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Effect of organizational factors on interoperability adoption for Indian portals

Effect of
organizational
factors

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Abstract

Purpose – The purpose of this research is to examine the impact of organizational factors on the adoption of interoperability technology for Indian portals.

Design/methodology/approach – This exploratory study was conducted through a survey questionnaire from 300 portals of government departments and public sector undertakings (PSUs) in India. Data were also collected from portals of Indian companies.

Findings – The study finds that adoption of interoperability for Indian portals is highly associated with certain organizational factors. In addition, multiple regression analysis reveals that the functionalities of government portals in India are significantly related to four organizational factors.

Practical implications – The research provides insights for government officials and practitioners to understand and improve the level of interoperability in government portals. The study also provides a 2 by 2 matrix framework that helps the government officials to focus on the relevant organizational factors.

Originality/value – This study is the first to examine the effect of organizational factors on interoperability adoption in Indian portals. The results lead to a number of recommendations for achieving interoperability for government portals in India.

Keywords Integration, Interoperability, One-stop portal, E-government, Open systems

Paper type Research paper

1. Introduction

At an advanced stage of maturity, e-government is oriented around user services where the web site is a “one-stop” portal offering a comprehensive menu of services specifically tailored to the profile of the individual user (Wimmer, 2002; Tripathi *et al.*, 2011). However, numerous studies in the literature have provided evidence to suggest that governments are far from an advanced stage of e-government maturity. Therefore, in order to achieve a one-stop government portal, interoperability of information systems and the processes that are supported by these information systems is essential (European Commission, 2003; Klischewski, 2004).

However, there are significant barriers to achieve interoperability in an effective and wide way. These barriers can be classified as politics, organizational, economical and technical (Andersen and Dawes, 1991; Lam, 2005; Virili and Sorrentino, 2009): political – conflicts in the definitions of the levels of privacy in the accesses to the information, predominant organizational culture, etc.; organizational – lack of experience and absence



of the predisposition of sharing, organizational culture, etc.; economical – lack of resources for disposing the information for other agencies, form of acquisition of the resources, etc.; technical – incompatibility of adopted hardware and software; property rights. Therefore, interoperability standards setting can be considered as a hard task to achieve, since the defined specifications have to overcome several barriers to be adopted.

Several authors have indicated that efforts to progress towards a more advanced stage of e-government maturity is hampered by the considerable challenges in interoperability (Watson and Mundy, 2001; Golden *et al.*, 2003; Li, 2003). An organization's information technology sophistication (or IT maturity) depends not only on the technological aspect but also on various organizational characteristics (Cheney and Dickson, 1982). Identifying the determinants of IT sophistication requires a thorough literature review from various perspectives.

In a developing country like India, there has been evolution of electronic government but only few departments have achieved some type of integration (Gupta, 2010; Smart, 2010). Thus, two important aspects have to be undertaken. First, examine the position of interoperability of government portals in technological adoption space in India in terms of three critical dimensions: data integration, process integration and communication integration (Tripathi *et al.*, 2012). Second, the impact of organizational factors on interoperability adoption needs to be estimated that will help achieving higher levels of e-government.

Prior research work of the authors (Tripathi *et al.*, 2011) is dovetailed into adoption space model in ascertaining the level of interoperability and degree of integration. This includes an understanding of critical factors necessary for the successful adoption of interoperability technology along three dimensions of integration – process integration, communication integration and data integration. Organizational factors were also identified in this study. All the dimensions and organizational factors are inter-related. In Tripathi *et al.* (2012), the position of interoperability has been measured so that an organization can focus on improving the factors to achieve interoperability. This study being an extension of the previous research has an objective to analyze the effect of organizational factors on interoperability adoption for Indian portals. The research provides three main benefits. First, it identifies the relevant organizational factors in Indian context. Second, the research computes the impact of organizational factors on interoperability adoption. And third, the research provides a framework that can help government officials to take decision on organizational factors that require improvement and have impact on interoperability adoption for Indian portals.

In order to examine the effect of organizational factors on interoperability adoption this article is divided into several sections. Literature review of the technology interoperability has been covered in Section 2. In the same section organizational factors have also been identified and discussed. Section 3 discusses the research methodology used in this research. Section 4 provides the results of survey and analyzes the results of two regression techniques: Linear regression and logistic regression. Current position of organizational factors in Government portals in India is presented in Section 5. A framework has been provided for government officials involved with portal development in Section 6. This framework will assist the government officials in deciding on deploying resources to the organizational factors that will lead to high level of interoperability. Implications for both practitioners and

researchers are listed in Section 6. Finally, in Section 7 the article offers some conclusions that include limitations of the paper along with future work.

2. Literature review

There have been numerous definitions of interoperability put forth by researchers, standard bodies and government over last so many years. Lack of a uniform definition has forced most of the countries which have come out with their interoperability framework to define the term in the first. The term interoperability has been defined by different organizations and authors: The European Commission (2003) has defined interoperability as “the means by which the inter-linking of systems, information and ways of working, whether within or between administrations, nationally or across Europe, or with the enterprise sector, occurs”. Interoperability is the ability of government organizations to share information and integrate information and business processes by use of common standards and work practices (State Services Commission, 2007). According to the Government Interoperability Framework (E-Government Interoperability Framework, 2004) and Government CIO (2007), if the coherent exchange of information and services between systems is achieved then the systems can be regarded as truly interoperable. When information and services are provided to and accepted between systems and organizations, they are said to inter-operate. Some of the most common definitions from different domains and sources are given in Table I.

