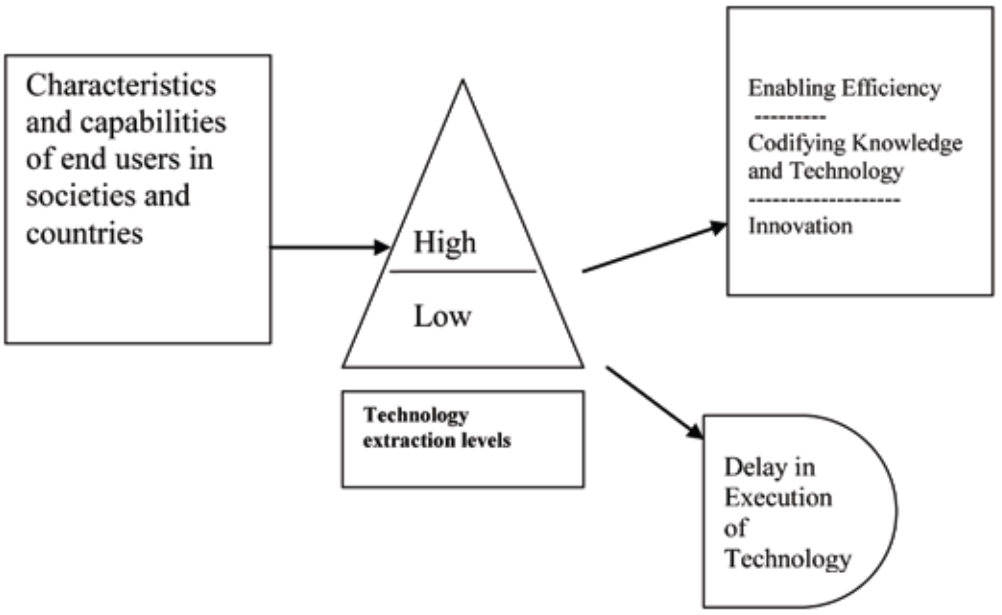

Figure 1. Role of Information Technology in the contribution to countries

4. Research Problem

It is clear from any questions that the information age is the reality and both public and private institutions are experiencing an increase in the use of a variety of information technologies (IT). Realistically, it has become nearly impossible for an individual or country to work without the use of one or more IT. From the period of the application of IT, it is viewed as the means for addressing the organizational challenges. However, it is the pertinent to pose a question – whether the application and exploitation is equal across countries. If not, what mechanisms need to be introduced to track the problems and how the local conditions can be monitored and recorded for proposing remedies?

The gap and the problems that exist in the societies and countries in terms of the effect and implementation failure were extensively treated by *Gottschalk,* [13, 14, 15], *Boar* [16] and *Lee* and *Bai* [17].

There are multiple, interrelated issues which impact effective IT implementation in Saudi Arabia. These issues must be identified and addressed before an IT implementation model for Saudi Arabia can be developed.

5. Research community and the data for the study

The research community focused in this study consists of computer system operating users located in the government as well as private sectors. We have limited our study to nine organizations that include the government sector and private sector.

A total of 120 questionnaires were distributed during the period April, 2009, and collected on various dates in May, 2009. These One hundred and twenty questionnaires were distributed in 9 organizations. In addition, several initiatives were taken to ensure a satisfactory response rate such as: the front page emphasized the assurance of respondent's confidentiality; the number of questions was limited to fit a four-page layout. Also, only necessary and relevant questions were asked to avoid redundancy and to maintain reliability.

Our study has two divisions as follows:

1 - The first part deals with the basic data of the members of the community study.

2 - The second part deal with – IT work and service that is divide into nine sections as follows:

- Consists of six questions of data management and data infrastructure.
- Consists of three question of personal computer and operating system
- Consists of five questions of collaboration tools.
- Consists of five questions of enterprise applications
- Consists of six questions of networking and communications
- These Section of security divide into two part:

-Consists of four questions about some application of security apply in its organization.

