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Technology, Institutions and Their Interactions: How Do These Explain E-Participation Degree and Levels? A Cross-Country Analysis

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by

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ABSTRACT

TECHNOLOGY, INSTITUTIONS AND THEIR INTERACTIONS: HOW DO THESE EXPLAIN E-PARTICIPATION DEGREE AND LEVELS? A CROSS-COUNTRY ANALYSIS

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This dissertation aims at explaining the difference in the degree of e-participation across countries using institution and technology variables. It further looks at how the factors differ in their influence across the three levels of e-information, e-consultation, and e-decision making. Institutional and technology variables are identified using the literature review of offline and online public participation (or e-participation). Using the policy feedback theory and Giddens' structuration theory a conceptual model depicting the complex relationship between institutional and technology variables is developed. The dimensions of digital divide, namely ICT affordability and skills, are found to be the most important explanatory variables. However, the most significant finding of the current study is the role of institutions as the antecedent to technology resources for promoting e-participation. Previous cross-national studies have not looked at this relationship between the institution and technology variable. The results of data analysis inform that ICT affordability and skills in a country act as mediator for the institutions to promote e-participation. At the same time ICT skills and the political rights and civil liberties interact to generate a greater impact on e-participation than their solo effect. Although the magnitude of influence of previous e-participation score increases as one progresses to more complex e-participation levels, but its marginal effect reduces considerably at the advanced level of e-decision making.

This dissertation is dedicated to my mother who instilled in me the value of education at a very early age. My loving husband, Abhishek Kumar, and my amazingly talented daughter, Pakhi Gupta, wholeheartedly supported and encouraged me throughout this PhD journey.

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1. INTRODUCTION

Purpose

The idea of public participation in governing decisions is not new (Dahl, 1989) and governments at all levels are increasingly adopting public participation in governing decisions (UN, 2014). Public participation is a logical extension of the democratic process in more local, direct, deliberative ways (Brabham, 2009). Several mechanisms for public participation have been used across governments and recommended in the literature; for example, voting, sample surveys, public meetings, citizens' juries, and opinion polls (e.g. Delli Carpini, Cook, & Jacobs, 2004; Rowe & Frewer, 2000; Smith, 2005; Verba, 1996). After the popularity of World Wide Web in 1990s, there has been a growing literature on the use and advantage of technology such as internet and social networking sites (Fredericks & Marcus, 2013; Tolbert & Mossberger, 2006; Mossberger, Tolbert, & McNeal, 2008), and Geographic Information System (GIS) in public participation (Ganapati, 2010; Kingston, Carver, Evans, & Turton, 2000).

While e-government is the use of information and communication technology (ICT) for the provision of information and public services to the people, e-participation is "the process of engaging citizens through ICTs in policy and decision-making in order to make public administration participatory, inclusive, collaborative and deliberative for intrinsic and instrumental ends" (UN, 2014, p.61). The purpose of this dissertation is to identify and evaluate the impact of factors that can help explain the difference in e-participation, that is public participation using information and communication technology (ICT), in different countries.

The study of e-participation is important for multiple reasons. First, various international communities and forums have time and again emphasized governments to incorporate measures for encouraging public participation and the value of public participation in attaining sustainable

development (e.g. UN Millennium Declaration, 2000; Tunis agenda for the information society, 2005; World public sector report, 2015; World social situation, 2016). Second, several scholars have shown a conviction in the capability of the internet technology to enable deeper public participation in public decision-making (e.g. Brabham, 2009). Third, the governments at all levels are investing money in the ICT infrastructure and yet it is not utilized fully, especially for online public participation (Moon, 2002; West, 2005).

The current study uses data from the biennial survey by the United Nations (UN) that assesses its member countries on the indices of e-government and e-participation. In the UN e-participation survey results, one can see countries with different levels of income, democracy, and technology status side-by-side. It raises the important question of what explains the difference in the online participation between different countries?

The current study reviews the scholarly work in the field of "offline" and "online participation" (Gibson & Cantijoch, 2013, p. 701; Lim & Oh, 2016, p.676; Smith, Schlozman, Verba, & Brady, 2009, p. 1) and ICT adoption studies to identify a set of antecedents that influence e-participation. Offline participation refers to participatory activities that are face-to-face or use mail, or letters, or phone as a medium; online participation or e-participation refers to use of internet, social media, websites, or text and instant messaging as a medium for participatory activities (Smith, Schlozman, Verba, & Brady, 2009). A conceptual framework is developed for the study supported by the theories from the public policy and socio-technical premise. Secondary data are used to measure the dependent and explanatory variables. The data are statistically analyzed and conclusions relevant for public policy and administration are drawn from the results. The study helps discern the actions that different countries have taken and can take for promoting e-participation.

Research Questions

Despite the faith in the digital medium to empower participation, various scholars over the years have pointed towards the lack of utilization of e-governance and internet in realizing their full democratic potential (Musso, Weare, and Hale, 2000; Chadwick & May, 2003; Moon, 2002; West, 2005). Studies have evaluated the usage of, and motivators and barriers to e-participation (Dawes 2008; Soonhee & Jooho, 2012; Norris & Reddick, 2013; Royo, Yetano, & Acerete, 2014; Kukovič & Brezovšek, 2015; Jho & Song, 2015; West, 2005). However, studies that have conducted a comparative analysis of multiple countries based on contextual factors in e-participation are minimal (some examples are Åström, Karlsson, Linde, & Pirannejad, 2012; Gulati, Williams, & Yates, 2014). The current study addresses this gap.

The first research question that this paper seeks to answer is:

RQ1: What factors explain the difference in the degree of e-participation across countries?

To measure the construct of e-participation, the current study uses the United Nations e-participation index. This index is based on a qualitative assessment of online participatory services available in a country with respect to other member countries (UN, 2014).

Several studies have discussed the offline and online public participation as a continuum with stages attaining increasing complexity (e.g. Arnstein, 1969; Rowe & Frewer, 2000; UN, 2014). However, the e-participation studies have never looked at difference of influence of factors across these stages. Do factors differ in their influence as one progresses from less comlex to more complex stages of e-participation? The current study attempts to answer this question by using the stages of e-participation as defined in the United Nations e-Government Survey (UN, 2014). The UN survey uses a three-level model of e-participation that moves from more passive to active engagement with people: “1) e-information that enables participation by

providing citizens with public information and access to information upon demand, 2) e-consultation by engaging people in deeper contributions to and deliberation on public policies and services and 3) e-decision-making by empowering people through co-design of policy options and co-production of service components and delivery modalities" (p. 63). In addition to the e-participation index score, every member country is assigned a percentage utilization score for each of the three levels of e-participation. The past cross-country studies have not evaluated the factors for the different stages of e-participation. Since e-participation stages are widely recognized in the literature and the UN survey as well, this study additionally aims to identify the significant set of factors for each level of e-participation. The second research question, therefore, is:

RQ2: How do the factors differ, if at all, in their influence on e-information, e-consultation, and e-decision making levels?

Contribution

A preliminary literature review informed that though there are several studies on adoption and diffusion of e-government and information and communication technology (ICT) in general, there are relatively fewer studies that study the factors of e-participation. Still fewer are the studies that deal with a cross-country analysis of the e-participation dimension. The majority of studies in e-participation are single-country case studies, followed by some qualitative case comparisons and comparative studies within specific regions, and far fewer that explore e-participation on a global basis (Åström, Karlsson, Linde, & Pirannejad, 2012). Little research exists to answer how the use of ICT and/or institutions could influence distinctive outcomes on e-participation across countries (as cited in Jho & Song, 2015). Most e-participation studies lack a connect to the policy literature and have evaluated limited factors in simplistic frameworks

studying direct and one-way impacts. Another criticism of scholarly work in the field of e-government is that it has been devoid of theory use and development (Heeks & Bailur, 2007). The purpose of this study is to overcome these shortcomings in the e-participation literature. The study aims to evaluate the factors influencing e-participation in a cross-country analysis and do so using a combination of public policy and technology theories. The study aims to generate insights on the change in the role of each factor in a country as the degree and level of e-participation changes.

By using policy and technology theories, this dissertation aims to gain better insights into the processes of e-participation and contribute to the learnings of both theoretical frameworks. The practical contribution of the study is in policy making. The findings guide governments and administrators on what factors are important and need to be promoted for encouraging e-participation. The findings also reveal the limitations of technology alone as a promoter of e-participation and inform that both technology and institutional factors play an important role in facilitating use of ICT for participation.

Dissertation Structure

The remaining study progresses as follows: A detailed literature review is conducted next, followed by discussion of theories used in the current study, an analytical model development, and data and analysis section. Rudestam & Newton (2007) talk about "long shots", "medium shots" and "close-ups" in literature review (p. 68). For this study, the long shot is the public participation literature, the medium shot is the e-participation literature and the close-up comprises of those studies that have conducted a quantitative cross-national analysis of e-participation similar to the current study. The first area of literature studied in the current study is public participation (in offline mode). This is the long shot that serves as the background for this

study. In this case it is important to understand the history and rise of public participation and the theoretical underpinnings of the literature. It helps place e-participation in the overarching literature of public participation and democracy. Therefore, first, history and rise of public participation is discussed along with some prevalent definitions of public participation, to give readers an idea about what is public participation. The remaining sub-sections in this head discuss why public participation is required, its levels, what are the critiques and concerns raised, factors impacting public participation as identified in the offline participation literature, and the approaches for public participation. It is important to identify the factors of offline participation in order to compare online participation factors to offline participation, and to identify gaps in online participation literature. Technology is only a tool and other contextual factors relevant for public participation can be an important determinant of e-participation in a country.

The medium shot in the literature review is the literature of e-participation to understand the scope and general areas of research in e-participation. This section discusses what is meant by e-participation and details the three levels of e-participation and their assessment criteria as used by the UN survey. The types of studies in this section include e-participation, e-government, and public-sector ICT adoption studies using quantitative or qualitative data analysis, conducted at any level of jurisdictions such as state or local governments, or involving one or few countries. Special focus is given to factors identified as determinants of e-participation, and factors for e-government or ICT adoption and diffusion. The analysis helps compare the offline literature with online literature; to detect the factors that are relevant in both as well as those that do not matter for online participation, and to identify novel factors that are relevant in an ICT based scenario.

The close-up literature includes those studies that utilize quantitative data and statistical analysis for comparing multiple countries utilizing UN e-participation survey scores to measure their dependent variable. The close-up literature discusses the studies that closely match the current study and reviews the explanatory and dependent variables, measures, and their data sources, and methodology used in these studies.

The gaps in the cross-country literature are identified based on the literature review. Next, a discussion of theories leads to the development of a conceptual model for the current study. First, the policy feedback theory is discussed and the technology and institutional resources' relationship with e-participation is established. It is followed by a discussion of socio-technical approaches to manifest the complex relationships of mediation and moderation between the technology and institutional resources. A conceptual model that establishes a policy feedback and socio-technical approach to e-participation (PFSTeP) is thus developed. A methods chapter discusses the measures used for the dependent, explanatory, and control variables and the sources of data. The methods chapter also discusses data collection activities, sample, missing data handling, and data transformation. Further the chapter discusses the data analysis methods that are used for testing the hypotheses. The methods chapter is followed by a chapter on data analysis results and discussion. It starts with a descriptive summary of data that is followed by results and discussion of mediation analysis, moderator analysis, and analysis for e-participation at different levels. The chapter also has a discussion on measurement validity, internal, and external validity. The dissertation ends with conclusion and suggestions for future studies.