Regarding interoperability, IDABC (2004) defines interoperability as the capability of ICT systems and of the business processes they support to exchange data and to enable the sharing of information and knowledge. More specifically, Scholl and Klischewski (2007) define e-government interoperability as the capability for direct machine-to-machine interaction in business-to-government (B2G) as well as government-to-government (G2G). According to the Government Interoperability Framework (E-Government Interoperability Framework, 2004) and Government CIO (2007), if the coherent exchange of information and services between systems is achieved then the systems can be regarded as truly interoperable. When information and services are provided to and accepted between systems and organizations, they are said to inter-operate. As identified by Traummüller (2005) and Landsbergen and Wolken (2001), the benefits of interoperability become clear in the following settings: more effectiveness (interconnection instead of isolated solutions), efficiency (reduction of the transaction costs and increase of the involved agents’ participation), and responsiveness (better access to more information, making possible the fastest resolution of the problems).

Interoperability of systems enables interoperability of organizations. Systems interoperability is concerned with the ability of two or more systems or components to exchange information and to use the information that has been exchanged. Organizational interoperability is concerned with the ability of two or more units to provide services to and accept services from other units, and to use the services so exchanged to enable them to operate effectively together (Legner and Lebreton, 2007; Sarikas and Weerakkody, 2007). Further interoperability facilitates the re-use of the information (resources) once the levels of integration are achieved. As identified by Traummüller (2005) and Landsbergen and Wolken (2001), the benefits of interoperability become clear in the following settings: more effectiveness (interconnection instead of isolated solutions), efficiency (reduction of the transaction costs and increase of the

Definition	Source	Interoperability type and origin
The ability of two or more systems or elements to exchange information and to use the information that has been exchanged	IEEE quoted by Morris (Morris <i>et al.</i> , 2004)	Technical, semantic, standard
The capability for units of equipment to work together to do useful functions		
The capability, promoted but not guaranteed by joint conformance with a given set of standards, that enables heterogeneous equipment, generally built by various vendors, to work together in a network environment		
The ability of two or more systems or components to exchange information in a heterogeneous network and use that information		
The ability of systems, units, or forces to provide services to and accept services from other systems, units, or forces and to use the services so exchanged to enable them to operate effectively together. The condition achieved among communications-electronics systems or items of communications-electronics equipment when information or services can be exchanged directly and satisfactorily between them and/or their users. The degree interoperability should be defined when referring to specific cases	Kasunic and Anderson (2004)	Technical, operational, defence
A state which exists between two application entities when, with regard to a specific task, one application entity can accept data from the other and perform that task in an appropriate and satisfactory manner without the need for extra	CEN/ISSS (2005)	Technical, data, semantic, health
To be interoperable, one should actively be engaged in the ongoing process of ensuring that the systems, procedures and culture of an organisation are managed in such a way as to maximise opportunities for exchange and re-use of information, whether internally or externally	Miller (2000)	Technical, organisational
Interoperability is the way in which reliable data is provided and communicated in a secure, accurate and efficient way. It has to surmount barriers of national policies, culture, language, and systems of medical knowledge representation and use of ICTs	Telemedicine Alliance (2005)	Technical, semantic, human, health
The ability of government organisations to share information and integrate information and businesses by use of common standards	NZ e-GIF (State Services Commission, 2007)	Technical, semantic, e-government
Interoperability describes the ability to work together to deliver services in a seamless, uniform and efficient manner across multiple organisations and information technology systems	Australian Government Information Management Office (2005)	Technical, information, organisational, e-government

Table I.
Interoperability definitions

involved agents' participation), and responsiveness (better access to more information, making possible the fastest resolution of the problems).

In a narrow sense, the term interoperability is often used to describe technical systems. In a broader sense, social, political, and organizational factors influencing systems and systems performance must also be taken into account (Gottschalk, 2009;

Klischewski and Askar, 2012). Klischewski and Scholl (2006) further stress that systems and applications that inter-operate are characterized by the following aspects: independency, heterogeneity, and control by different jurisdictions/administrations or by external actors; yet also cooperation in a predefined and agreed upon fashion. Likewise, Wimmer (2002) stresses that interoperation can only be reached by means of open standards, whereby interoperation needs to be addressed on technical, semantic and organizational level alike. The European Interoperability Framework (EIF, 2003) definition identifies three separate aspects:

- (1) Technical – linking up computer systems by agreeing on standards for presenting, collecting, exchanging, processing, transporting data.
- (2) Semantic – ensuring that transported data shares the same meaning for link-up systems.
- (3) Organisational – organising business processes and internal organisation structures for better exchange of data.

Currently there are several research efforts that try to address interoperability issues in e-government in all three EIF dimensions. Guijarro (2007, 2009) surveyed existing e-government interoperability initiatives and enterprise architectures (EAs) in the EU and the USA. Naiman and Ouksel (1995) classified semantic conflicts in database systems. Park and Ram (2004) also give a description of semantic interoperability conflicts regardless of the application domain, while Park and Ram (2004) propose the resolution of these conflicts using ontology.

Due to the intense research interest in interoperability, several frameworks for interoperability have emerged in recent years (Legner and Wende, 2006; Ray *et al.*, 2011). In the context of e-government interoperability, two prominent examples are the EIF and the R4eGov Interoperability Framework. The EIF takes a holistic view on interoperability by distinguishing between three levels of agreement (organization, semantics, and technique) on which interoperability issues have to be addressed (IDABC, 2004). The even more comprehensive R4eGov Interoperability Framework takes three dimensions into consideration:

- (1) interoperability at a technical, a semantic and an organizational level;
- (2) seamless e-administration over cross-functional domains; and
- (3) organizational hierarchy (local, national, EU wide) (Diedrich *et al.*, 2006).

