Determinants Impacting the Adoption of E-Government Information Systems and Suggesting Cloud Computing Migration Framework

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***Abstract*—This research intends to investigate underlying elements that effect the adoption of E-Government Information Systems in Board of Intermediate and Secondary Education (BISE), Pakistan. The study is grounded on the theory of technology, organization and environment (TOE) model. Cloud computing is becoming a viable alternative for System Analysts or IT managers to consider in today's latest information technology environment and dynamic changes in the technology landscape. The second purpose of this study is to help Government decision makers appropriately decide on the reasonableness of uses for migration to cloud computing. Considering that the provided Services in e-government (BISE) are available by means of the Internet, in this way cloud computing can be used in the implementation of e-government architecture and provide better service utilizing its benefits.**

Keywords*—*E-government information systems; adoption; TOE; cloud computing migration; Board of Intermediate and Secondary Education (BISE), Pakistan

I. Introduction

Advancements in Information and Communication Technologies (ICTs) have advanced the modernization of latest services and features offered through the web [1], [2]. Open facilities are one of the territories which have been advanced fundamentally by methods for these improvements in ICT field [3]. The usage of ICT's to overhaul the capability of open organizations constitutes the possibility of e-government [4]. The main objectives of using information technology are to enhance the effectiveness, innovativeness and productivity of organizations [3]. IT conveys these objectives using services, particularly with IT departments in huge organizations that make longer further than the country of origin and offer services globally [4], [5].

In spite of the fact that e-government services propose large advantages and a lot of online services, the number of citizens utilizing these services is a fundamental component in estimating how well a convinced nation utilizes e-government's services [5].

In today's marketplace and the universe of competitions, all organizations need to increase productivity and adoption of Information systems [6]. These latest technologies and features place pressure on system analyst and IT managers to implement latest information systems, features and innovations that improve systems. Cloud computing has become an increasing area of importance for gathering these requirements [1], [2], [31]-[33]. The rest of this paper is structured as follows: Section II presents the study theoretical foundation that base on e-government information systems in Pakistan, a survey of e-government by United Nations and adoption frameworks. Section III presents the study main theoretical model and hypotheses. Section IV presents the study research methods that contains instrument development, study sample & setting and data analysis method. Section V presents the cloud computing migration framework. In conclusion, Sections VI and VII summarize the paper findings and presents probable extensions based on this study.

II. The Study's Theoretical Foundation

Information and services available in the form of an online website is known as e-government. E-government runs significant over every part of the government, somewhere inside the center of each government body [6]. The appearance and significance of e-government have involved researchers to look at elements connected to levels of development in e-government and proceeding that make e-government acceptance [7], [8]. Therefore, a great amount of e-government phase frameworks has been planned to clarify the diffusion and acceptance of e-government information systems among citizens. Such frameworks diverge beginning with one context then onto the next, for example, technological, organizational and the managerial context.

The achievement of e-government depends on the amount of citizens utilizing it. Hence, audience's adoption of e-

government services is considered as unique of the hit standard for e-government [3]. Tornatzky and Fleischer [8] utilized a model comparative by the hypothesis of innovation diffusion in a relationship by Rogers in working up a model to include nature component to their system. It clarified an organization's technological development performance, and the environment shows both imperatives and chances for technological advancement.

According to the technological, organizational and environmental (TOE) framework, these areas decide how to get benefits using latest technologies and features that are related to the e-government. Technological part submits to the current technologies and also latest technologies related to the organization [8]. These variables assume a critical position in the organization's selection matters as it finds the capacity of the organization to take full advantage of government programs, technology users and latest computer in the organization [8], [9]. For example, Pakistan, a developing nation, where over the past numerous years, economic and political unsteadiness and governance have deteriorated its government foundations with several components as yet repressing e-government appropriation.

In Pakistan [10]-[12], e-government was recognized on October 2002, e-government as using the internet for delivering the services to the citizens and other departments. The main features of e-government in Pakistan are online system for hujjaj, online ticket booking, online pay the utility bills, apply for visa, immigration policy, PIA, Pakistan railway, travel guide, apply and verify NTN, online taxpayer verifications, online admissions, view the results of examinations i.e. middle, SSC and HSSC, NIC verification through SMS and broadband services. Punjab is the most populous province of Pakistan.