2. LITERATURE REVIEW

What is Public Participation – History and Rise

The idea of public participation in governing decisions has been prevalent from the ancient times. Evidences from Rig-Veda (1700 BCE), suggest that self-governing village bodies called 'sabhas' and ‘samitis’ existed in the remote past (Das, 2014). In the Athenian Greece the idea and practice of rule by the many, as opposed to rule by the few, is known to have persisted (Dahl, 1989). In the 1830s and 40s in Britain, a movement appeared calling for a revivification of decentralized government followed by the rise of populist politics (Inscape, 2013). By the 1960s, driven by mass youth movements, enormous gatherings in public, mass media, and political ideas around civil society, a new theory of democratic participation evolved as a renewed vision of democracy (Inscape, 2013). In the United States, the reforms under the New Deal (1933-38) included the Administrative Procedure Act (APA) that became a law in 1946. APA required agencies to keep the public informed of their organization, procedures and rules and provide for public participation in the rulemaking process (National Archives, n.d.). Later reforms like the Freedom of Information Act (1966) and the Privacy Act (1974) were steps towards strengthening public engagement in public policies.

Scholars have cited several theoretical arguments that support the rise of political participation. The new public service (NPS) literature credits interpretive theory (Harmon, 1981), critical theory (Denhardt, 1981), and postmodern (McSwite 1997; Miller & Fox, 2007) approaches to collectively shape public organizations less dominated by issues of authority and control and more by the needs and concerns of employees, clients, and citizens (Denhardt & Denhradt, 2000). Moynihan (2003) cites postmodern discourse theory, disillusionment with bureaucracy, and the search for a democratic ideal that contributed to the rise of political

participation. The public discourse as a means to find solutions in participatory policies in place of the bureaucratic structures identifies with the postmodern discourse theory (Moynihan, 2003). Cross-time and cross-national surveys are evidence of shift to post-modern age that includes a desire for more participatory democracies (Inglehart, 1980).

The roots of public participation can be found in the democracy literature. The traditional governmental system was criticized as producer dominated and bureaucratic, which gave support to the idea that networks and partnerships have participatory and democratic potential and market or quasi-market innovations are a means of expanding participatory democracy (McLaverty, 2011). The approach resulted in measures associated with new public management (NPM) but here the public was empowered as a consumer and not as a democratic citizen (McLaverty, 2011; Denhard & Denhardt, 2000). Other scholars saw decentralization of control over neighborhoods and services as the 'bottom up' democracy to engage with the people, particularly the historically marginalized groups (McLaverty, 2011). Due to declining participation in traditional types of politics (Dalton, 2004), and the evidence of declining trust in political regimes, the interest in ideas of governance began to grow and governments began to look for new mechanisms of political participation (McLaverty, 2011). As a consequence of public sector reform, the technological revolution, and devolution, as well as globalization, the traditional state methods of command-and-control gave way to more flexible and inclusive modes of state–citizen interaction (Le Gales, 2011). Increased education leads to greater demand for involvement and access to information (Thomas, 1995) and the access to information is facilitated by new technologies (Moynihan, 2003).

Several definitions, continuums, set of characteristics, and descriptions exist for indicating the type and level of public involvement in communities and government. The

examples range from Habermas's (1992) idea of public sphere of like-minded citizens debating equally in an open public arena, to Arnstein's (1969) ladder with eight rungs of citizen participation that juxtaposes powerless citizens with the powerful; to Beetham's (1993) democracy continuum; and Smith's (2005) *57 Democratic Innovations from Around the World* (also the report's subtitle). King, Feltey, and Bridget O'Neill (1998) consider "authentic participation" (p. 317) as the effective form of participation that moves the administrator away from a reliance on technical and expertise models of administration and towards meaningful participatory processes. Public participation has often been equated with a more continuous involvement in shaping policies and public service delivery than one time voting (UN 2014).

Some of the terms and their definitions, in practice, that indicate citizen involvement in public decision-making activities, are quoted below:

> Citizen participation implies the involvement of citizens in a wide range of policymaking activities, including the determination of levels of service, budget priorities, and the acceptability of physical construction projects in order to orient government programs toward community needs, build public support, and encourage a sense of cohesiveness within neighborhoods (UN, 2008).

> Public participation incorporates a group of procedures designed to consult, involve, and inform the public to allow those affected by a decision to have an input into that decision (Smith, 1983).

> Citizen participation is the redistribution of power that enables the have-not citizens, presently excluded from the political and economic processes, to be deliberately included in the future, in determining how information is shared, goals and policies are set, tax-resources are allocated, programs are operated, and benefits like contracts and patronages are parceled out (Arnstein, 1969).

> Citizen engagement is a commitment from government to cultivate deeper levels of knowledge among and to provide opportunities for citizens to exercise that knowledge in service of policy and program development in a regular and ongoing basis (Lukensmeyer & Torres, 2006).

> Political participation is the legal activities by private citizens aimed at influencing the selection of governmental personnel and/or the actions they take (Verba, Nie, & Kim, 1978)

The definitions vary to a large extent and several terms are used by scholars such as citizen engagement, public participation, and political participation (Lim & Oh, 2016). For the purpose of the current study, these terms are used interchangeably. The terms are used here to refer to procedures to inform, consult, and involve citizens (Smith, 1983) in order for them to be able to participate in the public policymaking.

Why is Public Participation Important?

Public participation can be seen as a logical extension of the democratic process in more local, direct, deliberative ways (Brabham, 2009). At the very least, involving citizens in the planning process helps ensure a plan that will be more widely accepted by its future users (Burby, 2003; as cited in Brabham, 2009). Some see the rise in public participation as a shift from government to governance where 'government' refers to actions backed by legally and formally derived authority and policing power; and 'governance' refers to sharing power in decision-making and actions backed by the shared goals of citizens and organizations, who may or may not have formal authority and policing power (Van der Arend & Behagel, 2011).

Copious reasons have been quoted for citizen participation in public-decision-making. The reasons for public participation can be divided into two categories. The first category points to the issues in the traditional governmental system such as limited knowledge of the experts, elites concealing or ignoring risks, issues of elite or special interests and domination by them, public's rejection of expert's claims, and disillusionment with government (Horlick-Jones, Rowe, & Walls, 2007; Moynihan, 2003; Rowe & Frewer, 2000). Public policy decisions impact several people. The second category points towards the benefits of public participation. Burton et al. (2004) argue that involvement is people's right; it overcomes alienation, makes the community stronger, maximizes the effectiveness of services and resources, helps join-up different

contributions to development, and helps sustainability. Better understanding of problem, multiplicity of ideas for solving them, public education and control, development of a sense of citizenship, public support for implementation, building public perceptions of fairness and trust in the authorities, and formation of responsive and accountable states are other benefits cited in participation studies (e.g. International Peacebuilding Advisory Team [IPAT], 2015; Horlick-Jones, Rowe, & Walls, 2007; Tolbert & Mossberger, 2006). Deliberation is also expected to lead to greater empathy with others and is considered a normative good (Delli Carpini, Cook, & Jacobs, 2004). Webler (1999) contends that one of the most commonly cited reasons for why there should be citizen participation is that it improves decisions. Rowe and Frewer (2000) claim that the most persuasive argument for public involvement is that the public is theoretically able to play a role in risk management at most, if not all, stages of policy.

Levels of Participation

Several scholars have attempted to define a continuum of different levels of public participation. One of the seminal works in this area is Sherry Arnstein's (1969) eight rungs ladder of citizen participation, which juxtaposes powerless citizens with the powerful. The bottom most rungs indicate non-participation (contrived as participation) techniques and as one goes up the ladder, the participation improves from merely informing and consulting citizens to delegating power to citizens, and eventually citizen control when have-nots obtain the decision-making seats, partially or fully (Arnstein, 1969).

Beetham (1993) argues that at one end of the democracy continuum is complete direct democracy, where all decisions are made by all participants and at the other end is complete autocracy with democratic systems falling somewhere in between the two extremes. Rowe & Frewer (2000) state that the lowest level of public involvement employs top-down

communication and a one-way flow of information, while the highest level is characterized by active participation in the decision-making process. Lukensmeyer & Torres (2006) have differentiated between citizen 'participation' (which they refer to as a more general term) and 'engagement'. However, the current study does not differentiate between participation and engagement terms, as also observed in a previous section. To simply inform and to consult are participatory techniques while citizen engagement is an active, intentional partnership between the general-public and decision makers, that engages and empowers citizens, is fundamentally knowledge building, and can have profoundly positive benefits to the policy development and the citizens' view of government (Lukensmeyer & Torres, 2006). Further, citizen engagement is considered as "…part of a family of democratic reform ideas that includes public participation, public involvement, participatory democracy, deliberative democracy, and collaborative governance" (Lukensmeyer & Torres, 2006, p.9). Delli Carpini, Cook, and Jacobs (2004) point that even political talk (that they refer to as public deliberation) is a type of civic engagement. Thus, despite the differences in how scholars define the levels of participation, there is a general agreement in these studies about public participation that it has levels or stages of development.

Concerns, Critiques and Challenges of Public Participation

Despite the foregoing benefits of public participation, there are studies that question, debate, or instigate future research on the usefulness of public participation (Irvin & Stansbury, 2004; Webler, 1999; Kingston, Carver, Evans, & Turton, 2000). Concerns are often raised about the legitimacy of citizen participation as the participants are not necessarily representative of the general population, have no authorization or accountability towards the public, and the way their inputs feed into policy decision making is unclear (McLaverty, 2011). In a seminal article, Arnstein (1969) emphasized the importance of redistribution of power, in order to empower the

powerless, as essential for public participation in the absence of which the participatory exercises are sham (non-participation in Arnstein's terms). Who participates, who controls the agenda, and whether the decision makers respond to the outcomes of public participation are underscored as major concerns and criticisms against public participation (Innes & Booher, 2004; McLaverty, 2011; Parry & Moyser 1994; Webler, 1999; Rowe & Frewer, 2000). Whether or not the participants are representative of the public as a whole is a matter of concern (Verba, Schlozman, Brady, and Nie, 1993). Other criticisms raised are related to making unreasonable demands on people's time, reducing complex issues to a yes or no decision such as in referendums, lack of expertise of members of the general public, and time & cost investments (McLaverty, 2011). Challenges for public participation are studied from the institutional as well as citizen perspective. Ganapati (2011) proposes that it is the institutional issues and not technological issues that hinder greater participation. Public participation is limited by political structures, opposition from local leaders and administrators, and relationship between government and nongovernmental agencies (Ganapati, 2011; Parry & Moyser 1994; McLaverty, 2011).

Lowndes, Pratchett, and Stoker (2001) reported the findings drawn from 30 focus groups discussions carried out with citizens in 11 contrasting local authority areas in Britain, probing the views of citizens themselves about the prospect and reality of public participation. The reasons reported by citizens for non-participation were a negative view of the local authority as well as the councilors, citizens' perception (or experience) of a lack of council response to consultation, lack of even acknowledgement of receipt of complaint, the length of time taken to resolve an issue, and the perfunctory nature of the solutions provided (Lowndes, Pratchett, & Stoker, 2001). Many involved in the focus groups expressed that they felt excluded based on who they were and that certain people always dominated in the participation (Lowndes, Pratchett, & Stoker, 2001).

Lack of trust in participatory processes and government agencies are cited as hindrance to public participation in other studies as well (e.g. Brown, Adger, & Tompkins, 2002). Some scholars have suggested grave consequences such as political participation by extremist groups can result in undermining democratic regimes, policy participation by people intending to violate policies can result in a decrease in compliance with government rules and social participation in the form of exclusive bonding can strengthen stereotyping of groups in society (Meijer, Burger, & Ebbers, 2009).

Some recommendations for overcoming the challenges of public participation are such as one-stop shops that are open all day where people can register their issues or suggestions, long term community development objectives, informing residents of outcomes, good customer care, direct invitations and appropriate incentives, and employment of different methods for involving different groups (Lowndes, Pratchett, & Stoker, 2001). Relevant, accessible, and timely information and a two-way feedback where the governments not only ask for citizen inputs but are also accountable to provide information on what they did with the citizen inputs are imminent to citizen engagement (Rajani, n.d.). Enabling institutional factors such as political structure, and policy initiatives are important (Chadwick, 2011; Gulati, Williams, & Yates, 2014; Zheng, Schachter, & Holzer, 2014). Political knowledge, interest, efficacy, trust, and democratic attitudes are posited to increase participation but participation is also considered to facilitate a positive change in knowledge and attitudes (Moehler, 2007).