Organizational factors

Besides the technological factors, organizational factors also play a vital role in achieving complete interoperability. In favour of this, organization has to gear up several resources and support which may be a challenge (Tripathi *et al.*, 2011). Relevant organizational factors that were developed are the following.

Financial resources. In a developing country like India, one of the most critical factors is financial resources. Without a proper financial backup even a good plan will fail. To come up with an effective portal a strong financial support is required for manpower, machinery and communication (Chen *et al.*, 2007; Iacouvou *et al.*, 1995; Kannabiran and Banumathi, 2008; Zarei *et al.*, 2008).

Top management support. Support of top level management is a key success factor for most new initiatives in an organization, whether they are technology related or not.

There are a considerable number of studies that underscore the role of top management support as one of the deciding factors for the success of any IT endeavour (Kambil *et al.*, 2000; Eder and Igbaria, 2001). Many authors suggest that leadership commitment is a key challenge for the success of any knowledge management initiative (Venkatesh *et al.*, 2003; Wang, 2003; Fu *et al.*, 2004; Chang *et al.*, 2005).

Technical expertise. Chen *et al.* (2003) put forward that IT skill set is one of the factors affecting adoption and diffusion of innovations for e-business systems. In addition, Anurag Srivastava, IT Director of Madhya Pradesh, India (personal communication, 13 April 2009) states "A skilled person with an experience in developing portal can easily understand the requirements of the portal and also can help in adopting new technologies". Availability of skilled manpower is a major concern especially for government organizations, given the abundance lucrative opportunities available in the private sector. As a result most government department in India finds it difficult to successfully implement an e-government project.

Strategic goals. Development of portal has various stages (Layne and Lee, 2001) and hence, it is essential to have a proper strategic plan to achieve each level of portal. Lack of clarity will lead to an improper infrastructure which will further lead to unsatisfactory results.

Promotion efforts. People are often unaware of the availability and usefulness of the e-government projects. Adequate training is necessary for the end-users to make them understand the benefits of e-government (Brown and Brudney, 2003; DeLone and Mclean, 2003; Garson, 2003). As stated by Neeta Verma, Senior Technical Director, National Informatics Centre (NIC), India (personal communication, 8 August 2007), "if the users are unaware of the services provided by the portal then the portal will not be fully utilized". Hence, awareness of the portal's utility among the citizens is requisite.

Internal motivation. It is essential to have both vertical and horizontal integration within and among different government departments to achieve one-stop portal (Elliman *et al.*, 2007; Ulbrich, 2010). "At present in some departments of India vertical integration is being achieved. But to achieve horizontal integration a full support from various departments is required" (Janmejay Thakur, Principal System Analyst of Indian Government Tenders, India, personal communication, 3 March 2009; Neeta Verma, Senior Technical Director, NIC, India, personal communication, 8 August 2007). Thus, every government organization must be encouraged for integration.

Collaborative mindset. The level of trust that exists between the organization, its sub-units, and its employees greatly influences the amount of knowledge that flows both between individuals and from individuals into the firm's portal (DeLong and Fahey, 2000). Many a times the people who are important, namely, boss, peers, subordinate do not support the use of e-government (Brown and Brudney, 2003; Edmiston, 2003; Gupta *et al.*, 2005; Heintze and Bretschneider, 2000; Holden *et al.*, 2003; LaPorte *et al.*, 2002; Venkatesh *et al.*, 2003). Therefore, attention should be paid to the supporting norms and behavioural practices that manifest trust as an important organizational value.

IT maturity. If the level of IT maturity is high then fewer efforts are required to achieve a one-stop portal as high IT maturity means higher user awareness, good IT planning, good IT usage history, etc. (Benbasat *et al.*, 1980). In addition, in firms with a high level of IT management maturity, top management may be expected to have

greater knowledge about IT and participation in IS planning (Johnston and Carrico, 1988; Lederer and Mendelow, 1987; Sabherwal and King, 1992).

Security apprehensions. Security is not only a technical issue but also a prime organizational factor. For any portal security is one of the biggest concerns (Layne and Lee, 2001). E-government users are concerned about the security (Petrovic, 2004; Seifert and Relyea, 2004; Suh and Han, 2003) and privacy related issues, which have also been raised by several authors (Andersen and Dawes, 1991; Moon, 2002; Reddick, 2009).

3. Research methodology

There exist several methods for assessing proposed e-government stage models such as statistical methods, best practices, historical analyses, and questionnaires. In this research paper, the last method has been used. The successful investigation of the research objectives is dependent upon the analysis of a large number of responses, and consequently survey research is the most suitable form of data collection. The questionnaires based approach is a well-established technique in obtaining data in social sciences research. A number of IS research projects with the objective of getting data from user groups have been successfully conducted using this method. Precise, structured multiple-choice questionnaires were designed keeping in mind the need for eliciting the requisite information.

It must be noted that questionnaire went through a pretesting process before it was administered. First, pretesting was carried out with a panel comprising four high ranking government officials involved with e-government initiatives in India and an eminent academician. The questionnaire was refined according to the comments and suggestions made by this panel. The modifications made mainly relate to the instructions in the survey and rephrasing of some measurement items. Since there were no major comments received, the questionnaire was considered ready for data collection. Our target respondents were assured of confidentiality and an executive summary was promised as an incentive to encourage their participation.

The questionnaire was divided into two sets. The first set of questions was designed to collect the personal information about the respondent that included name, designation and experience in e-government initiatives of the respondent. The second set of questions was asked on the organizational factors that were identified in the study (Appendix). Questions were asked on a five-point Lickert scale on the basis of organization's position with respect to their portals: where 1 – being “very low”; 2 – being “low”; 3 – moderate; 4 – high and 5 very high. The answers of the categories are mutually exclusive so that respondent had to select not more than one choice against an item. Apart from this, the respondents were given the opportunity to offer their comments on any issue related to e-government development.