There are different services provided by the government of the Punjab, which are Punjab revenue authority, Punjab medical faculty, Punjab pharmacy council, development authority, higher education department, planning and development department, school education department and information & culture department, etc. [11], [12]. Board of Intermediate & Secondary Education (BISE) is one of the higher education autonomous body of the Punjab, Pakistan.

A National Commission on Education, comprising of specialists from various fields of education was designated in December, 1958 [11]. The Commission was commanded to audit the then existing education arrangement of the nation. The Commission suggested that Secondary Education be given a free status with particular points and targets [12], [13]. The secondary education isolated from University and the Boards of Intermediate and Secondary Education were set up. The Board will be in charge of the lead of Examination at the secondary and intermediate levels [14]. Maybe the thought was that the secondary education, which was the most developmental stage, may get uncommon consideration for its development and advancement on other making good environment and conditions for the University to care for Higher Learning and Research work which might ensure fit and motivated initiative for the nation.

The principle Services of the Boards are to direct and hold examinations relating to Secondary Education, Intermediate Education, Classical and Pakistani Languages and such other examinations as established by the government of Punjab, Pakistan [13], to accord decline or pull back recognition to the Educational Institutions, to set down circumstances for appointment to different examinations held by the Board, to give confirmations [12], [13] and certificates to the successful candidates, to settle demand and receive fee as might be prescribed by, to grant medals, prizes and scholarships to position holders, to order and bolster extra wall painting activities, to create posts and hire such staff as might be considered necessary with the end goal of its capacities; provided that a post in Bs-17 or more than, should be formed with an earlier endorsement of the Controlling Authority, to make arrangements for building's premises, furniture, contraption, books and other means required for doing the purposes of the Act [11]-[14]. The principle online features of BISE Faisalabad and BISE Gujranwala are online affiliations, online registrations, online admissions, online challan, online duty form, online roll no slips, online results and online rechecking, etc.

The United Nations (UN) E-Government Survey 2016 on "E-Government in Support of Sustainable Development" proposes a description of inclinations in the improvement of e-government over the globe in the countries. As per the investigation, governments are implementing information & communication technologies (ICTs) to distribute latest services and to connect people in conclusion creation developments in all areas of the world [15]. The Survey shows an optimistic universal tendency towards advanced points of e-government latest improvement in all regions are gradually more accepting improvement and using latest ICTs to distribute latest services/features and connect the community in decision-production procedures.

As stated in the survey, Pakistan positioned 159th amongst 193 countries in e-government development index (EGDI). There are three major parts in EGDI: Online Service Component (OSC), Telecommunication Infrastructure Component (TIC) and Human Capital Component (HCC) [15]. Pakistan scored is provided in Table 1.

In E-Participation Index, Pakistan positioned 114th. E-Participation Index (EPI) is not a complete dimension but it positioned countries' contribution achievement relation to one another [15]. Pakistan's EPI scores are provided in Table 2.

TABLE I. PAKISTAN'S E-GOVERNMENT DEVELOPMENT INDEX (EGDI)

Rank	Country	EGDI Level	EGDI	OSC	TIC	HCC
79	Sri Lanka	High	0.5445	0.6522	0.2445	0.7369
106	Iran (Islamic Republic of)	Medium	0.4649	0.3333	0.3514	0.7101
107	India	Medium	0.4637	0.7464	0.1430	0.5019
117	Maldives	Medium	0.4330	0.2319	0.4370	0.6301
124	Bangladesh	Medium	0.3799	0.6232	0.1193	0.3973
133	Bhutan	Medium	0.3506	0.3188	0.2192	0.5139
135	Nepal	Medium	0.3458	0.3986	0.1675	0.4714
159	**Pakistan**	**Medium**	**0.2583**	**0.3261**	**0.1299**	**0.3190**
171	Afghanistan	Low	0.2313	0.3043	0.1066	0.2830

TABLE II. PAKISTAN'S E-PARTICIPATION INDEX (EPI)