-Consists of eight questions about some problem in security facing Daly while they work.

-Consists of three questions about software and web development.

6. Data Analysis

The data extraction through the respondents was carried out in a longitudinal study. The user population has the following types and characteristics.

6.1 User population

The studied users have heterogeneous characteristics. In information access, use and exploitation, the research literature has identified two classes of end-users. These two classes of end-users such as 'proficient' and 'novice' have significant impact on the analysis of results. There is a wide variation between these two types with respect to their characteristics.

The Characteristics and Definition of Proficient and Novice: The proficient not includes the factor, 'experience' rather it denotes the extent of 'ability' the end users have. It happens that many experienced users do not possess skills and techniques in the implementation of information technology. In many organizations, the entry-level users score over others. The classification

for this study is thus the division of them in to the above two categories. To ascertain their levels, the division head is asked to specify the levels of them. The table 1 reflects their categories.

	Total	Novice	Proficient
Area- Hardware Type - Novice Proficient	19	11	8
Area - software novice Proficient	31	7	24
Area - networking novice Proficient	25	6	19
Area - services novice Proficient	2	1	1
Area - manager novice Proficient	5	1	4
Total	82	26	56

Table 1. Classification of IT implementers

The classification of the users is based on the decision of their respective division heads as they assess the IT implementers for a longer period. The table 1 indicates the number of implementers in five identified areas.

Measure	**Factor Loadings**	**t-value**
A. Data Management and Data Infrastructure (n=82)		
Difficulty in back-up of data (valid =81; Missing = 1)	.59	12.15
Difficulty in Data Recovery (valid =79; Missing = 3)	.59	18.32
Difficulty in Data Security	.62	18.76
Supporting for business intelligence using data (valid =80; Missing = 2)	.91	22.43
Supporting from data centre for data analysis (valid =80; Missing = 2)	.61	17.59
B. Personal Computer and Operating Systems		
Convenient type of computer to use	.88	20.24
Prefer operating systems:		

Limitations in using the OS they have (valid =78; Missing = 4)	.63	17.65
Collaboration Tools		
Using E-Mail Client:	.79	19.54
Using Web Presentation Software (valid =78; Missing = 4)	.69	17.82
Using Spreadsheets	.68	16.82
Using Word Processing	.87	19.85
Enterprise Applications		
Using ERP application: (valid =79; Missing = 3)	.64	16.42
Using of Workflow Management tool (valid =80; Missing = 2)	.62	16.98
Document management tool (valid =80; Missing = 2)	.74	16.72
Using Groupware	.57	14.54
Networking and Communications		
Using LAN:	.66	18.02
Using WAN:	.62	17.76
Using Ethernet	.61	17.52
Using Network Interface Cards (valid =76; Missing = 6)	.60	16.85
Using VPNs (valid =74; Missing = 8)	.59	16.86
Security		
Using Encryption applications	.73	17.45
Using Digital Signatures application	.59	18.64
Using E-commerce Security applications	.61	19.49
Experienced Intrusion problem	.86	19.05
Experienced Tampering problem (valid =68; Missing = 14)	.73	16,88
Experienced Virus problem	.82	17.52
Experienced Spyware problem	.65	14.62
Experienced E-mail Fraud problem (valid =64; Missing = 18)	.77	18.68
Experienced Phishing problem	.66	17.56
Software and Web Development		

Using ASP, PHP, HTML,XML Applications / Languages	.58	16.96
Using Java, Middleware Applications / Languages	.52	15.76
Using Programming Languages	.51	15.46
Storage Management		
Prefer storage managements to store data	.86	18.96
Network Management		
Difficulty in network technology	.65	18.52

Fit indexes

Goodness-of-Fit Index (GFI) = .91

Adjusted Goodness-of-Fit Index (AGFI) = .89

t values are significant at p < .05

The t values are measured at where valid data is total sample.