The survey was conducted in August 2011. The survey has been done using random sampling. The questionnaire along with a covering letter mentioning the objective of the study was sent to approximately 400 officials of government departments of India (central ministry, states and union territories), Indian public sector undertakings (PSUs) (government owned and controlled corporations) and Indian companies portals. A large number of government portals are developed and maintained by NIC, India. Regular visits to NIC were made. Only those PSUs and Indian companies were selected that tend to have their corporate/head office in national capital region (NCR). The officials were selected on the basis of their

involvement with e-government initiatives and portal development of their respective organizations in India. The questionnaires got hand delivered to the respondents by volunteer students and for this prior appointments were taken.

The statistical methods used in this study are linear regression and logistic regression to model the factors that explains interoperability adoption. These methods are used to determine organizational factors that might possibly effect the adoption of this technology.

4. Results and analysis

Responses were received from 273 (out of 400) officials in India. The response rate was 68 per cent. Break up include 93 government organizations (including states, central ministries and their departments), 90 Indian PSUs and 90 Indian corporations.

Profiles of respondents

Work experience of the respondents that are involved in e-government initiation and in field of IT is presented as frequency distribution in Table II. 72 respondents refused to enclose their personal details. 74 respondents had experience less than five years. There were 54 interviewees with an experience more 15 years. These were mostly the officers at director level and have been working for e-government growth in India for several years.

Table III summarizes the profiles of the usable respondents. Data was collected from 19 states of India. Majority of the Indian state portals are maintained by NIC, India. 43 central ministry officials of Indian Government responded to the questionnaire and provided information on portal development. Data was also collected from 14 independent offices and 17 departments in India. 90 usable responses were received from the PSUs in India. Also, data from 90 Indian companies was collected.

Table II.
Experience of
respondents in
e-government and IT

Experience (in years)	Number of respondents
NA	72
Up to 5	74
5-10	51
10-15	22
15 and higher	54
Total	273

Table III.
Profiles of respondents

Profile	Number of respondents
States	19
Central ministries	43
Independent offices	14
Government departments	17
Public sector undertakings (PSU)	90
Indian companies	90
Total	273

Collinearity diagnostics

Before conducting any of the analytic technique, it is important to identify strongly correlated input variables and drop them to eliminate the problem of co-linearity. Collinearity refers to the inter-correlation among independent variables. The high correlation among independent variables may lead to deviation of the estimation of regression statistics (Pedhazur, 1997). Variance inflation factor (VIF) was used to check for the collinearity of the independent variables. In this case, VIF cut-off has been taken as less than 2 for robust results. Table IV presents the results of collinearity diagnostics. SPSS identified three variables:

- (1) availability of financial resources;
- (2) technical expertise; and
- (3) internal motivation where VIF exceeded 2.

Therefore, we conclude that the above three inputs are highly correlated. The variable “Availability of financial resources” has been included for further analysis and the other two variables (technical expertise and internal motivation) have been dropped from regression. Hence, seven out of nine organizational factors have been identified for regression.

The collinearity diagnostics was conducted again to check the correlation among the rest of the organizational factors but no serious violation was indicated. Result of collinearity diagnostics is presented in Table V which shows for all organizational factors $VIF < 2$ and hence, collinearity between variables is low enough to be considered acceptable.

Variable	VIF
Intercept	0
Cat_G	1.81
Cat_M	3.09
Financial resources	2.82
Strategic goals	1.98
Security apprehensions	1.67
Top level management support	1.84
Technical expertise	2.51
Collaborative mindset	2.13
Promotion efforts	1.96
IT maturity	1.48
Internal motivation	2.11

Table IV.
First collinearity
diagnostics

Variable	VIF
Financial resources	1.95
Strategic goals	1.81
Security apprehensions	1.65
Top management support	1.71
Collaborative mindset	1.66
Promotion efforts	1.77
IT maturity	1.32

Table V.
Second collinearity
diagnostics

Regression

In order to determine key organizational factors that have an impact on interoperability adoption two different regressions as the analytic technique were approached: linear regression and logistic regression. One may ask the reason behind this. Linear regression is adopted when underlying variables are continuous, whereas logistic regression is better suited for binary (or discrete with few values) variables. When eliciting responses on the questionnaires a Likert scale is typically used for ease of administering the questionnaire. We wanted to inculcate additional rigor in analysis by eliminating any bias that may have come in from internal interpretation of the scale by the respondents. The use of two different techniques allowed us to compare the relative impact of the organizational factors. By comparing results of both the regression techniques an in-depth insight of organizational factors was attained. The regression techniques were conducted on the factors identified post collinearity diagnostics (Table V) and the results are presented in Table VI for linear regression and Table VII for logistic regression. The results of regressions were tested with significance at 95 per cent confidence level.