Factors Impacting Public Participation

In the context of (offline) public participation, seminal studies have looked at a range of socio-economic and demographic factors, and role of institutions in citizen's level of participation in politics and policy. The measures used for participation are, such as, individual decision to vote

or abstain, individual's campaign and communal activity (e.g. Verba, Nie, & Kim, 1978), contacting officials, giving money, sitting on a local board, joining a group, and protesting (e.g. Verba, Schlozman, & Brady, 1995). Findings suggest that higher levels of socio-economic resources such as education and income lead to higher levels of political participation (Verba, 1996; Verba, Nie, & Kim, 1978; Verba, Schlozman, & Brady, 1995). Verba, Nie, and Kim (1978), in a cross-national study of seven countries, argue that institutions, such as political parties, trade unions, ethnic and religious organizations, and neighborhood associations play an interfering role between an individual's socio-economic status and participation (measured as voting, campaign, and communal activity). As per Verba, Schlozman, and Brady (1995) inequality impacts participation. The poor lack civic skills that impacts their participation levels and institutions such as churches help develop these skills (Verba, Schlozman, & Brady, 1995). Moynihan (2003) also raises the concern of full and representative participation in civic summits. Administrator values and how managers organize participation are important determinants of full and representative participation and the willingness to employ meaningful participation increases at the time of a crisis (Moynihan, 2003). Rosenstone and Hansen (1993) emphasize on mobilization as the key resource for participation, while Verba et.al.'s (1995) study argues for recruitment - where the former is the political approach focusing on the role of political institutions and elites and the latter is the sociological approach that focuses on community organizations (Mettler & Soss, 2004).

Putnam (2000) looked at changes in family structure, women's roles, suburban life, work, age, television, computers, and other factors that contributed to the decline in the stock of social capital, which in turn generated an individual's disconnect with democratic structures (apart from family and friends). Verba and Nie (1972) argue that participants and non-participants

differ in how they view problems and the solutions to those problems and their study of public participation in America includes wide range of explanatory variables such as size of city, race, sex, age, income, religion, location, ethnic groups and their mobilizing agents (Verba & Nie, 1972). Webler (1999) contests that citizens will not participate unless the issues are tangible, significant in their view, or they feel that their participation will make a difference. While some consider tendency of groups to pursue private interests and incentivizing individuals may promote participation (Olson, 1965), others rely on solidarity, public spiritedness and indicate less importance to self- interest as a motivator (Putnam, 2000; Lowndes, Pratchett, & Stoker, 2001).

Citizens become involved in politics when they have resources enabling them to participate, attitudes motivating them to participate, and people asking them to participate (Verba, Schlozman, & Brady 1995). Nearly all models of participation take into account individual-level demographic characteristics and resources; most consider attitudes, and far fewer incorporate recruitment or mobilization as important factors of participation (Leighley, 1995). Impact of mobilization factors on participation has been studied to a lesser extent as compared to attitude and mechanisms (Moehler, 2007). Moehler (2007) studies how participation is impacted by mobilization factors using measures such as the respondents' relationships to the government councils, civil society, and community, as well as the probability that the respondents received messages from program organizers. Verba and Nie (1972) study the impact of collectivities (ethnic groups) and their mobilizing agents such as labor unions on public participation. In another study, Verba, Schlozman, and Brady (1995) develop a civic voluntarism model that considers resources (time, money, and civic skills), psychological engagement with politics (political efficacy explained as an individual's belief that s/he can

make a difference), and access to recruitment as important antecedents to political participation. Downs (1957), in his seminal article, highlighted the role and power of "persuaders" over those who are rationally ignorant (p. 139). The voters do not have full knowledge about the action of the government and persuaders present them with a biased selection of facts that influences the voter's decision (Downs, 1957). Government, on the other hand, does not know what citizens want and needs representatives to persuade citizens to re-elect them (Downs, 1957). Apathy of citizens towards elections is a result of imperfect information (due to high cost information in real world) and at the same time government decision making is contextual and depends on a society's political constitution - the power relation between the governors and those governed (Downs, 1957). Some seminal studies and the factors of (offline) participation discussed are presented in Table 1.

Table 1: List of factors for offline participation

Source: Compiled by the author based on public participation studies.

Explanatory variables in (Offline) participation studies	**Study**
Institutions; Mandates; Administrative systems and processes	Arnstein (1969); Moynihan (2003); King, Feltey, and O'Neill (1998)
Instrumental factors such as administrative costs and perceived benefits; modes/ tools for participation (such as surveys) and participation forums	Moynihan (2003, p.183); Verba (1996); King, Feltey, and O'Neill (1998);
Administrator - Reeducation of public managers; existing values of administrators; administrative self-interest costs such as loss of influence; how seriously managers take public input	Moynihan (2003); Lowndes, Pratchett, and Stoker (2001)
Social Capital - Changes in work, family structure, women's roles; Suburban life; Role of television, computers; or citizens' involvement in family, work, school, and religion	Putnam (2000); Verba & Nie (1972)

Table 1 Continued

Explanatory variables in (Offline) participation studies	**Study**
Mobilizing Agents/ Recruiters measured as belonging to an organization; collectivities (ethnic groups) and their mobilizing agents (labor unions, parties); social and political institutions (political parties and organizational systems such as trade unions, ethnic and religious organizations and neighborhood associations); access to recruitment networks; role of persuaders; respondents' relationships to the government councils, civil society, and community, as well as the probability that the respondents received messages from program organizers	Verba (1996) ; Verba & Nie (1972); Verba, Nie, & Kim (1978); Verba, Schlozman, & Brady (1995) ; Downs (1957); Moehler (2007)
Resources: time, money (or income), civic skills	Verba, Schlozman, & Brady (1995) ; Verba & Nie (1972); Verba (1996)
Citizen attitudes such as: psychological engagement with politics like political efficacy (the belief that they can make a difference); views and perceptions about the local authority; level of trust in participatory processes	Verba, Schlozman, & Brady (1995); Lowndes, Pratchett, and Stoker (2001); Brown, Adger, & Tompkins (2002); Webler (1999)
Difference in participants and non-participants views of problems and solutions	Verba & Nie (1972)
Socio-Economic, Demographic: Age, education, race, sex, religion, location, size of city	Putnam (2000); Verba (1996); Verba & Nie (1972)
Information: Imperfect information, cost of information	Downs (1957)
Rationality: political party's private interests, incentives, type of issue	Downs (1957); Olson (1965); Webler (1999)
Normative factors: Solidarity, public spiritedness	Moynihan (2003); Lowndes, Pratchett, and Stoker (2001); Putnam (2000)

Mechanisms of Public Participation

Several mechanisms for public participation have been used and recommended in the studies. In his report *Beyond the Ballot,* Graham Smith (2005) outlines *57 Democratic Innovations from Around the World* (also the report subtitle), grouped around six headings:

electoral innovations (e.g. postal ballots, public opinion surveys, compulsory voting and reducing the voting age); consultation innovations (e.g. standing forums, public meetings and opinion surveys); deliberative innovations (e.g. citizens' juries, deliberative opinion polls, consensus conferences and deliberative mapping); co-governance innovations (e.g. participatory budgeting, giving citizens places on partnership boards, and citizens' assemblies); direct democracy innovations (e.g. referendums); and e-democracy innovations. Rowe & Frewer (2000) mention referenda, public hearings, public opinion surveys, consensus conference, citizen's jury, focus groups, negotiated rule making, and citizen advisory committees as public participation techniques. Delli Carpini, Cook, and Jacobs (2004) argue that participation can involve private individuals in informal, unplanned exchanges; those who convene for public purposes but do so outside the normal processes of government operations (for example, in such places as libraries, schools, homes, churches, and community centers); and those who are brought together in settings such as town hall meetings of political representatives and their constituents. Discursive participation can occur through a variety of media, including face-to-face exchanges, phone conversations, email exchanges, and Internet forums (Delli Carpini, Cook, & Jacobs, 2004).

After the popularity of World Wide Web in 1990s, there has been a rising literature on electronic participation (*e-participation*). E-participation is participation using ICTs and encompasses activities such as informing public of government activities, consultation with public for policy issues and decision making, and empowering them for decision making (UN, 2014).

E-participation

Electronic participation or e-participation is use of information and communication technology (ICTs) to enable citizens to participate in policy making (UN, 2014). There is a tension between technology and institutional dominance literature. ICTs are considered to have a transformational impact that can change the way government works, make the government accountable and responsive to the citizens, change citizen attitudes, and improve citizen engagement in decision making (Fountain, 2001; Torres, Pina, & Royo, 2005; West, 2004). On the other hand, some scholars deny this technological determinism and suggest that IT will not transform democracy but in fact reinforce the existing social and political norms (Chadwick & May, 2003; Davis, 1999; Nam 2012; Norris, 1999). Fountain (2001) contends that the institutional arrangements, budget scarcity, group conflict, cultural norms, and prevailing patterns of social and political behavior are constraints on the transformational capabilities of technology.

In the forgoing section, the theoretical underpinnings of public participation particularly as grounded in the democracy literature was discussed. E-government and e-participation have been additionally seen in the light of new public management (NPM) and new public service (NPS) (Meijer, 2011; Nabatchi & Mergel, 2010; Torres, Pina, & Royo, 2005). The literature on privatization starts with the reform movement around the late 1970s (Kettl, 2015) and NPM strategies started taking shape around the same time (refer Denhardt & Denhardt, 2015; and Hood, 1991 for NPM timelines). However, the major work on NPM by Hood (1991) and Osborne and Gaebler (1992) along with Clinton's National Performance Review (NPR), aimed at reinventing government to work better and cost less (refer Kettl, 2015 for NPR), appeared around the same time as the internet was taking shape in the 1990s. NPM strategies included,

amongst other things, privatization and a strong supporting information technology system (Kettl, 2015; West 2005). Privatization and competition of the telecommunications industry is considered critical for healthy competition, innovation, and lowering of ICT prices for consumers (Gulati, Williams, & Yates, 2014). However, NPM came under criticism for being an elitist system and viewing of citizens as customers and not as democratic participants (e.g. Denhard & Denhardt, 2000; Dunleavy, 1985; McLaverty, 2011; Pollitt, 1990). Denhardt and Denhardt (2000) proposed principles of new public service (NPS) as an improvement upon the NPM. NPS is focused on democratic governance where public service is expected to create opportunities for building citizens' trust and work with citizens to define policy problems, and develop and implement solutions (Denhardt & Denhardt, 2000; 2015). Torres, Pina, and Royo (2005) emphasize that e-government aims beyond NPM as its goal is to transform the relation between public sector and society.

The initial models of e-government maturity are associated with the NPM ideas of technological capability, positivistic rationale, and treating citizens as customers (Kim & Robinson, 2014). An example is Layne and Lee's (2001) four stages of e-government starting with cataloguing of documents, online transactions, vertical integration with local systems, and horizontal integration across functions. These models have a narrow outlook and are comparable to translating e-commerce activities of private sector to the public sector (Torres, Pina, & Royo, 2005). The NPS perspective, on the contrary, is citizen-centric instead of customer-centric and promotes democratic approach. The new information technology and particularly social media applications are acknowledged as tools for bottom-up approach and that enhance public participation (Kim & Robinson, 2014). Kim and Robinson (2014), therefore, call for an e-government approach that takes into consideration the expanding public sphere, and includes

citizens as an essential part of design and practice. They call the former approach rooted in NPM -- a rational design approach, while the later based on NPS -- a social design or social construction approach (Kim & Robinson, 2014). Later models that discuss stages or levels of e-government (or government's adoption of ICT), often discuss participatory activities as an advanced stage of e-government. These levels or stages usually begin with the first stage where ICT is used as a one-way communication for information dissemination from the government to the public, that later advances to a two-way transaction enabling mechanism, and the final stages involve active public participation and empowerment of citizens. As an example, Moon (2002), adapting Hiller and Belanger's (2001) framework, discusses five stages of e-government that are based on the degree of technical sophistication and interaction with users: "(1) simple information dissemination (one-way communication); (2) two-way communication (request and response); (3) service and financial transactions; (4) integration (horizontal and vertical integration); and (5) political participation" (p.426). Another example is of Nabatchi and Mergel (2010), who adapt a Lukensmeyer and Torres (2006) framework to suggest social media tools along the levels of e-participation that progresses as: inform, consult, include/ incorporate, collaborate, and empower citizens. NPS literature review claims that online technologies and social media has transformed citizen engagement (Denhardt & Denhardt, 2015; Meijer, 2011; Nabatchi & Mergel, 2010). Nevertheless, Kim and Robinson (2014) argue that there is a lack of connection between the NPS dialogue and e-government model building and the field of e-government needs to be examined through the NPS point of view.