Rank	Country	EPI	Total %	Stage 1%	Stage 2%	Stage 3%
27	India	0.7627	76.7%	79.4%	94.7%	14.3%
50	Sri Lanka	0.6610	66.7%	79.4%	63.2%	14.3%
84	Bangladesh	0.5254	53.3%	73.5%	36.8%	0.0%
89	Nepal	0.5085	51.7%	58.5%	57.9%	0.0%
104	Afghanistan	0.4237	43.3%	61.8%	26.3%	0.0%
114	**Pakistan**	**0.3729**	**38.3%**	**52.9%**	**26.3%**	**0.0%**
118	Bhutan	0.3559	36.7%	47.1%	31.6%	0.0%
146	Maldives	0.2203	23.3%	29.4%	21.1%	0.0%
149	Iran (Islamic Rep. of)	0.2034	21.7%	29.4%	15.8%	0.0%

To concentrate the variables that affect the adoption of new technology, specialists built up a few hypotheses and systems. Two primary sorts of adoption hypotheses exist: one works at the individual stage and other works at the organization stage [16]. The hypotheses that work at the individual stage include Theory of Planned Behavior (TPB), Technology Acceptance Model (TAM) and bound together Unified Theory of Acceptance and Use of Technology (UTAUT). The hypotheses that work at the organization stage include the Technology Organization Environment (TOE) and Diffusion of Innovations (DOI) models [17], [18].

III. THEORETICAL MODEL AND HYPOTHESES

Using the TOE model to develop an adoption framework for e-government can provide a comprehension of government's new innovation adoption actions [19]. The TOE model is a proper hypothetical framework for understanding e-government adoption because it studies organization adoption behavior by taking technological improvement and its personnel's responses to it into account while incorporating the organizational factors that constrain the behavior and while accounting for environmental factors that impact the adoption behavior [8]. To this end, this research study integrates a number of TOE factors in a generalized model, to provide a comprehension of the issues that impact and e-government organization's tendency to accept technology.

The research model to be addressed in this study is representing in Fig. 1. It illustrates the effects of three selected technological factors (perceived benefits, IT infrastructure and complexity), three organizational factors (organization size, top management commitment & innovativeness and resource commitment) and three environmental factors (external pressure, regulatory environment and work overload) on the government organization's tendency to adopt e-government information systems. Each of these elements and their effects are investigated in the section that takes after and the hypotheses supporting the model are determined.

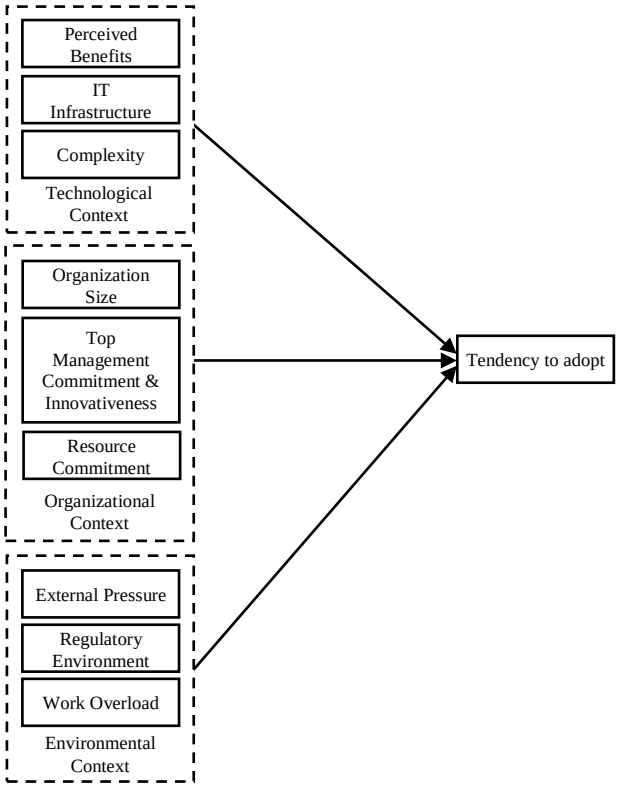

Fig. 1. The study's theoretical model.