Using the statistical tool SPSS, the results of linear regression are presented in Table VI. The results reveal that all the organizational factors have an impact on interoperability adoption. Security apprehension, and supports from top management are the organizational factors with least impact on interoperability adoption. Only four out of seven organizational factors: financial resources, strategic goals, promotion efforts and IT maturity were found to be significantly related with the overall functionalities of interoperability (95 per cent confidence level). All these factors are positively related to overall interoperability adoption. The result of β -coefficient shows that the

Table VI.
Linear regression

Organizational factors	Un-standardized coefficients		Standardized coefficients		Significance	% variability explained
	B	SE	β	<i>t</i>		
(Constant)	0.66	0.15		4.38	0.00	
Financial resources	0.14	0.04	0.25	3.56	0.00	24
Strategic goals	0.12	0.04	0.19	2.86	0.00	19
Top management support	0.03	0.04	0.06	0.85	0.39	5
Promotion efforts	0.09	0.03	0.17	2.50	0.01	16
Collaborative mindset	0.07	0.04	0.12	1.81	0.07	11
IT maturity	0.09	0.04	0.14	2.37	0.02	13
Security apprehensions	0.04	0.04	0.08	1.20	0.23	8

Table VII.
Logistic regression

Organizational factors	Probability > χ^2	Standardized estimate	% of variability explained
Financial resources	0.00	0.41	29
Strategic goals	0.00	0.33	23
Top management support	0.97	0.00	0
Promotion efforts	0.06	0.21	15
Collaborative mindset	0.03	0.24	17
IT maturity	0.15	0.14	10
Security apprehensions	0.32	0.11	8

organizational factor “financial resources” has the highest impact on interoperability adoption among other organizational factors (0.25). This implies, providing proper funding for the development of portal will increase the level of interoperability.

Likewise, strategic goals have a positive impact on adoption for interoperability for portals in India. Therefore, clarity of strategic goals is necessary. Lack of promotion of portal utility will head towards lower level of interoperability for portal development. Awareness of portal and its effectiveness needs to be promoted. This will increase the demand for higher level of portal development which will lead to integration of information and hence, adopt interoperability.

IT maturity also has a positive impact on level of interoperability. IT maturity means higher user awareness, good IT planning, good IT usage history, etc. (Benbasat *et al.*, 1980). By improving the level of IT maturity and focussing on each division of it, will help in increasing level of interoperability and therefore, help in achieving one-stop portal.

The results of logistic regression have been presented in Table VII. The results indicate that similar to linear regression results, each organizational factor has an impact on interoperability adoption. Security apprehension, and Top management support are the organizational factors with least impact on interoperability adoption. Only three out of the seven organizational factors have a significant impact on interoperability. The organizational factors with a positive impact: financial resources, strategic goals, and collaborative mindset. It has been shown in results of linear regression (Table VI) that “Availability of financial resources” and “strategic goals” have positive impacts on interoperability. But the result of logistic regression points out that collaborative mindset has also significant effect on interoperability adoption. Hence, along with the other two organizational factors, i.e. availability of financial resources and strategic goals, focussing on collaborative mindset is also essential. This implies high level of trust that exists between the organization, its sub-units, and its employees are required for a strong collaborative mindset. It has been noticed in results of linear regression that though collaborative mindset has an impact on adoption of interoperability with 93 per cent significance level (less than 95 per cent).

By assessing the results of both the regression techniques it can be concluded that security apprehension and top management support are the two factors which appear to have minimal impact on interoperability adoption. Financial resources and strategic goals are the organizational factors with highest impact on interoperability adoption. Therefore, these factors should be improved as much as possible in order to achieve an interoperable portal. It has been shown in the collinearity diagnostics result (Table V) that financial resources are highly correlated to the factors: technical expertise and internal motivation. Thus, both organizational factors: technical expertise and internal motivation also have a positive impact on interoperability adoption. So, it can be stated that four out of the nine organizational factors have a positive effect on adoption for interoperability and improving the position of these organizational factors will lead to high level interoperability.

Though organizational factors: promotion efforts, IT maturity and collaborative mindset have a significant impact on interoperability adoption but their significance level has varied in the two regression techniques. Still it can be stated that they also require close attention and can help in improving level of interoperability.

5. Current position of organizational factors in government portals in India

After evaluating the relation between organizational factors and adoption of interoperability for one-stop portal, the study explores the current position of organizational factors in government portals in India. The reason behind focussing on government portals only is to come up with a framework for the government to adopt interoperability in order to achieve a one-stop government portal. Figure 1 summarizes the results of survey. The current position of each organizational factor is measured on a five-point Lickert scale (Appendix). The result reveals that none of the organizational factor is at a very high position. Majority of the factors are at low to moderate level and only one factor is at the high level.

The position of financial resources is the lowest (2.47 on five-point Lickert scale) in government portals in India as compared to rest of the organizational factors. Although it has been noticed that in both regression results (Tables V and VI), this factor has a positive impact on interoperability adoption. The position of financial resources is dragging interoperability at a lower level. Therefore, for an interoperable government portal, it is essential to improve the position of financial resources.

Technical expertise, promotion efforts and internal motivation are the factors that are at a lower position in government portals in India (less than 3 on a five-point Lickert scale). More resources are required to improve the position of these factors. Promotion efforts have a positive impact on interoperability adoption, but its position is at a low level (2.50). More efforts are required to promote portal utilities and enhance awareness in order to improve this factor.

Security apprehensions are at the highest position (4.04) in government portals in India, which implies that government is focussing on the security issues of the portals. Hence, fewer resources are required for this organizational factor to reach the desirable position.

The organizational factors that are between the moderate level and high level (3 and 4 scale) in government portals in India are: strategic goals (3.14), top management support (3.49), collaborative mindset (3.46) and IT maturity (3.39). These organizational factors are neither at a low position nor have reached the desirable destination. Measures of

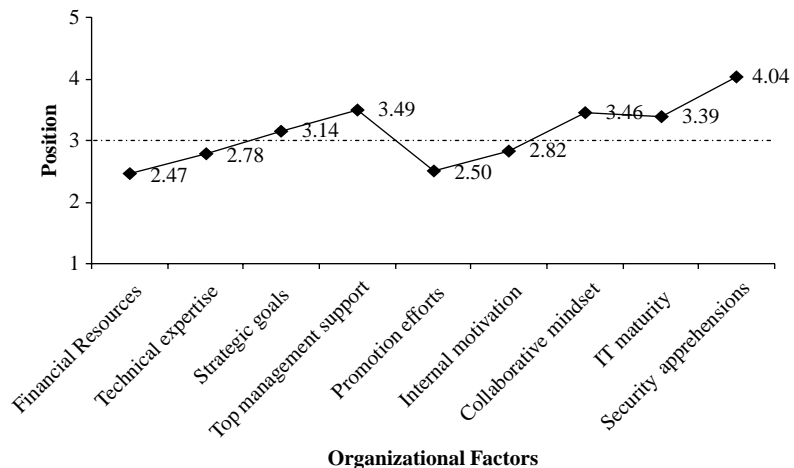


Figure 1.
Current position of organizational factors in government portals in India

improving the positions of these factors depend on their effect on interoperability adoption. The organizational factors with higher impact on interoperability adoption should be given preference as compared to the ones with less impact.