Laudon (1977) identified communication technology forms of three types: data transformation technologies suitable for managerial type of democracy; mass-participation technologies that included opinion polling and interactive cable TV for populist democracy; and

interactive technologies for example, telephone conference calls, that suits a pluralist model of democracy. Note that the examples are in accordance with the time of the study. The use of communication technology for democratic purposes has been considered in technology as well as policy literature and has been prevalent even before internet's popularity.

UN E-Participation Survey

The United Nations (UN) has been conducting an e-government survey of its member countries since 2001. The effort started through a collaboration between the American Society for Public Administration (ASPA) and the United Nations Division for Public Economics and Public Administration (UNDPEPA) of the UN Department of Economic and Social Affairs (UNDESA). The intent is to present an objective assessment of the e-government environment in a country and its capacity to sustain online development using a comparative analysis of a country's official online presence, its telecommunications infrastructure, and human capital development for each UN Member State (UN, 2001-2016). The survey has been conducted for years 2001 (a benchmarking study), 2003, 2004, 2005, 2008, 2010, 2012, 2014, and 2016 (UN, 2001-2016). Since year 2003, the extent of e-participation is being measured as a part of this survey across three stages of e-information, e-consultation, and e-decision making, yet the separate scores for the stages are available only since 2014. E-participation espouses to assess the willingness of a country's government, to use ICT to provide quality information and effective communication tools for the specific purpose of empowering people for participation, as consumers of public services as well as citizens (UN, 2001-2016). The methodology of assessment includes review of websites on a quantitative index of items as well as public sector professionals' survey. The e-participation survey limits itself to exploring only government

willingness to promote participation through the use of the ICT and is confined to the citizen-to-government (C2G) and government-to-citizen (G2C) realm (UN, 2001-2016).

The United Nations e-Government Survey (UN, 2014) uses a three-level model of e-participation that moves from more passive to active engagement with people: "1) e-information that enables participation by providing citizens with public information and access to information upon demand, 2) e-consultation by engaging people in deeper contributions to and deliberation on public policies and services and 3) e-decision-making by empowering people through co-design of policy options and co-production of service components and delivery modalities" (p. 63). The survey looks at all three levels of e-participation across six sectors: education, health, finance, social welfare, labor and environment. The UN e-government survey deals with measuring the facilities for the three levels of participation and not the actual usage.

Mathematically, the E-participation is normalized by taking the total score value for a given country subtracting the lowest total score for any country in the UN survey and dividing by the range of total score values for all countries (UN, 2014). For example, if a country has an e-participation score of x, and the lowest value of any country is 0 and the highest is equal to y, then the E-Participation Index that country would be: = x – 0/ y – 0. The survey reports the e-participation index, which ranges from 0 to 1, but not the absolute score. The three stages are reported as a percentage utilization of e-participation across the three stages.

The UN studies recognize the importance of social, political, and economic configuration of a country in its e-government development. At the same time, it recognizes the exceptions as evidenced in its surveys and emphasizes that telecommunications infrastructure, the strength of human capital, the political will, and policy and administrative priorities play important roles in e-participation development (UN, 2001-2016).

Factors Impacting E-participation

This section comprises the medium shot in the literature review looking particularly at studies that evaluate the factors influencing e-participation. Studies that look into e-government adoption OR diffusion and ICT adoption are also included as several e-government models consider e-participation as an advanced stage of e-government. It makes sense to do so, as there cannot be e-participation without the adoption of e-government or ICT at some level in the public sector. The current study used online library search and citation tracking to identify relevant studies for literature review. Sæbø, Rose, & Skiftenes Flak (2008) provide a literature review of 131 scientific articles considered important for the e-participation's theoretical development and all citations in this article were also reviewed to determine relevant studies.

Verba, Schlozman, and Brady (1995) identified three important resources of time, income, and civic skills, as important predictors of public participation but their study was limited to offline participation modes. Scholars have argued that there is a difference in the resources required for offline and online participation: Knowledge of ICTs, frequency of internet use, or broadness of the repertoire of internet activities of an individual influences online political participation (Anduiza, Gallego, & Cantijoch, 2010). Civic skills that promote the effective navigation of the offline political world, may not facilitate online political participation and instead individuals may rely on new online skills (Best & Krueger, 2005).

The current study divides the online literature into two parts for evaluating the factors addressed by the scholars. The first set of studies is in Table 2 that lists the factors identified in the online participation literature. These studies are relevant for the current study but unlike current study they either use qualitative analysis, or are not a multi-country analysis, and/or do

not use e-participation as a dependent variable but use e-government or ICT adoption, or diffusion as the criterion.

Table 2: List of factors for online participation

Source: Compiled by the author from e-participation, e-government, and other ICT studies.

Explanatory Variables	**Measures**	**Studies**
Institutions, policies, type of government	Laws for information resource management; facilitating laws and regulations on electronic governance; democratic institutions;	Chen and Hsieh (2009); Fountain (2001); Moon (2002); Vicente and Novo (2014); West (2005)
Organizational forces	Organizational effort to engage citizens; online development of public administrations; public administration style	Chen and Hsieh (2009); Fountain (2001); Royo, Yetano, and Acerete (2014); Vicente and Novo (2014); West (2005)
Digital skills	Survey questions on type and extent of computer and internet use	Be´langer and Carter (2009); Best and Krueger (2005); Krueger (2002); Vicente and Novo (2014)
Traditional participation-related resources	Socio-economic characteristics, time, civic skills	Anduiza, Gallego, and Cantijoch (2010); Best and Krueger (2005); Krueger (2002); Vicente and Novo (2014)
Demographics	Age, gender	Anduiza, Gallego, and Cantijoch (2010); Best and Krueger (2005); West (2005)
Socio-economic	Income, education, race, locality (rural-urban)	Norris (2001); Leigh and Atkinson (2001)
Regulation	Privacy issues	Bingham, Nabatchi, and O'Leary (2005); Moon (2002)
Cultural norms, and prevailing patterns of social and political behavior	Hofstede's cultural framework	Erumban and de Jong (2006)
Location characteristics	City size ; population; metropolitan status; region	Moon (2002); Norris and Reddick (2013)
Fiscal factors	Costs of technology; budget deficits	West (2005)

The second set of studies are those that comprise the close-up literature review. These are four studies (namely Åström, Karlsson, Linde, & Pirannejad, 2012; Gulati, Williams, & Yates, 2014; Jho & Song, 2015; Zhao, Shen, & Collier, 2014) that conduct cross-national analysis of the nature that the current study is interested in undertaking. All these studies use the UN e-participation survey results as a measure for their dependent variable. Jho and Song (2015) study the impact of technology, institutions, and their moderating effects on civic e-participation. Åström, Karlsson, Linde, and Pirannejad (2012) study the impact of domestic factors and international factor of globalization on e-participation. Gulati, Williams, and Yates (2014) study the impact of governance on on-line services and e-participation. Zhao, Shen, and Collier (2014) study national culture, with moderating effects of economic development, as the predictor of E-government diffusion. The theories used in the four studies are: 1) Åström, Karlsson, Linde, and Pirannejad (2012) use the Washington hypothesis of economic globalization that argues societies will open up as the development of capital markets prevents rent-seeking activities and increase the bargaining power of businesses (Maxfield, 1998; Rudra, 2005); 2) Gulati, Williams, and Yates (2014) refer to Fountain's (2001) theoretical framework (discussed in the theory section of this paper); 3) Jho and Song (2015) do not cite any particular theory as the basis for their analytical model; 4) Zhao, Shen, and Collier (2014) use contingency theories that emphasize the importance of the effects of environment (contingency factors) on performance. At the end of the analytical framework section, Table 3 lists exclusively these four studies that have used quantitative data with statistical analysis in a cross-country comparison across the world. The explanatory variables used in these studies along with their measure and data sources are listed in the table. These studies use e-participation index of UN survey as their dependent variable and

most closely represent the type of effort that the current study is undertaking. These studies also provide the basis for gap analysis in the literature.

Table 3: Factors in e-participation cross-national studies

Source: Author's own compilation of e-participation cross-national literature

Study	**Dependent Variable/s**	**Explanatory Variables**	**Measures and Data Sources**
Jho and Song (2015).	Civil e-Participation Source: UN e-participation Index (2012)	Political Institutions	Political rights and civil liberties - Level of institutionalization of freedom of speech and association- Freedom House, 2012 Level of democracy - EIU (Economic Intelligence Unit)
		Technology	Online population - % individuals using internet --ITU (2012)
		Moderating effects between technology and institutions	
		Control variable: Socio-economic	Human Development Index (HDI) - UNDP, 2013 – this index incorporates actual national income, level of education, rate of illiteracy, and average citizen lifespan

Table 3 Continued

Study	Dependent Variable/s	Explanatory Variables	Measures and Data Sources
Åström, Karlsson, Linde, and Pirannejad (2012).	E-participation index Source: UN e-participation survey	Domestic Factors: Technological development, Democracy development	Technological development -The spread of internet use - internet users per 100 people - ITU Democratization - A combined Freedom House/Polity measure of democratization Levels of development and modernization - Human Development Index (HDI) - UNDP
		International factor---Economic globalization	KOF Index of Globalization
Gulati, Williams, and Yates (2014).	On-line services and E-participation Measures: 1) Online service index 2) E-participation index Source: UN's E-government and E-participation Index	Investment	Gulati and Yates' (2011) Financial Investment Index to measure a nation's financial investment in ICTs.
		Competition	Gulati and Yates' (2011) Telecommunications Competition Index

Table 3 Continued

Study	Dependent Variable/s	Explanatory Variables	Measures and Data Sources
		Governance	Worldwide Governance Indicators (WGI) project - (1) Government effectiveness; (2) Regulatory quality; (3) Rule of law; (4) Political stability and absence of violence; (5) Control of corruption; and, (6) Voice and accountability.
		Control variables: Democratic politics Urbanization Land Area Education	Democratic politics - Unified Democracy Scores (UDS) for 2008. (the UDS is derived from 10 frequently used indicators of democracy e.g., Polity IV and Freedom House to produce a single composite scale). Urbanization - Percentage of residents living in urban areas - CIA website, 2011 Land Area - Country's total size in square kilometers - CIA web site, 2011 Education -UN Education Index
Zhao, Shen, and Collier (2014)	E-government diffusion Measures: UN's survey 1) E-government development index (2) E-participation index	National culture	GLOBE by House et al. (2004) - 1) Uncertainty Avoidance (2) Power Distance (3) In-Group Collectivism (4) Future Orientation (5) Performance Orientation
		Economic development as Moderating variable	GNI per capita -World Bank