A. Technological Dimension

An organization's technological setting includes the innovation that has been executed and the innovation accessible available [8], [9]. The choice to adopt an innovation is impacted by the accessible innovation's fit for the organization, how effectively it can be coordinated into the current innovation scene and the degree to which the innovation is used inside the organization.

Perceived Benefits (BP) mentions to the level of detection of the benefit that a technology can present to the organization [18]. The adoption of e-government results in direct benefits such as reduced administrative load, increased effectiveness, enhanced communication and fast access to information [19]. Government organizations can also increase their visibility through their adoption of e-government information systems. Government organizations, who perceived e-government to be directly and indirectly beneficial, as opposed to disorderly, are more likely to accept information systems [20]. This directs to the following hypotheses

H1: The greater the perceived benefits of e-government information systems, the greater will be tendency to adopt e-government information systems.

Zhu, Kraemer and Xu [21] defined a second-order construct "technology competence", whose dimensions

contain IT infrastructure, IT skills and know-how, as determinants of whether an organization adopts latest ICT systems. IT infrastructure refers to the existing technology resources within the organization that allows and improves processes. Government organizations that have the latest IT infrastructure required to connect with ICT systems and adopt additional IT systems. This directs to the following hypotheses:

H2: The more advanced a government organizations' existing IT infrastructure, the greater will be its tendency to adopt e-government information systems.

Organizations turn to technology to make simpler process and they seek to adopt technology systems to assist achieve this goal. Systems that are composite and not easily grasped by learner workers and administrators may add workload and make it harder to achieve daily routine tasks. If latest systems or applications supposed to be more difficult to use and recognize is known as complexity [22]. Cooper and Zmud [22] further indicated that if organization employees have an observation that using a technology needs more skill to complete tasks, as opposed to when the technology is not being used, their organization will be less expected to adopt innovations. This directs to the following hypotheses:

H3: The higher the complexity of information systems or applications, the lesser will be the tendency to adopt e-government information systems.

B. Organizational Dimension

Organizational dimension includes issues that survive within the organization and straight linked to the organization's working environment and procedure of managing its recourses in order to complete the organization's work and objectives [8], [23].

Ein-Dor and Segev [23] list organizational size and formation as variables that influence the implementation achievement or failure of information systems. The larger organization requires robust information systems that assist information sharing within sites. A large number of transactions and information storage requirements effect from a large number of users using a system and e-government systems assist in the organization of this information and allow for simple sharing across departments. Hence, a large number of technology users affect the need for technology innovation. This directs to the following hypotheses:

H4: The larger the size of a government organization, the greater will be the tendency to adopt e-government information systems.

Boonstra and Broekhuis [24]-[26] declared that top management/seniors act as a vital responsibility in the acceptance of information systems in an organization, without the top management interest and commitment, the adoption of latest systems and technology might turn into a challenging issue. So, top management commitment (TMC) is another organizational factor. TMC declares that their commitment leads the organization to the adoption of latest systems and technology.

Top management willingness and innovativeness to hold innovative ideas and thoughts to explain the organization problems and to increase its performance, leads to top management innovativeness (TMI) factor [27]. Top management personality assumes a key part in motivating the acceptance of latest systems within the organization and his/her skills about latest information systems can reduce the doubt about latest innovations and as an effect encouraging its execution by the organization and its acceptance by the employees [27]-[29]. Top management commitment and top management innovativeness converged and will be represented by the construct "Top Management Commitment & Innovativeness (TMCI)". This directs to the following hypotheses:

H5: The higher the level of top management commitment & innovativeness, the greater will be the tendency to adopt e-government information systems.

Bose and Luo [18] stipulated that financial resource commitment is an ancestor to the acceptance and diffusion of latest technology systems within an organization. An investment in software, hardware, employee training and system integration is required for the unbeaten performance of e-government information systems. Financial resources for successive improvements and ongoing expenses that happen through usage should also be budgeted for. This directs to the following hypotheses:

H6: The greater an organization's level of resource commitment for information system implementations, the greater will be its tendency to adopt e-government information systems.