6. Framework

Majority of the paper is assessing the impact of organizational factors on interoperability adoption. While this would be helpful information for decision makers involved in development of one-stop government portal, it would not be sufficient for decision making. The decision makers need to know which organizational factors they should focus their energies on to make the biggest impact in moving towards interoperability. The framework was developed to address this need, i.e. for those devising one-stop government portal developments. The framework developed in this research is similar to importance-performance analysis (Martilla and James, 1977). The axes given in the paper are effect and current position and it suggests appropriate strategies depending on them. The strategies given in the paper are similar to importance-performance analysis though. Figure 2 shows the framework where one dimension is the current status of organizational factors in an organization’s portal development and other dimension represents the relative impact of these factors on interoperability adoption for achieving one-stop portal. Both the dimensions have been divided into two levels: low and high. Hence, the framework consist four quadrants and it must be noted that the numbers in the quadrants are for reference only, and do not imply any sort of sequence. Each of the four quadrants requires a different approach toward interoperability adoption.

Quadrant I: low priority. Current position of the organizational factor in this quadrant is low in government portals in India and they also have a low impact on interoperability. This implies, focussing on these factors can be put on hold as improving the position of these organizational factors will not improve the level of interoperability significantly. Hence, the strategy for organizational factors falling in this quadrant is to ignore their position and work on other quadrants.

Quadrant II: intensify. This quadrant comprises the organizational factors whose current position is low in government portals in India but have high impact on interoperability. The most appealing phase in terms of the interoperability adoption for portal development would be quadrant II. These are the factors that have scope for

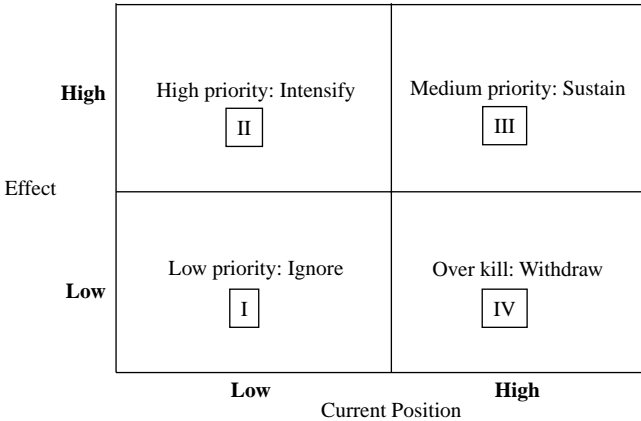


Figure 2.
Framework of
organizational factors
for decision makers

improvement and will also significantly increase the level of interoperability in portal development. The organizational factors lying in this quadrant are most crucial and deserve focussed attention and maximum resources. The appropriate strategy for this quadrant would be focus, i.e. the existing systems require urgent corrective action and thus should be given top priority.

Quadrant III: sustain. Current position of organizational factors in this quadrant is high in government portals in India and also their impact on interoperability is significantly high as well. While these organizational factors contribute significantly to interoperability adoption, they already are at a high level. Therefore, the strategy in this case is to deploy moderate resources in order to maintain their current position.

Quadrant IV: withdraw. Factors in this quadrant are at a high position but with relatively low impact. Even if these factors were to fall to lower position, they would not cause any significant drop in interoperability adoption. Therefore, resources being deployed on these factors can be withdrawn to improve the position of organizational factors in quadrant II. The appropriate decision for organizational factors lying in this quadrant can be insignificant strengths and a possibility that the resources invested may better be diverted elsewhere.

Organizational factors and government portals in India

The 2 by 2 grid framework developed above for organizational factors has been applied to the results of linear regression and logistic regression that are presented in Tables V and VI. The frameworks determine the effect of organizational factors on interoperability adoption in Indian portals. The effect of organizational factors has been compared to the current position of organizational factors in government portals in India shown in Figure 1. Therefore, two frameworks have been developed for both the regression techniques and are shown in Figures 3 and 4, respectively. In both 2 by 2 matrixes one dimension is the current status of organizational factors and is measured

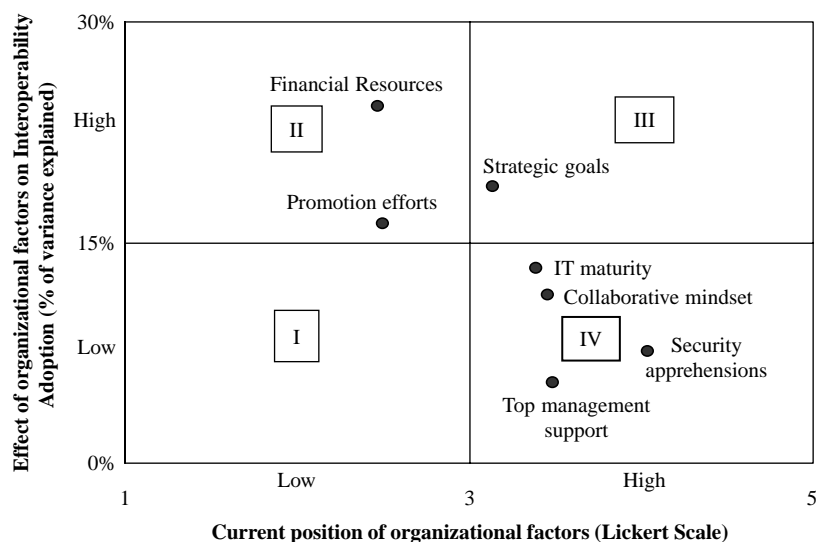


Figure 3.
Framework of
organizational factors for
government portals
(linear regression)