Gaps in the Literature

Several gaps are identified in the cross-country quantitative studies. However, one main gap is the missing path analysis on the effect of various technology and institutional variables on e-participation cross-national studies. The studies either explore the simultaneous impact of these variables or at the most the moderator effect of a variable. The current study aims to address this gap by studying direct and indirect effects of technology and institutional variables on e-participation. Second, the variables and measures whose impact on e-participation has been studied in cross-national studies is very limited. The only technology measure studied as a predictor is percentage of individuals using internet (in Jho & Song, 2015; and Åström, Karlsson, Linde, & Piranejad, 2012). Clearly, a large number of variables and measures are yet to be studied in cross-national, online participation, when compared to offline participation studies and other e-government and ICT adoption studies. The impact of important demographic and technology features such as young population, ICT usage, and ICT affordability on e-participation is not assessed. Third, the use of composite indexes fails to provide actionable information for public policy. For example, Human Development Index (HDI) is a composite index that includes national income, level of education, rate of illiteracy, and average citizen lifespan. Using this index as a measure of development or modernization (Åström, Karlsson, Linde, & Piranejad, 2012) or socio-economic condition (Jho & Song, 2015) denies one the information about the independent impact of income or education on e-participation. Besides, more appropriate measures can be used for analysis; for example, as a measure for their control variable of education, Gulati, Williams, and Yates (2014) use the UN education index 2007/08 (UN, 2007) that assesses enrolment in secondary or tertiary education although a more focused predictor for online skills can be the World Economic Forum's skill index that is based on

quality of educational system and math and science education along with enrolment. Another gap is that the impact of interaction between technology and institutions on e-participation is underutilized with just one study analyzing moderating effects with a single technology variable and that is by Jho and Song (2015). The current dissertation uses multiple dimensions of technology and institutions to draw attention toward the argument that neither technology nor institution can independently influence e-participation. Moreover, the important aspect of digital divide is minimally attended to and hardly discussed in the existing cross-national studies. Digital divide is paid diligent attention to in this study and more than one measures are used to assess digital divide and its impact on e-participation. Lastly, technology studies have argued that the active use of technology generates familiarity and ease in its use and therefore technology use fosters further use of technology (Orlikowsky, 2000). Yet, no study explores how usage of and familiarity with e-participation fosters further e-participation.

3. CONCEPTUAL FRAMEWORK

The literature informs a range of factors that impact e-government and e-participation. Factors prominent in the combined offline and online participation literature and relevant for the current e-participation study are combined into two categories – the social / institutional factors (Chen & Hsieh, 2009; Putnam, 2000; Verba, 1996; Zhao, Shen, & Collier, 2014), and the technological factors (Chen & Hsieh, 2009; Gulati, Williams, & Yates, 2014; Jho & Song, 2015). These are the two set of predictors that are explored for their influence on e-participation in the current research. A third set of factors can be clubbed into demographic and socio-economic category. Factors in this third set are used as control variables in the current study. The theoretical frameworks that inform this study are: 1) Policy feedback theory (Pierson 1993; Mettler, 2002; Mettler & Sorrelle, 2014; Mettler & Soss 2004); the 2) Structuration theory (Giddens, 1984); and its extension to 3) Technology-in-practice (Orlikowsky, 2000). Orlikowsky's (2000) work is based on Giddens's (1984) structuration theory and both these works fall under the broader category of socio-technical approaches.

This section discusses the theories that lead to the development of the conceptual framework for the current study. Figures are used at the end of each sub-section to represent the step-by-step development of the framework as the discussion progresses. A comprehensive conceptual framework for the current study is illustrated in figure 6 at the end of this chapter.

Policy Feedback Theory

Based on Schattschneider's (1935) and Lowi's (1972) argument that policies beget politics, scholars began to explore how an enacted policy restructures subsequent political processes (e.g. Skopcol, 1992 who also coined the term policy feedback), a literature that was aptly named as the feedback effects of public policies (Mettler & Sorrelle, 2014); The policy

feedback theory argues that policies and programs influence future political activity that has consequences for subsequent policymaking efforts (Mettler & Welsch, 2004). Pierson (1993) argued that the influence takes place through the mechanisms of: 1) resource effects: the resources and incentives provided by the policies shape patterns of behavior and 2) interpretive effects: the meanings and information that policies convey to citizens. Pierson's (1993) ideas have helped political behavior scholars to empirically evaluate citizen engagement and participation (Mettler & Sorrelle, 2014). Mettler and Soss (2004) bring together the policy feedback and mass behavior approaches, to explain how policies influence mass politics and list "structuring, stimulating, and stalling political participation" (p. 55) as one of the major effects. The participation literature, both offline and online, credits resources approach as the most popular explanation for citizen's social and political participation (Anduizo, Gallego, & Cantijoch, 2010; Vicente & Novo, 2014). Resource approach emphasizes that social and political participation requires resources such as time, money, and other factors (Vicente & Novo, 2014). This approach contrasts with prior theories that suggested deprivation and grievances explain social and political engagement (Vicente & Novo, 2014). Public policies that offer goods, payments, or services may engender resource effects that enhances participation (Mettler & Sorrelle, 2014). In the case of e-participation, for example, the ICT infrastructure, online skills, economic status, and set of policies facilitating e-government and e-participation can act as the resources. The policies of the government can alternatively be considered to impose interpretive effects by shaping the perceptions of the citizens about their engagement in politics.

It was earlier discussed in the offline participation section of the current study that the resources of free time, money, and civic skills positively impact civic engagement (Verba, Schlozman, & Brady, 1995). Public policies affect people's civic engagement or involvement in

politics (Mettler & Sorrelle, 2014); for example, educational policies engender public participation through endowment of skills, resources, and social networks (Verba, Schlozman, & Brady, 1995; as cited in Mettler & Sorrelle, 2014). Saglie and Vabo (2009) find that internet (a technological resource) promotes participation amongst youth. The finding that offline participation also promotes online participation (Saglie & Vabo, 2009) can be interpreted as a resource effect because offline participation helps develop necessary participatory skills (resource) for online participation. It can also be argued as an interpretive effect because it has shaped the citizens' perceptions of self-efficacy that furthers their involvement in e-participation.

While the work by Mettler (2002) and others (Mettler & Sorrelle, 2014; Mettler & Soss 2004) cite Pearson's policy feedback theory when talking about resources effect; others' work under the resources approach does not mention Pierson (1993) or policy feedback effects (e.g. Anduizo, Gallego, & Cantijoch, 2010; Vicente & Novo, 2014). However, the literature cited in both the policy feedback based mass participation approach and the resources approach are the same; for example, Verba et.al.'s (1995) civic voluntarism model or the work of Lazarsfield, Berelson, and Gaudet (1948). Mettler (2002) combined Pierson's (1993) work with the learnings from Verba, Schlozman, and Brady's (1995) civic voluntarism model to make the former applicable to civic engagement. Vicente and Novo (2014), on the other hand, cite Verba, Schlozman, and Brady's (1995) work in developing categories of resources (socio-economic characteristics) that help explain social and political participation. Vicente and Novo (2014) state that both the traditional (e.g. Lazarsfield, Berelson, & Gaudet, 1948) and more contemporary literature (e.g. Norris, 2001) rely on the resources approach. McCarthy and Zald (2001) inform of resources approach as resource mobilization theory that was developed in order to understand collective action and social movements and argue that this approach started developing around

the 1970s. Mettler and Soss (2004) inform that there is diverse literature in the field with few realizing that it has a common thread. They criticize that policy effects are generally analyzed as social or economic outcomes, and their impact on democratic practices has been of less concern to scholars (Mettler & Soss, 2004).

Verba, Scholzman, and Brady's (1995) civic voluntarism model applied to offline participation is a seminal model underlining resources effect and argues that people with more money, time, and skills are more likely to participate (Anduizo, Gallego, & Cantijoch, 2010). In the online participation world, the resources model is revised in two ways: First, the traditional resources can shape the online participation, and second, new resources of computer skills are required (Anduizo, Gallego, & Cantijoch, 2010). On one hand, scholars argue that people with the traditional resources such as higher education and income are more likely to use internet (e.g. Norris, 2001). On the other hand, scholars argue that the resources required for online participation are different; traditional resources such as time are less important for online participation (e.g. Best & Krueger, 2005; Krueger, 2002) and new resources of internet skills enable online participation (Krueger, 2002). Vicente and Novo (2014) identify four types of resources in the participation literature - 1) individual resources or the socio- economic characteristics e.g. age, gender, education level, and income (e.g. Norris, 2001; Verba, 1996; Verba et.al. 1995), although some recent literature shows that poor are no less interested in democratic participation (Krishna, 2008); 2) political attitude such as personal efficacy or political interest (Verba, Nie, & Kim, 1978); 3) group resources such as network of friends (Putnam, 2000); and 4) institutional and political environments that effect individual attitudes such as trust that further effects participation (Eisinger, 1973). After the advent of internet, its effect on participation, based on the resources approach, has been the subject interest of several

studies (Anduizo, Gallego, & Cantijoch, 2010; Best and Krueger, 2005; Hansen & Reinau, 2006; Krueger, 2002; Norris, 2001; Vicente & Novo, 2014) and digital skills is identified as a key resource to explain e-participation (Anduizo, Gallego, & Cantijoch, 2010; Krueger, 2002; Vicente & Novo, 2014).

There are two ways to view the support that policy feedback theory provides to the conceptual model in the current study. Mettler (2002) extends the policy feedback theory to explain the ways in which it explains civic engagement: 1) the policies bestow resources on citizens that provide them the capacity to participate, and 2) policies and administrative rules shape citizen's perceptions about their roles in community and their predisposition to participate. Thus, the existing policies of a country either provide physical resources or generate perceptions that shape the behavior of the citizens of that country towards public participation. The other way is to look at it by Vicent and Novo's (2014) work who categorize all requirements such as individual and group resources, and institutional and political environments as resources for political participation. Note that in Vicent and Novo's (2014) work, institutional and political environments are just another category of resources and their work does not particularly resort to Pierson's (1993) policy feedback theory, although common literature is referred to in both Mettler's (2002) and Vicente & Novo's (2014) work.

The take away from the forgoing discussion on policy feedback theory is its emphasis that participation requires resources and that existing government policies provide or constrain those resources. The resources can be physical or people's interpretations of the existing rules and regulations and these together will shape the future citizen engagement. This theory helps develop the basic analytical framework for the current study. In the current study, resources for participation are identified based on the literature review and are used as the explanatory (and

control) factors for e-participation. In this study two categories of resources are included as explanatory variables: 1) technological resources act as the physical resources that enable the citizens in a country to participate in political activities online, and 2) the institutional resources that help citizens interpret their role in the society influencing their behavior towards citizen engagement. In addition, demographic and socio-economic resources are included as control variables.

Technology Resources

Various resources have been identified in the offline and online participation literature such as time, income, and social skills by Verba, Schlozman, and Brady (1995); time, and material resources by Rowe and Frewer (2000); information by Rowe and Frewer (2000) and Downs (1957); and socio-economic and demographic variables by Putnam (2000), Verba (1996), and Verba and Nie (1972). Some variables are not fit for online participation; for example, time as a predictor may not be important because internet features may considerably cut the need to have free time in order to act politically (Best & Krueger, 2005; Delli Carpini, 2000). Nevertheless, physical resources of information and communication technology are a must for e-participation. Previous cross-country e-participation studies have focused only on one dimension of technology and that is availability of internet connections as a percentage of population (e.g. Jho & Song, 2015). The current study focuses on four dimensions of technology as predictors for e-participation: availability, affordability, skills, and usage. The first three comprise the ICT resources while the last dimension pertains to the usage of these resources. The discussion on the usage dimension of ICT is dealt with in the later part of this chapter. The former three ICT resource dimensions are discussed here.