C. Environmental Dimension

The external environment dimension is identified as the field in which an organization performs its dealing, its members, knowledge producers, customers and suppliers. These external factors may inspire innovation adoption and distribution within organizations as the organization reacts to competitive pressure, regulatory actions and customer fulfillment requirements [27]. Lee and Shim [21], [26] posited that e-government systems vendors can play a responsibility in determining the adoption result. The imposition of vendors creates pressure to use their technology offerings. In addition to this, users based pressure can also make the government to adopt the technology. This directs to the following hypotheses:

H7: The greater the perceived pressure to use information system, the greater will be the tendency to adopt e-government information systems.

Regulatory support has been recognized as serious disturbing innovation diffusion. Zhu, Kraemer and Dedrick [21], [23] defined regulatory support as "ways in which government regulations could affect innovation diffusion". The government can practically support adoption of e-government information systems throughout law enforcement or further means. When government grants support by means of legislation and policies for using e-government systems, government organizations will be more disposed to adopt the latest technology. This directs to the following hypotheses:

H8: The greater the perception of a supportive government regulatory environment, the greater will be the tendency to adopt e-government information systems.

Furthermore, the writing expressed issue similar to work overload that might impact the pattern of innovation acceptance while it refers to the representatives' observations in regard to the workplace being packed with many undertakings, due dates and killing working hours. The Workload in government organizations measures a very important factor negatively distressing the acceptance of e-government information systems [21]. This directs to the following hypotheses:

H9: The higher the perceived workload, the lesser will be the tendency to adopt e-government information systems.

IV. Research Methods

A. Instrument Development

To construct the instruments difference studies were viewed for this study. Each construct was picked from approved measures from the past theories and adjusted to the e-government context. The technological elements were signified by three constructs: Perceived Benefits (PB), IT Infrastructure (ITI) and Complexity (CM). The organizational elements were signified by three constructs: Organization Size, Top Management Commitment & Innovativeness (TMCI) and Resource Commitment (RC). The environmental context was represented by three constructs: External Pressure (EP), Regulatory Environment (RE) and Word Overload (WO) [21]-[23], [26], [27]. In the questionnaire, all these constructs were measured by seven Likert-type scale, ranging from one "strongly disagree" to seven "strongly agree".

B. Study Sample and Setting

To attain the essential generalizability of the results, this study based on a quantitative approach. The study was conducted in the government education boards, Board of Intermediate & Secondary Education (BISE) of Punjab (Faisalabad & Gujranwala), Pakistan, which allows the study to observe and calculate the most recent developments in the government education boards (BISE) in Pakistan. The current users of e-government (BISE) information systems were target subjects and this approach was followed by several researchers in the literature.

Altogether, 201 questionnaires were circulated on the objective respondents; 175 accurate surveys came back with a rate of 87.06% and these questionnaire results were used for analysis. Table 3 introduces the demographic attributes of the members.

TABLE III. Demographic Elements of the Respondents

Characteristics		**Percentage**
Department	BISE Faisalabad	47.4%
	BISE Gujranwala	52.6%
Gender	Males	93.7%
	Females	6.3%
Age	Below 30	41.1%
	30-45	46.6%
	Above 45	12.6%

C. Data Analysis Method

Principal components factor analysis is used in this study to establish construct validity SPSS (version 21) was used to extract components using the principal component analysis (PCA) method of extraction. PCA allows for an assessment of both convergent and discriminant validity.

The internal reliability of the measurements scales was evaluated through the Cronbach's alpha (α) coefficient. A scale is deemed reliable and acceptable if the computed Cronbach's alpha value is at 0.70 or higher. Item-to-total correlations were also examined and correlation coefficients less than 0.400 indicated measurement error. This meant that the item did not measure the same construct the rest of the items were measuring and should be dropped. No item has item-to-total correlations less than 0.400 when each construct was tested for reliability and all items were retained.

All variables in the framework were normally analyzed from questionnaire seven Likert-type scale data, except for "organization size" variable (measured by asking the respondents the number of employees within the organization). Organization size variable was standardized by subjecting it to a logarithmic transformation. Organization Size before transformation (Mean=4.114, Std. Deviation=1.640, Min=1, Max=5) and after transformation (Mean=0.547, Std. Deviation=0.284, Min=0, Max=0.70). The dependent variable "tendency to adopt" was calculated based on the total number of information systems in use within the organization (Mean= 4.377, Std. Deviation= 1.048, Min=1, Max=5).