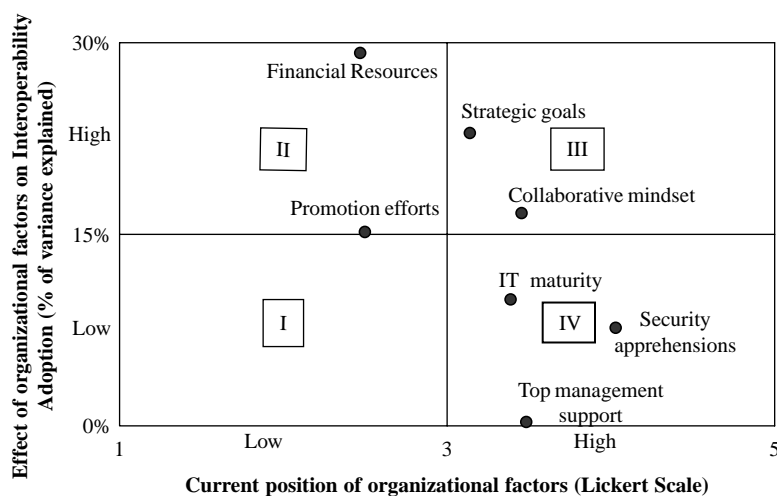


Figure 4.
Framework of
organizational factors for
government portals
(logistic regression)

on a five-point Lickert scale. The factors with current position less than 3 on Lickert scale in government portals in India are considered low or else high. Other dimension represents the relative impact of organizational factors on interoperability adoption for Indian portals. This dimension has been measured on the percentage of variability explained for both regression techniques. 15 per cent variable explained is the cut-off and factors with variability explained more than 15 per cent are considered high otherwise low.

Figure 3, shows a framework of organizational factors with results of linear regression. It shows that quadrant I does not contain any of the organizational factors. This implies that there are no factors with low impact on interoperability adoption and also the position of these factors is low on Lickert scale in government portals in India. Therefore, no attention is required for this quadrant.

In quadrant II, it can be observed that the factors: financial resources and promotion efforts are the most prominent factors that require maximum consideration. The current position of these factors is relatively low in government portals but they have a positive impact on interoperability adoption. This signifies that government should apply its resources and focus on these factors and improve their current position which will further help in increasing the level of interoperability.

Two organizational factors: strategic goals and IT maturity are in quadrant III. These factors have both, high impact on interoperability adoption and high position in government portals in India. With a high current position, resources are only required to maintain the position of these factors.

Quadrant IV, include three organizational factors: collaborative mindset, security apprehensions and top management support. These are the factors that have strong position in government portals in India (Lickert scale > 3), but have a low impact on interoperability adoption. Hence, focussing on these factors is not relatively essential as the contribution of these organizational factors is relatively low on interoperability adoption. Moreover, resources being deployed on these factors can be withdrawn to improve the position of organizational factors in quadrant II.

Figure 4, shows the framework of organizational factors using the results of logistic regression. Similar to Figure 3, quadrant I of Figure 4 does not include any of the organizational factors. Hence, like above this quadrant can be ignored.

Financial resources and promotion efforts are the two factors in quadrant II. These factors are also in the same quadrant in Figure 3 but with different percentage variability explained. Financial resources have a higher percentage variability explained in the results of logistic regression as to the results of linear regression. These are the two prominent organizational factors that require utmost focus from the government. Improving their current position will help in achieving interoperability.

Quadrant III consists of two organizational factors: strategic goals and collaborative mindset. Both factors have achieved a high position and have high impact on interoperability adoption. Maintaining the position of these factors would be an appropriate strategy. It can be noticed that in Figure 3, collaborative mindset was in quadrant IV and this factor has moved from quadrants IV to III with new criteria.

Figure 4 shows three organizational factors are in quadrant IV: IT maturity, security apprehensions and top management support. The position of these factors is high in government portals in India but impact of these factors is low in adoption of interoperability. Hence, as said above, redeploying the resources of these factors and applying them to quadrant II or III would be an apt strategy.

Recommendations

Comparing the frameworks of organizational factors with both the results of regression techniques, there are following recommendations for those devising interoperability adoptions for development of government portal in India:

- In the frameworks shown in Figures 3 and 4, the factors: financial resources and promotion efforts are in quadrant II. Stated by Kambil *et al.* (2000), there is a strong correlation of an organization's web presence and its financial strengths and hence, believed to be positively associated with IT adoption. A similar position has been seen in Indian portals where financial resources have a positive impact on interoperability. Therefore, in order to achieve an interoperable government portal, a strong financial support is essential. There is also a necessity to market online services that governments offer to citizens. Specifically, governments should be marketing their online transaction-based services more effectively (Edmiston, 2003). Hence, awareness of the portal's utility among the citizens is requisite.
- The organizational factor "Strategic goals" is in quadrant III for both regression techniques. Thus, resources should be applied to this organizational factor in order to sustain its position.
- Collaborative mindset is the organizational factor which is alternatively in quadrant III (Figure 4) and quadrant IV (Figure 3). The strategy for quadrant IV is to redeploy the resources. Where as the maintaining the position is the strategy for quadrant III. So to reduce risk, collaborative mindset should be considered in quadrant III and hence, its position should be maintained.
- The organizational factors: IT maturity, security apprehensions and top management support are in quadrant IV in Figures 3 and 4. The relevant

strategies for these factors are withdrawn of resources deployed in these factors and apply to other organizational factors.