Table 2 - Factor Analysis Data

6.2 Measurement Issues

The total factor analysis data is given in the table 2. All scale items of the data about implementers were measured with a 2-level scale, ranging from '*difficulty'* and '*no difficulty'*, largely on the basis of validated scales. The operation was largely based on an instrument from *Ad de Jong* and others' tolerance model. [18] (2003). The usefulness and ease-of-use scales were measured using a scale designed initially by *Davis* [19] (1989). Innovativeness and risk aversion were measured using items from a scale developed by *Grewal, Mehta, and Kardes* [20] (2000). However, the scale of *Ad de Jong* was modified by this study as *Jong* has employed a 7 point scale.

For the factor loadings, two systems were used to test the factors and item loadings of the scale constructs. We first used the coefficient and the factor structure (through principal component analysis) for all the scale items simultaneously. The factor structure was achieved with items loading on the assumed dimensions. In addition, we performed a confirmatory factor analysis (CFA) In addition the fit indexes of the proposed factor model, construct reliabilities of the scales, and confirmatory factor loadings with *t*-values for each item are represented in Table 2. The proposed factor model generated indexes as defined below that reads two measures called the Good fit (Goodness-of-Fit Index [GFI] = .91 and Adjusted Goodness-of-Fit Index [AGFI] = .89.

The factor loads are tested by different researchers earlier that used the coefficients. According to *Nunnally* and *Bernstein* [21], if the Coefficients of all measures were equal to or greater than .80, then it implies that reliability which is deemed acceptable (*Nunnally* and *Bernstein 1994*).

In addition, Chi-square difference tests with 1 *df* were used to test for unity between pairs of constructs. All tests were significant at the .05 significance level.

As the general over all aim of the work is to study the problems and limitations of the use of IT which was made into operation as a given users deployment and problem levels. Each respondent was asked to indicate how many times he or she actually used a specific IT application and what is the level of the problem in usage.

The supplementary testing was carried out to reinforce the inferences. We have used the confirmation of the division leader about the views and scores given by the participative users. Besides, a comprehensive list of 20 software applications was drafted, and individual team members were asked to indicate (a) which three IT applications they used most frequently and, consequently, (b) their usage rates for these applications. The group-level variable inter-team network concerns a dummy indicating whether a team participated in a network of multiple teams. Finally, the demographic variables computer training, work training, and age served as control variables when testing the data.

Variable	Mean 1	Mean 2	SD 1	SD 1
Data Management and Data Infrastructure	36.3	63.2	0.32	2.45
Personal Computer and Operating Systems	37.33	62.66	0.21	2.43
Collaboration Tools	73	27	5.65	0.75
Enterprise Applications	46.66	63.34	1.22	3.45
Networking and Communications	53	47	2.33	1.3 5
Security	37.8	62.2	1.33	2.67
Software and Web Development	72.3	37.7	6.54	0.65
Storage Management	70.7	29.3	7.54	0.23
Network Management	25.6	74.4	0.69	2.45

Mean 1 and Mean 2 denotes the Bi-variable either 'yes' or 'no'

Table 3 - Group level correlations

Table 3 indicates means, standard deviations, and individual-level as well as group-level correlations between levels of IT problems as identified by the users either as low or high. In the research on averages, the issue is that corrections for individual-level measurement error should be made first, before comparing individual and aggregate-level correlations [22] (*Ostroff 1993*). Therefore, we calculated individual- level correlations between the antecedents and IT adoption variables after increasing the reliability for those level constructs that had lower reliabilities. Overall, the results indicate some increase of the individual-level correlations but do not imply major changes in the magnitude differences between the two levels novice and proficient.

When analyzing the group level outcome measures, group user preferences and the ratings measured on the two point scale, ranging from difficult to no difficult *which was* gathered from the users expression. Table 3 represents the overall means, standard deviations, and the correlations between the adoption level of standardized and customized IT problems and difficulties and the outcome variables are presented.