Previous cross-country analysis studies have assessed the impact of percentage of people using internet on e-participation and found statistically significant positive impact (Astrom et.al., 2012; Jho & Song, 2015). Gulati, William, and Yates (2014) argue that countries that invest more in ICT have better developed e-government. They, however, find no relationship between the level of financial investment and e-participation (Gulati, William, & Yates, 2014) and conclude that the investment is essential to build the infrastructure but not enough to promote citizen participation. The current study agrees that ICT investment is not enough for promoting e-participation. However, an e-government infrastructure ensures availability of a basic platform for citizens to interact online with the government. No online interaction is possible in complete absence of ICT infrastructure. Additionally, the UN survey results (UN, 2014; 2016) show that the regions with better ICT infrastructure e.g. the Europe and the Americas have better e-participation (0.4765 and 0.6985, respectively) as compared to the regions with comparatively poorer infrastructure such as Africa (0.2599). The current study argues that the improvement in the availability of the ICT infrastructure - such as electricity, mobile network coverage, secure internet servers, and internet bandwidth per user - improve citizen's online political engagement. H1a): The availability of ICT resources has a positive influence on e-participation.

The ICT affordability dimension in the current study is measured by cellular and fixed broadband internet tariffs and internet and telephony competition. Competition in the telecommunications sector has been used as a predictor for e-government in a study by Gulati, William, and Yates (2014), and they find that countries that have a more competitive telecommunication sector have more extensive development of e-government than those countries that have state-owned telecom. Further, such countries also have greater opportunities for citizen participation (Gulati, William, & Yates, 2014). Government policy to open up the

telecom sector for private competition or keep it under state control has policy feedback effects on the affordability of online participation; it can influence the cost of ICT resources making them affordable or expensive for the citizens to participate. The current study hypothesizes that the more affordable the ICT resources, more people will have the access to and will be able to use ICT resources thus influencing e-participation positively.

H1b): The affordability of ICT resources has a positive influence on e-participation.

Mettler (2002) found that the educational provisions of a bill for veterans promoted their civic and political engagement and contended that policy feedback theory provided the best explanation for her findings. Mettler (2002) argued that resource and interpretive effects of policy feedback were evident in her study as the policy increased education that effected the veterans' capacity to be involved (resource effects); this in turn made them notice the improvement in their well-being and life-opportunities that increased their predisposition toward participation (interpretive effects). A recent Organization for Economic Co-operation and Development [OECD] survey reported that one fifth of adults in OECD member countries cannot work with ICT (OECD, 2015). Some scholars have found that internet skills, or cognitive abilities, are more important for online participation than the traditional resources of time, civic skills, or income (e.g. Anduiza, Gallego, & Cantijoch, 2010). There is some consensus amongst scholars that online skills positively influence online public participation (Anduiza, Gallego, & Cantijoch, 2010; Best & Krueger, 2005; Krueger, 2002). Parvez (2008) points out that ICT knowledge and skills of the users constrain and facilitate the actors' use of ICT for e-democracy. Internet skills are considered a measure of internet resources (e.g. Anduiza, Gallego, & Cantijoch, 2010). In a survey-based research study, computer or internet skills are assessed asking questions about whether the individual has used email, sent attachments (Best & Krueger,

2005), and individual's frequency of internet use (Anduiza, Gallego, & Cantijoch, 2010). However, evaluation of either computer or online skills is missing in the cross-country analysis literature of e-participation, probably due to lack of such data at national level. Usually education is used and measured using enrolment ratio or literacy rate in the cross-country models; for example, Gulati, Williams, and Yates (2014) measure education level in a country using gross enrolment ratio and adult literacy rate (refer UN Education Index, 2007) use higher levels of education as a control variable and find that higher levels of education have substantial effect on a nations e-participation capabilities. Jho and Song (2015) and Astrom, Karlson, Linde, and Piranneiad (2012) use Human Development Index which is a composite index of income, education, and lifespan that does not specifically provide any insight on unique impact of ICT skills on e-participation. The current study specifically selects the World Economic Forum's (WEF) ICT skills as a measure. In the absence of data on computer and internet skills at national level, WEF's ICT skills is a better measure than HDI because it does not club health and income aspects with education. At the same time WEF's ICT skills is a better measure than the education levels used in Gulati, William, and Yates (2014) because apart from education levels it uses survey data of countries on questions related to the ability of the educational system to meet the needs of a competitive economy, and the quality of math and science education in a country (WEF, 2016a). This measure is used to assess the impact of ICT skills on e-participation using the following hypothesis.

H1c): ICT skills have a positive influence on e-participation.

Digital divide refers to the gap in access to ICT between demographics and regions. A gap that is discussed in the current study is about minimal discussion and consideration of digital divide when developing the analytical framework for factors impacting e-participation in the

cross-national studies. Digital divide creates economic problems as it effects cost savings envisioned based on the per-unit costs of digital technology; social problems of equity as it exacerbates the gap between the information haves and have-nots, thus reinforcing existing class divisions; and political problems as it restricts the ability of ICT to improve the functioning of democracy (West, 2005). Unequal participation has been raised as an issue even in the literature of offline participation (Arnstein, 1969; Liphardt, 1997; Norris, 2001; Verba, 1996). Verba (1996) argued that participation depends on resources and resources are unequally distributed. International Telecommunication Union (ITU, 2012) reports that by the year 2015 only 44 percent of world's population used internet and while 81 percent of households in the developed countries have internet access, only 38 percent of households in the developing countries had internet.[i] Scholars have warned that the inequalities in ICT access are closely linked to the inequalities traditionally observed in political participation (Vicente & Novo, 2014). Leigh and Atkinson (2001) find support for their hypotheses that broadband use is more prevalent amongst richer, urban, and white. A broadband connection is shown to increase the probability of engaging in various online activities (e.g. Grubesic and Murray, 2002). Faster connection enables quick downloads that facilitates research and information gathering, and ensures better sound and video transmission (Best & Krueger, 2005). Leigh and Atkinson (2001) argue that in future the differences in access (or the digital divide) may not be between having access to the internet or not, but between those who have high-speed access and those without. Nowadays several countries have designed mobile websites and services are provided over mobiles due to the increasing spread of mobile usage. The current study uses the dimensions of availability, affordability, and skills to represent the digital divide. Figure 1 depicts the hypothesized influence of technology resources on e-participation.

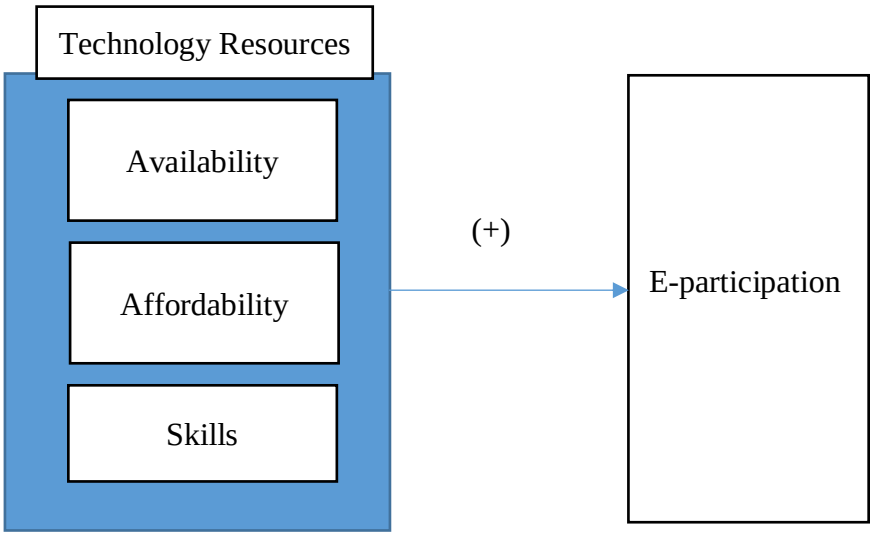

Figure 1: Effect of technology resources on e-participation

Institutional Resources

Although, ICT resources are essential for e-participation, technology by itself cannot foster public participation (Astrom et.al., 2012; Davis, 1999; Putnam, 2000). Moynihan (2003) highlighted the importance of mandates in offline public participation. E-government started off as a nonpartisan and technology-based reform, dominated by experts, and expected to attain efficiency in the public sector (West, 2005). However, governments are increasingly facing budget deficits and IT spending needs to be balanced with other expenses such as health, welfare and defense (West, 2005). Rising internet usage means growing number of recipients that increases partisanship and more press coverage over digital government (West, 2005). Political institutions set up the rules that can accelerate or slow down socio-political changes (Jackman & Miller, 1995; as cited in Jho & Song, 2015). Political institutions, such as forms of democracy (Norris, 2011), bureaucracies and institutions (Fountain, 2001) influence public participation. Institutional resources include laws and policies that enable the development and implementation

of electronic governance (Chen & Hsieh, 2009). Such laws and policies enable agencies to work together and support the strategic direction of e-governance (Fountain 2001). Fountain (2001) considers habits, culture, social and professional networks, and laws and governmental rules – all as institutional influences that play a significant role in the process of enactment of technology. This paper uses two separate measures of institutional variables: political and regulatory environment, and political rights and civil liberties.

Studies have evaluated and highlighted contextual factors such as income, and government structures as important determinants of e-participation (Gulati, Williams, & Yates, 2014; Vicente & Novo, 2014; Zheng, Schachter, & Holzer, 2014; Jho & Song, 2015). The UN e-participation index results, however, suggest that e-participation can be promoted in different political and economic contexts. For example, 2014 survey results place the United States and India in the top 50 performers (of the 193 UN member countries) in e-participation. This is noteworthy because there are several contextual differences between the two countries, such as economic (the US is a developed and high-income country while India is a developing and lower middle-income country) and political (the US has a presidential system while India has a parliamentary system).

E-participation calls for a political and social change and as such requires not only individual adoption but also institutional change with both moving in the same direction (West, 2005). West (2005) argues that organizational settings and political dynamics constrain the rate of technological change. Institutional characteristics exert a policy feedback effect. They influence citizen's trust, efficacy, satisfaction, and political attitude, thus influencing citizen participation (Marien & Christensen, 2013; Norris, Walgrave, & Van Aelst, 2006; Vicente & Novo, 2014). The current study uses political and regulatory environment as an explanatory

variable for e-participation. Political and regulatory environment in a country such as effectiveness of legislations and judicial independence promotes public participation and laws relating to ICTs and software piracy specially support online participation. The current study hypothesizes that:

H2a): Supporting political and regulatory environment in a country is positively associated with the e-participation in that country.

Studies using the resources approach underline that where power is not concentrated on a single individual, there are more channels to influence policy that reduces the cost of participation (e.g. Kriesi, Koopmans, & Duyvendak, 1995). Schlozman, Verba, and Brady (1999) argue that democratic institutions support citizen participation. Gulati, Williams and Yates (2014) do not find a statistically significant relationship between a country's democracy scores and e-participation scores indicating that a more democratic political structure has no effect on the extent of a country's participatory e-government. They measure democracy by a composite index including Freedom House scores. Conversely, Jho and Song (2015) find that the level of democracy (as measured by the Economist Intelligence Unit [EIU] index) has a positive relationship with e-Participation. They (Jho & Song, 2015) do not, however, find a significant relationship between freedom of speech and e-participation.

A major criticism in public participation literature is related to the representativeness of participants: "who participates?" (Verba, Schlozman, Brady, & Nie, 1993, p. 303; refer the literature review section). Better political rights and civil liberties translate into empowerment of residents, especially the marginalized, which in turn can translate into more participation as well as better representativeness of participants. The current study uses a second institutional resource of political rights and civil liberties in the current study from the Freedom House index as used

by Gulati, Williams and Yates (2014). Political rights and civil liberties have an interpretive effect on subsequent e-participation efforts. Political rights such as right to vote and compete for public office, and civil liberties of freedom of expression and association (measures used by Freedom House) have interpretive effects of how citizens perceive their role with respect to the government and each-other that can foster their participation in policy making. These rights also engender social networks (Mettler & Sorrelle, 2014) that effects citizen's involvement in politics. The hypothesis that follows is:

H2b): Political rights and civil liberties influence e-participation positively.

Figure 2 depicts the hypothesized influence of institutional resources on e-participation.