7. Research implications

The results from this study provide organizations with a better understanding of role of organizational factors on adoption of interoperability, which will be useful reference for them to develop appropriate strategies. It has been noticed that all the organizational factors have a positive impact on the technology adoption of interoperability but few have relatively high impact. Therefore, for achieving a one-stop government portal, the government need to focus on all these organizational factors with a special attention on the factors that have a higher impact.

The adoption model can be used for other technologies such as EA and EA integration, that being adopted these days. EA is particularly relevant to organizations that have a large portfolio of applications where problems such as functional overlap, duplication and redundancy are common. Enterprise application integration (EAI) refers to “the plans methods, and tools aimed at modernizing, consolidating, integrating and coordinating the computer applications within an enterprise”. At technology level, EAI involves the development of messaging middleware, an integration broker that serves as a hub for inter-application communication, and adapters that allow applications to interface to the integration broker.

The study on impact of organizational factors on interoperability adoption for India portals has implications for practitioners and researchers. Practitioners refer to a myriad of individuals including developers, users and managers are responsible for the implementation, deployment and maintenance of e-government initiatives. From the practitioner’s perspective, the continued development of the e-government platform in India can provide a starting for other government and business led initiatives including electronic markets. For decision makers this study is helpful in formulating strategies for improving those factors that make the biggest impact in moving towards interoperability.

From a research perspective, new organizational factors can be added and their impact on interoperability adoption for government portal can be estimated. Moreover, other factors such as socio-economic and political factors can be covered as these factors too have an impact on technology adoption.

8. Conclusion

The purpose of this paper is to analyze, the relationship of organizational factors and interoperability adoption for Indian portals. In previous research work, the authors have identified nine critical organizational factors that are necessary for achieving an interoperable portal through review of current literature in information systems research and success of IT initiatives and also through interviews and discussions with the high rank government officials in India. In addition to this authors have also examine the position of interoperability of government and corporate portals in technological adoption space in India in terms of three critical dimensions: data integration, process integration and communication integration.

The present study through a questionnaire survey provides empirical data about organizational factors that have an impact on interoperability adoption on Indian portals. Two regression techniques: linear regression and logistic regression have been applied to observe the effect of these organizational factors on interoperability adoption. The results

show that the factors financial resources and promotion efforts are the two prominent factors that have high impact on interoperability adoption but their current position in government portals in India are low. Hence, more focus is required for these two factors, which will lead to higher level of interoperability for achieving one-stop government portal in India.

The contribution of this paper is three-fold. First, this research scrutinizes the impact of organizational factors on the adoption of interoperability technology for Indian portals through two regression techniques. Second, the current position of each organizational factor in government portals in India is also presented in the paper and the results have been mapped with the results of both regression techniques. Finally, given the effect and current position of the organizational factors, a 2 by 2 matrix framework has been developed that helps the government officials to focus on the relevant organizational factors.

As future work, the effect of organizational factors that have been identified in this paper can be further applied to adoption of other technologies such as EA, web services, semantics, etc. that help in achieving an improved government portal. According to the organization, the organizational factors may vary.

This study is the first to estimate the effect of organizational factors on adoption of interoperability in government portals in India. There are some limitations which hindered this study from proceeding efficiently. First, only the NCR PSUs were approached, due to travel and time constraints. As future work, targeting other regions may generate additional insights. Second, this study provides a snapshot analysis of current interoperability adoption. However, e-government is a fast-changing phenomenon and the dynamics associated with it can hardly be well understood in one shot study. A longitudinal study can be used to find out e-government development trends across periods whereas a snapshot observation cannot.

In sum, this empirical study of impact of organizational factors on interoperability adoption for portals in India provides a comprehensive position for government organizations to succeed in achieving a one-stop government portal. Focussing on the organizational factors that have a positive impact on interoperability adoption will help in achieving one-stop government portal and will decrease transaction costs, thus enhancing the government organization's reliability.

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Appendix

A survey to assess the impact of organizational factors on Interoperability adoption in India

Section 1

Personal/Organizational Information

1. Your Name:
2. Your Position:
3. Your Experience in:

Field	Number of Years
1.	
2.	
3.	

Section 2

Portal Centric

1. URL of your portal http://www.....

2. Where does your organization lie with respect to the portal on: (Please tick ✓ in appropriate column)

Organizational Factors	Not Sure	Very Low	2[]	3[]	4[]	Very High
• Availability of financial resources	0 []	1[]	2[]	3[]	4[]	5[]
• Availability of qualified Manpower	0 []	1[]	2[]	3[]	4[]	5[]
• Clarity of the strategic goals	0 []	1[]	2[]	3[]	4[]	5[]
• Support from top level management	0 []	1[]	2[]	3[]	4[]	5[]
• Efforts to promote the utility of portal among users	0 []	1[]	2[]	3[]	4[]	5[]
• Motivation for integration among different departments	0 []	1[]	2[]	3[]	4[]	5[]
• Co-ordination between employees and management	0 []	1[]	2[]	3[]	4[]	5[]
• Level of IT maturity	0 []	1[]	2[]	3[]	4[]	5[]
• Security apprehensions	0 []	1[]	2[]	3[]	4[]	5[]

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