	IT problems Standardized		
Variables	Coefficient	(SE)[a]	Δ Magnitude Coefficient[b]
Data Management and Data Infrastructure	–.130	(.124)	
Personal Computer and Operating Systems	.098	(.059)	.332
Collaboration Tools	–.172	(.095)	
Enterprise Applications	.049	(.068)	
Networking and Communications	–.046	(.166)	.225**
Security	2.122	(.133)	.345*
Software and Web Development	–.104	(.078)	
Storage Management	.112	(.124)	.184*
Network Management	–.054	(.096)	

a. Standard errors are in parentheses.

b. Differences in magnitude between individual-level and group-level coefficients were tested by means of raw-score analyses and reflected by the presented group-level coefficients.

*p < .05. **p < .01.

Table 4 Multilevel Analyses

The results of the multilevel analysis are presented in Table 4 for the nine identified information technology issues. To begin with, the coefficient values show that team members' perceptions of difficulties stand varied levels. The standardized errors encompass a considerable part of between-groups variance. Regarding the possible impact of one limitation on other, strong positive effects exist of the individual-level within a group of problems, which implies that homogeneity exists among the group of problems. Furthermore, it appears that individual- level perceived problem is not significantly related to team members' perception level, whereas it shows a significant independent relationship of the problems in IT. These findings imply that heterogeneity also exists besides the general consensus on certain individual problems. This is perhaps due to the two divisions of novice and proficient users. In addition, individual-level ease of use has a positive impact on users' perception of problems in IT, whereas no significant relationship emerges with respect to team members' views.

7. Discussions

The preceding discussions shed light on the fundamental results that we obtained out of the statistical analyses of the perceived data of the Saudi Arabian users. Therefore, the following discussion will present the comprehensive results.

In Saudi organizations, considerable interest for the implementation of information technology was shown, where evidences and the direct observation reflect. Some barriers were found which prevent the provision of adequate services. Further problems were seen such as - the lack of co-ordination within and between Saudi organizations, as well as issues associated with technical, behavioral as structural factors. Some of the results could be summarized as follows:

All Saudi organizations suffered from the absence of trained personnel with sufficient ICT knowledge, experience and skills to manage and use the information systems efficiently and too take the maximum advantage of the information technology.

The non-availability of information technology training programs and the absence of co-ordination among the organizations were the major problems in adopting the ICT in the country. In the government sector, most of employees in the IT are related to the network division (30.0%), and another one third (33.3%) belongs to IT hardware area whereas the in the private sector (mostly hospitals) the share is different as 40% belong to 'network' division and half (48.1%) are related to the software. This has some impact on perceived and documented implementation difficulties. In the private sector, the identified problems are lesser than government.

8. Conclusion

The principal focus of this research was to determine what issues perceived as being the most problematic; and what is the magnitude with regard to IT planning, procurement, and implementation in Saudi Arabia. Each stage in the development and deployment process was viewed individually in relation to the fundamental issues in order to better understand the impact of each one on the process.

The changes in technology have considerable influence when viewed in the context of strategic national planning for IT. Information technology, as a natural evolution is constantly changing. The issue of rapidly changing technology is also a major issue which we intend to address in the subsequent studies. It is evident that in the last decades the high rate of innovations in information technology replaces the old ones quite speedily replacing or enhancing previous innovations. The significant application of the information technologies is to make dynamic progress in the way we communicate and function. Quick innovations and strong systems can drive technology and the time available to understand and implement is less. The window for opportunity on the new and innovative is quite large. It is evidenced that the information technology is producing new hardware, software, network and systems. It is found that the fundamental breakthroughs in this arena occur at the astonishing rate of 18-24 month intervals [23].

The considerable scale and range of investments required to raise Middle Eastern technology and innovation performance suggests policymakers should now explore new financing methods to build infrastructure and innovation capabilities. [24-26]. Thus it is understandable that the technology certainly has serious ramifications for evolving strategic planning and decisions. It is the organizations who can take initiatives to build a strong and viable system for technology application and improvement which will enable the people to implement technologies with ease.

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