Table 4 summarizes the results of reliability testing and presents the alpha (α) values, which are all above 0.70. Table 5 summarized the factor analysis.

TABLE IV. Reliability Analysis

	Number of Items	**Item Means**	**Alpha (α)**
Perceived Benefits	3	5.752	0.736
IT Infrastructure	6	5.298	0.753
Complexity	3	5.676	0.791
Top Management Commitment & Innovativeness	3	5.459	0.832
Resource Commitment	3	5.537	0.800
External Pressure	3	5.541	0.718
Regulatory Environment	3	5.366	0.723
Work Overload	2	5.363	0.772

TABLE V. FACTOR ANALYSIS

Rotated Component Matrix[a]								
	Component							
	Resource Commitment	*Perceived Benefits*	*IT Infrastructure*	*Complexity*	*Regulatory Environment*	*External Pressure*	*Top Management Commitment & Innovativeness*	*Work Overload*
PB1		0.690						
PB2		0.738						
PB3		0.736						
ITI1			0.722					
ITI2			0.563					
ITI3			0.761					
ITI4			0.712					
ITI5			0.794					
ITI6			0.678					
CM1				0.762				
CM2				0.868				
CM3				0.523				
TMCI1							0.713	
TMCI2							0.786	
TMCI3							0.811	
RC1	0.793							
RC2	0.735							
RC3	0.711							
EP1						0.644		
EP2						0.864		
EP3						0.847		
RE1					0.657			
RE2					0.780			
RE3					0.855			
WO1								0.905
WO2								0.877
PB=Perceived Benefits; ITI=IT Infrastructure; CM=Complexity; TMCI=Top Management Commitment & Innovativeness; RC=Resource Commitment; EP= External Pressure; RE= Regulatory Environment; WO=Work Overload								
Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.								
a. Absolute values < 0.40 were suppressed								

V. CLOUD COMPUTING MIGRATION FRAMEWORK

This area presents a prescriptive arrangement of steps e-government (BISE) should take to guarantee effective movement of existing projects to cloud computing (see Fig. 2).

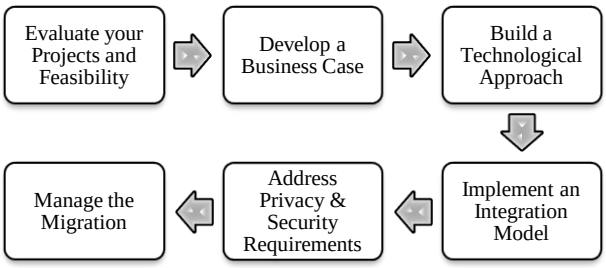

Fig. 2. Cloud migration steps.

A. Evaluate your Projects and Feasibility

Evaluating projects and feasibility for cloud availability will enable the organization to choose what projects/programs and information can and can't be promptly migrated to a cloud environment [30], [31]. At the very first stage, the better approach for migration to cloud environment such applications that have the lowest risk for data loss and such applications take benefits of the versatility in the cloud environment [32]. There is need to find out which applications will migrate to cloud environment firstly [33], [34]. Following are possible suitable categories of projects/applications that migrate to cloud computing:

- Applications that need huge processing resources during execution.
- Mobile workers that need to be more activities and time, but contribute limited data or information to the organization's main databases.
- Applications that change prototyping, developing and testing frequently even the final version of project/application will be executed on developer own infrastructure.

B. Develop a Business Case

For moving projects to cloud environment needs to develop a business case that includes cloud processing strategy and shows the main benefits to diminishing expenses as well as to convey significant value [30]. High stage value suggestions for migration to a cloud environment, include the flexibility, high speed of executions & deployment, cost saving and so forth, are vital

except deficient unless measured [32]-[34]. Inside the setting of an organization procedure for cloud migrations, individual organization issues with current projects/applications that cloud environment can conceivably deliver should be recognized and particular organization defense must demonstrate that cloud computing is the privilege key option.