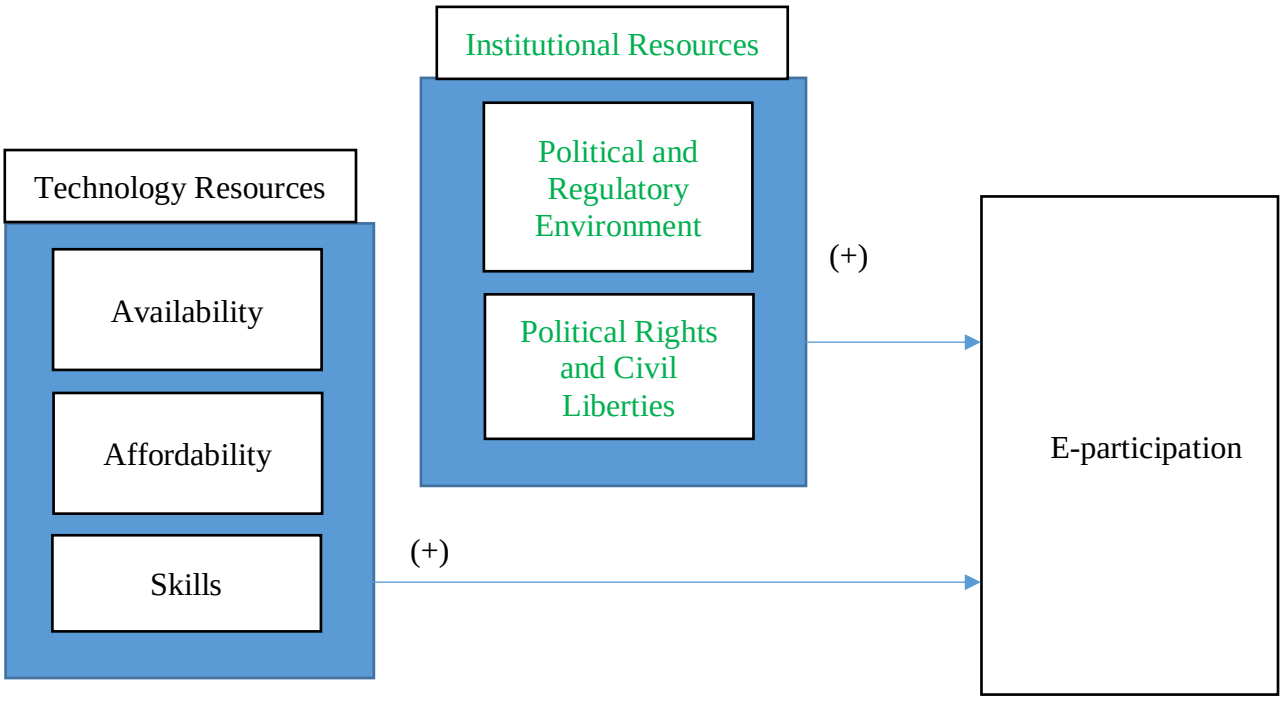

Figure 2: Effect of institutional resources on e-participation

Socio-Technical Theories

The previous section discussed the development of the analytical framework for the current research based on the policy feedback theory and its resource and interpretive effects (Pierson, 1993). However, using the technology and institutional resources as direct antecedents for e-participation is simplistic and does not explain the process of how these resources effect e-participation. A more nuanced understanding can be obtained by studying the interaction of these resources and their influence on each other to effect e-participation. To include the interaction effects of technology and institutions, this study depends on the theories under the socio-technical premises.

Socio-technical research is based on the interdependent and inextricably linked relationships between technological object or system and the social norms, rules of use and participation by a broad range of human stakeholders (Sawyer & Jarrahi, 2013). The technical system focuses on the processes, tasks, and technologies to produce designated output, and the social system on attributes such as people's relationships, rules, attitudes, skills, and values (Bostrom & Heinen, 1977a; 1977b).

Trist et.al. (1963) introduced the term socio-technical first as a result of observations made in an action-research project by Tavistock Institute of Human Relations, London, in the British coal-mining industry. Their argument was that organizations need not conform to the Tayloristic (Taylor, 1967) and bureaucratic principles as social and technical systems can no longer be viewed as separate approaches (Trist, 1981). Work in organizations requires people to use the technology and work organizations are socio- technical systems that require worker participation (Trist, 1981; Trist 1989). Socio-technical systems consist of "…artefacts, knowledge, capital, labor, cultural meaning, etc." (Geels, 2004, p. 900). Approaches e.g. actor-network theory

(Latour, 1987) emphasize that institutions and rules coordinate (but do not determine) human actions, and technologies and material contexts that includes buildings, roads, elevators, appliances and so on, shape human perceptions and behavior (Geels, 2004). Socio-technical systems thus form a structuring context for human action (Geels, 2004). Geels (2004) points out that there are three analytic dimensions - systems, actors, and rules. Dynamic interactions take place between these three and human activities are either viewed as forces of change (agency) or those following iron rules (structure) (Geels, 2004). Approaches such as that of Giddens (1984) theory of structuration attempt to solve the structure agency dilemma (Geels, 2004). Giddens' (1984) theory of structuration argues that behavior and structure are intertwined - social structures shape human activities and in turn are shaped by those activities. Structure is the influence or constraints in the form of rules and resources on individual or group actions (Giddens, 1984).

Sawyer and Jarrahi (2013) discuss the socio-technical premise and its various approaches including the seminal Tavistock work (Trist et.al., 1963), the structuration theory (Giddens, 1984), actor network theory (Callon and Law 1989; Latour, 1987), and technology-in-practice (or enacted technology) theory (Orlikowsky, 2000), some of them interlinked and some that developed independently of the Tavistock research or others. The socio-technical approach recognizes that technology and social norms are inextricably intertwined, that they both have the ability to act, and that this interaction is not independent of surrounding events resulting in co-evolution (Sawyer & Jarrahi, 2013). Contextual factors such as social structures shape the interaction between human and technology (Sawyer, 2006).

The socio-technical approaches are different from socially or technologically deterministic views that seek a single dominant cause of change (Sawyer & Jarrahi, 2013) and instead

emphasizes that humans and technologies jointly construct sociotechnical entities (Callon and Law 1989; Latour, 1987). In the socio-technical premise, ICT is embedded in the social context that both adapts to and helps reshape the social world through design, development, deployment, and use (Avgerou, 2001; Kling, 1980; Orlikowski, 1992; Sawyer & Jarrahi, 2013). Fountain's (2001) technology enactment framework examines how institutions influence the way a system is actually used by the actors. Institutional influences such as habits, culture, social and professional networks, laws, and governmental rules play a significant role in the process of technology enactment (Fountain, 2001).

Socio-technical approaches are profusely utilized in information technology studies. In participation behavior study of users in Web 2.0 environment, Chai and Kim (2012) use socio-technical approach to help understand the way in which technology is adopted and used in an organization. E-government studies cite one or more socio-technical works such as of Giddens (1984), Orlikowsky (1992; 2000), Orlikowsky and Iacono (2001), Fountain (2001), and Kling and Lamb (2000) and argue that e-government is a complex and multifaceted phenomenon that requires the knowledge of both the e-government project and its context (e.g. Bwalya, Plessis, & Rensleigh, 2014; Gil-Garcia, 2012; Gil-Garcia & Pardo, 2006). Fountain's (2001) technology enactment framework is based on the premises that it is the interaction between technology and institutions that influences adoption and enactment of technology. Parvez (2008) uses structuration theory (Giddens, 1984; Orlikowsky, 1992; 2000) to study adoption of e-democracy by elected members and formulates propositions for creating an e-friendly democratic culture. Parvez (2008) uses structuration theory to study the relations between ICTs and the organizational and inter-organizational structures. In another paper, Parvez (2006) interprets case study data of three UK local authorities in light of Giddens Structuration theory in order to make

sense of the role e-democracy plays in the democratic process and finds that social structures influence actors in shaping e-democracy. Porwol, Ojo, and Breslin (2013) develop an analytical framework to understand mutual reshaping of government led and citizen led e-participation and use Giddens' (1984) structuration theory to understand how the interactions between actors shapes and modifies institutionalized social structures. Senyucel (2007) uses structuration theory for understanding the mutual relationships between the information systems providers (supplier) and users (service departments) in UK local authorities and finds that technology oriented thinking has constrained the local authorities' e-government deployment. Senyucel (2007) argues that absence of norms or guidance on what to do or not to do and absence of formal rules leads to tensions between users and providers. Using socio-technical approach in e-government, scholars suggest that governments need to look beyond technology and into organizational, political, cultural, and required resources for e-government success (Gil-Garcia & Pardo, 2006; Weerakkody et.al., 2007).

The socio-technical approaches such as the structuration theory (Giddens, 1984) inform the current study as they bring out the intertwined nature of social and technical systems. Structuration approach studies the social and organizational structures and their relationship with information technologies (Gil-Garcia, 2012). The current study assumes that neither technology nor institutions work independently for encouraging e-participation but it is their interaction, their shaping of each-other, that effects e-participation. This study attempts to determine how technology and institutions interact by examining the moderating and mediating impacts of each on the other.

Technology and Institutions Interaction

Technology and institutions can seldom encourage meaningful e-participation without the presence of the other. The socio-technical premise considers social norms and technology as intertwined in a manner that it cannot be separated from each-other (Sawyer & Jarrahi, 2013). Based on the structuration theory of the socio-technical premises, there can be three ways that technology and institutions interact to influence e-participation: 1) institutions moderate (strengthen) the impact of technology on e-participation and vice versa, 2) institutions influence e-participation through information technology resources (mediating effect of technology), and 3) technology impacts e-participation by influencing policies and regulations to (mediating effect of institutions).

Laudon (1977) considered technology only as a facilitating factor, interacting with the historical, organizational, and environmental forces to shape the future. E-participation requires the necessary technological infrastructure and access and knowhow of IT tools by the public. At the same time, organizational settings, cultural, and political dynamics constrain the transformative potential of technological change (West, 2005). Institutions, by virtue of their regulation power, affect e-participation (Jho & Song, 2015). Jho and Song (2015) examine the effect of interaction between technology and institutions on e-participation. They hypothesize that "technology will positively increase the influence of institutions on e-participation, especially when technology is high" (Jho & Song, 2015, p. 490). They find a positive relationship between technology (online population) and e-participation but political institution variable is rejected, when each factor is evaluated independently (Jho & Song, 2015). Nevertheless, for the moderating effects between technology and institutions, they find that high level of e-Participation is associated with not only technological infrastructure but also the

political institutions such as freedom of speech and association and the level of democracy (Jho & Song, 2015).

In the use of ICT for democratic purposes, a lot of influence is exerted by the policy makers in the design and deployment of ICT tools (Parvez, 2008) indicating the influence of institutions on technology and its use for e-participation. Parvez (2008) points out that several factors constrain and facilitate the actors' use of ICT for e-democracy including the wider policies, institutional rules, and democratic activities and discourses surrounding e-democracy. The government actors in his study expressed the view that the ICT use policies hindered their use of ICT (Parvez, 2008). However, as the structuration theory scholars indicate, human actors are not passive receivers of ICT as they can comply with the rules for ICT use or modify or change it through usage leading to intended and unintended consequences even in social structures (Parvez, 2008; Orlikowsky, 2000). Social structures are the rules and actions that enable or constrain the actors and are both a medium and product of human action (Gidden, 1984; Parvez, 2008). In the current study, the institutional resources – political rights and civil liberties and political and regulatory environment- represent such structures that facilitate or constrain the use of ICT for e-participation. ICT and its usage is represented by the technology resources in the current study.