Once an application is recognized for moving to a cloud environment, a careful cost investigation has to be evaluated [35], [36]. The general charge of utilization moving to cloud environment must incorporate the following components:

- The application may need to redesign in order to be compatible to the cloud deployment.
- Once the application deployed, all the changes and testing will go through in the cloud environment.
- There will be need of integration software to keep the connection between old applications and migrated applications.
- IT staff may need to increase abilities and skills for deployment and preparations of virtual devices in order to support & maintenance the cloud computing migration.

In addition, it is important that the cloud base services and current services will be practically identical [36]-[38]. For every project being moving to a cloud environment, consider the following attributes:

- Using cloud services specific performance objectives must be attainable.
- Moving projects/applications to the cloud environment will require proper security controls.
- Personally Identifiable Information (PII) needs to be operated in a cloud-based program that should be maintained and stored. The access of PII must be restricted in a cloud service.
- Government controls may require extra measures, for example, limiting the migrated applications and information to live in a particular geographic area.

C. Build a Technological Approach

Platform as a Service (PaaS) and Infrastructure as a Service (IaaS) are two possible cloud environment target service models.

1) Platform as a Service

In PaaS, the programs/projects must be redesign for cloud environment available in the cloud PaaS service. Oracle's WebLogic, IBM's WebSphere or the JBoss server are examples of such scenario, in which all the components of logic run on an application server with a database stored procedures [37], [40]. All the requirements by a project PaaS must be provided, for example, a database, an application server and the operating system, so that there need to be worried about the particular application segments and information [38]. All the configurations required by the projects PaaS environment will ensure it [39]. This may include reporting, the power to run scripts, monitoring, software levels, etc.; similar or equal to those currently before migration to a cloud environment.

2) Infrastructure as a Service

In the case of IaaS, all the projects like application code, any helping code and basic operating system are migrated to cloud environment [34]. For this, make all the software packages into virtual machine images and then copied to cloud environment and run there [37]. Whether the virtual machine package works properly if not then it's not good for moving to cloud environment. For such scenario before moving to a cloud environment, the better approach is that the virtual machine that contains applications firstly to be executed on trial virtual machine in-house environment [35], [37], [39], [40]. In both (PaaS & IaaS) approaches, the organization needs new skills to migrate the applications and virtual machines deployment to cloud environment.

D. Implement an Integration Model

The organization needs to find out the connections between different applications and modules that are migrating to cloud environment and address it [38]. There are three types of integration: data integration, process integration and presentation integration [39], [40]. The reason for three integrations might be to execute a conclusion to-end work process that crosses the limit among numerous frameworks [38]. Another type of integration is the point at which the migrated application should keep on being observed and overseen by a current suite of on-premises IT devices [37], [39]. Different methodologies might be utilized to find out difficulties and there is generally not a solitary that works in all scenarios [36]. Consequently, the suggestion of these integration methodologies are: be adaptable, be founded on standards, and think about how possible it is that more migrations may happen later on, in this way migration to the cloud is a chance to refresh the design and give it more adaptable to these changes.

E. Address Privacy & Security Requirements

The most concerning issues in cloud services are security and privacy. These might be recently beneath worry about accessibility and execution as highest precedence [38]. Privacy is directly connected to security, as it conveys with it the further weight to an infringement of privacy. The expose of Personally Identifiable Information (PII) about organization own users who don't have access, will make harm your organization information [39], [40]. Since different studies inspected every one of the dangers and dangers that emerge while relocating an application to the cloud, truth be told, increment its security [38]. After the migration, here are some steps to follow for protection the organization information from an attacker who desires to get control overall organization applications.

- Understand what information, code or applications will be migrated to cloud computing.
- Every information or data must be matched with latest security definitions, if a security definition not

specifies the information might be detained on the basis of its classification.

- There is need to recognize that which data or information increases privacy concerns (Date of birth, CNIC, addresses, contact number, etc.).
- If there are some regulations in the organization, then migration to cloud computing meets these regulations.
- There is need to execute the risk management tasks of evaluating the threat of privacy violations.
- All the security measures like physical security, incident notifications, personnel screening, etc. must be reviewed according to SLA documentation.
- Decide if the results of these points enable the project to proceed.
- There is a weak point for bulk migration to cloud service, take the entire database as a physical file to cloud site.
- During the switch of data use encrypted data while using the cloud base applications and the cloud must support the encryption method.
- For more security; design and implement how to authorize and authenticate users. The best thing is that once the attempt has been completed for the applications to a cloud environment, it should create migrations much easier in future.

F. Manage the Migration

Finally, the IT manager or system analyst can manage, plan and execute the current projects to a cloud environment [34]. Migration to cloud computing is a complex task; therefore organization should have a professional IT manager with latest skills and a proper migration plan [37], [39], [40]. The considerations and key components of the application migration procedures are based on following elements:

- For migration to cloud computing, the structure of the virtual network is the first step in the cloud environment. In e-government scenario, the virtual network is done according to the department's current network addressing. Create new virtual machines and connect with storage units. Through network gateways configure Domain Name Service (DNS), Active Directory, firewalls and routers; make sure testing the network connections between the department's directory server and cloud service.
- All the applications and middleware must installed and configured on the cloud servers, execute all integrations between applications and cloud-based applications. Monitoring tools should be executed and apply the activation keys in case of monitoring licenses. These installations and configurations are also done through automated deployment templates.
- Install some anti-virus software, check backup policies, and manage the credentials for all members.
- There is need to implement a mock migration for checking the unobserved issues. Import some applications into the cloud environment with configuration settings. Execute some test scripts for validation and data migrations, after this run the cloud-based applications and ask users to validate work environment. If there are some major issues then repeat the mock migration after correcting the issues.

VI. DISCUSSION

This study extended the Technological, Organizational and Environmental (TOE) framework that base on three main contexts i.e. technological, organizational and environmental related to e-government information systems. The theoretical inference of this research was revising the TOE framework into a new environment that is characterized by the e-government body, Board of Intermediate & Secondary Education (BISE) information systems and the problems of e-government information systems adoption by staff. The current study confirmed the TOE applicability and generalizability and filled by gap by checking it inside this new e-government environment. Top management commitment & innovativeness and work overload are extra factors in this study and these factors were constructing to be relevant predictors to the adoption of e-government information systems.

The practical suggestion of this study informs government authorities to pay some interest in the e-government information systems acceptance problem as authorities pay a very important role in introducing new methods to solve existing problems that benefits to staff as well as to the organization.

On the other side, organizations are moving to cloud environment due to scalability, the speed of execution, deployment and cost saving. However, migration to cloud environment has to be completed in a logical manner. Current organization projects must be evaluated to find out which projects can advantage from early moving to cloud computing. Applications or projects availability, performance, privacy, security, redesigning and regulatory requirements must be taken into the description for moving to cloud environment. The main objective of this research is to help government (BISE) system analyst consider and analyze migration to cloud computing. All the migration steps and requirements with proper guidance are a list in this study. easier mobile access, improved security, improved responsiveness, improved availability, broader reach and improved analytics on application usage are motivations for the government organizations (BISE) for migration to cloud computing.

VII. CONCLUSION AND FUTURE WORK

This study presented an extended version of the TOE framework within a government organization, i.e. Board of Intermediate & Secondary Education (BISE), Pakistan to

find out factors that impact the acceptance of e-government information systems by BISE staff. Some additional factors included to the TOE framework to realize the needs of the study. Using qualitative approaches, additional studies can perform more in-depth to present deeper comprehension regarding this issue.

Furthermore, observing the problems of e-government information systems with other boards of Punjab and Pakistan can be another target in future in order to compare the outcomes and find out differences about adoptions of e-government information systems in boards and encourage other researchers to find out some other factors that contribute to the acceptance of e-government information systems within the other government departments.

This study also suggests a cloud computing migration framework in order to migrate current applications into the cloud environment. IT manager or system analyst can manage, plan and execute the current projects to a cloud environment. Migration to cloud computing is a complex task; therefore government organization should have a professional IT manager with latest skills and a proper migration plan.

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