Political rights and civil liberties such as rule of law, free and independent media, academic freedom, freedom to establish private business, free trade unions, interest groups, professional and private organizations, absence of economic exploitation and protection from political terror (measures used in the current study based on survey questions of Freedom House, 2012) are associated positively with the provision of technology resources such as availability and affordability of ICT infrastructure, ICT skills development, and usage of ICT. For example,

Freedom House (2015) has reported that more and more governments are pressurizing private companies to implement censorship on the internet content and dissidents face blockage and loss of business. The companies providing ICT infrastructure are thus vulnerable to the local laws and authorities which impacts the technology resources of ICT availability, affordability, and skill development negatively. In other cases, the governments curb ICT usage for political activities by coercing individuals to remove content, harassing and prosecuting those who refuse to follow the diktat (Freedom House, 2015). Thus, in such countries where political rights and civil liberties are limited, the institutions are hindering the provision of various technology resources that can promote e-participation. On the other hand, countries with better administration and governance and policies supporting ICT such as competition in the telecommunications sector have better provisions of e-participation such as more online services presence (Gulati, Williams, & Yates, 2014).

Jho and Song's study evaluates only the moderating effects of institutions on technology by using a single measure of technology (percentage of individuals using internet). The current study uses multiple dimensions of technology (ICT availability, affordability, skills, and usage) and evaluates the mediating as well as moderating impacts of two different institutions (political and regulatory environment; political and civil rights). Exploring both technological and institutional resources as moderating and mediating variables, informs the path and the intertwined complex nature of the relation between these resources and e-participation. The current study hypothesizes that:

H3: Technology and Institutions interact to influence e-participation.

H4a): Institutions mediate the influence of technology on e-participation.

H4b): Technology mediates the influence of institutions on e-participation

These effects of moderation and mediation are depicted in Figure 3.

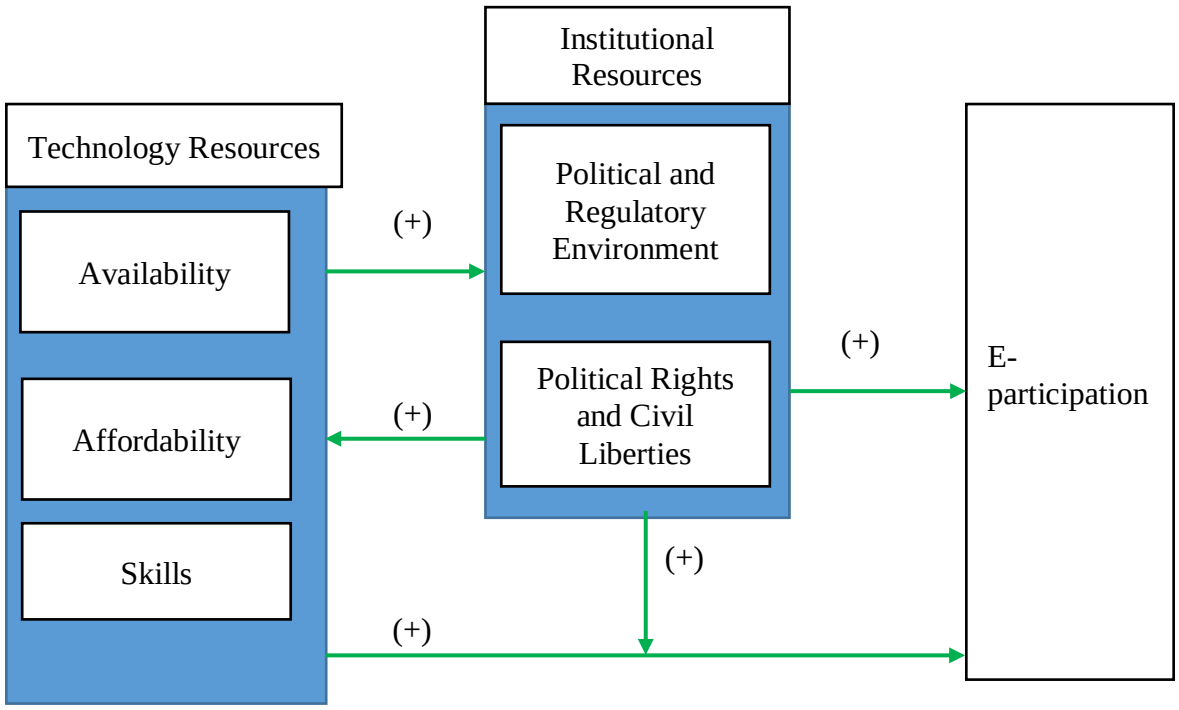

Figure 3: Moderation and mediation effects of technology and institutions on e-participation

Technology in Practice

Orlikowsky's (2000) technology-in-practice (or enacted technology) theory adopted Giddens' (1984) theory of structuration to connect agency and structure (Gherardi, 2009). Agency refers to purposive actions of social actors (Parvez, 2008). Structurational model informs how social -political process shapes technology resulting in structures embedded in technology (Orlikowsky, 2000). Orlikowsky (2000) argues that it is only through the use of this technology in a recurrent manner that user's actions can be structured in return; this implies that human interaction with technology shapes the technology-in-practice but at the same time the

human action is being shaped by the previous technology in use. Institutional arrangements including organizational characteristics influence the enacted technology (Fountain, 2001).

Orlikowsky's (2000) technology-in practice lens has generated a body of research bearing the acronym PBS (practice-based studies) in the organizational and managerial research (Gherardi, 2009). Orlikowsky (2000) applied the practice lens in an organization to study the use of Lotus Notes software in two groups of the company - one group that used the technology recurrently while the other group that was skeptical of the technology. The group using technology recurrently had a team oriented department culture and were able to use several of its properties as well as modify the properties that served to amplify the group's view that using Lotus Notes facilitated their work and reinforced their cooperative and team oriented department structure (Orlikowsky, 2000). Tying it back to the policy feedback theory, the enactment of technology displays interpretive effects both in terms of interpretation of ICT and the institutional structure around it. Mere availability of ICT does not mean that the actors will use it; instead they will conceptualize it in different ways based on the context in which they are embedded (Parvez, 2008; Orlikowsky, 2000).

Several e-gov articles cite Orlikowsky's (1992; 2000) work, either as structuration theory or technology-in-practice lens, in overviews, discourses, and debates about e-gov (e.g. Meijer et.al., 2012; Meijer, Burger & Ebbers, 2009) as well as in empirical research (e.g. Jiang & Xu, 2009; Parvez, 2006) and to develop propositions (Scholl, 2005) but the current study could not trace work that tests the theory. Scholl (2005) debates how e-gov research is different from traditional information systems research and argues that the transformational impacts of e-government practice take time to become visible. Scholl (2005) uses Orlikowsky's (1992) practice lens to propose that first-order changes through electronic government reinforce e-

government diffusion. As per Scholl (2005) a series of small incremental first order changes accumulate over time to result in a second order change that are radical and paradigmatic. Following Orlikowsky's (2000) technology-in-practice lens, this paper argues that mere availability of the technology is not enough to promote e-participation. Instead the available technology needs to be used recurrently in order to effect e-participation. The more people use ICT, the more they will develop the skills and comfort in using them and the more they will find new usage for the technology such as for their engagements with government, thus influencing e-participation positively. The paper hypothesizes:

H5a): Technology usage (enactment of technology) influences e-participation positively.

The current study measures usage of ICT using secondary data on the individual, business, and government usage of ICT in a country. Individual's usage of ICT resources such as social media, business and firm level technology absorption, and government's vision and promotion of ICTs is expected to influence e-participation positively. There is scarce work in the area of what effect does development of online public administration has on citizen's e-participation (Vicente & Novo, 2014). One study shows weak association between the efforts made by local authorities to stimulate e-participation and citizens' online engagement (Saglie & Vabo, 2009; as cited in Vicente & Novo, 2014).

Technology enactment induces a feedback effect of learning. The current study additionally uses the previous e-participation score of a country as a measure of ICT usage. This measure is focused on use of ICT for participatory activities thus instituting specific learning of online participation. In other words, the enactment of online participation in a country promotes e-participation in the subsequent years in a country. As mentioned in the gap analysis, the feedback effect of technology-in-practice (Orlikowsky, 2000) on e-participation is not

considered in the previous studies. Best and Krueger (2005) argue that a well-informed theoretical model of e-participation fails to account for the likely reciprocity between independent and dependent variables; for example, the possibility that the dependent variable (online participation) may contribute to the acquisition of the most influential independent variable (online skills) (addressed in Krueger, 2002). This paper, therefore, especially includes the past level of e-participation in a country as a predictor of current level of e-participation in the country. The hypothesis is:

H5b): Previous e-participation level influences e-participation positively.

Figure 4 depicts the hypothesized influence of previous e-participation level on the subsequent e-participation.

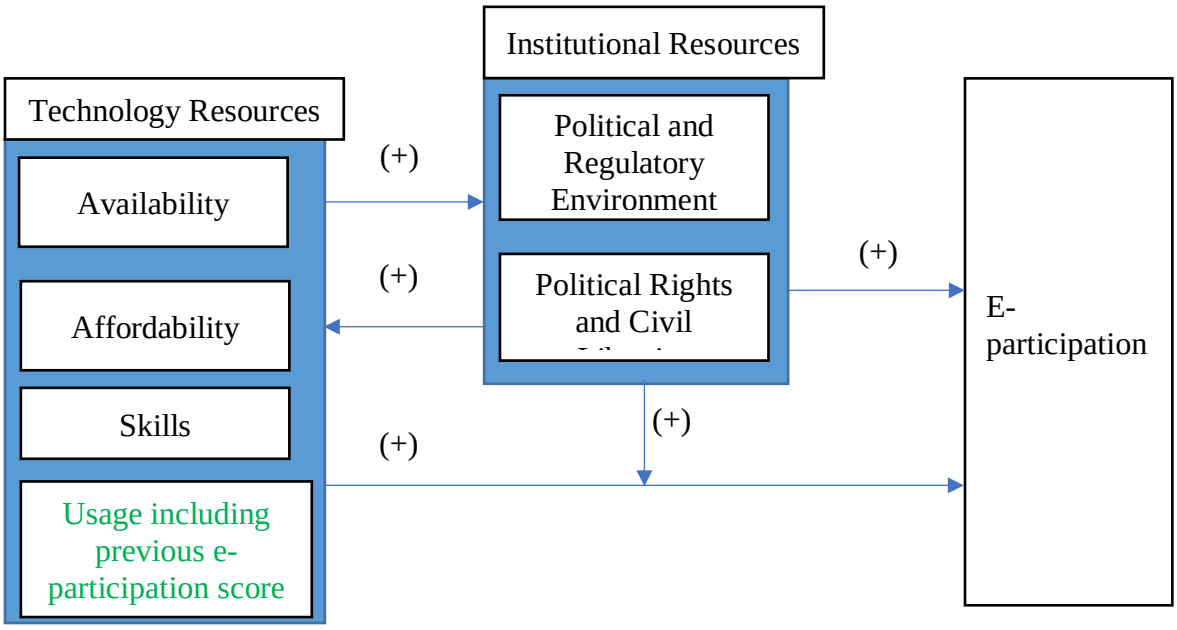

Figure 4: Effect of technology enactment on e-participation

Influence of Factors at Different Levels of E-participation

The dependent variable for the current study is e-participation. As discussed in the UN's e-participation survey section of the literature review, this variable is measured using the scores of e-participation and its three stages of e-information, e-consultation, and e-decision making (UN, 2014). Each member country gets a percentage score based on utilization of e-participation at each of the three levels of participation as well as gets a cumulative e-participation score. There is a significant difference in the utilization of e-participation in the three stages even amongst the top 50 performers. For example, both US and India are in the top 50 performers based on the overall e-participation score but their percentage utilization across different stages of e-participation varies significantly; while both India's and the US's scores for the e-information stage are close, India has failed to score even a single point in e-decision making in 2014 unlike US. The gap analysis informed that studies so far have not evaluated difference in factors for the utilization of e-participation by separate stages (or levels). The current study does not presume that all factors influence all stages of e-participation alike, and argues that there is a difference in the magnitude and significance of factors influencing e-participation utilization at different stages and evaluates the same as shown in Figure 5.

This argument is based on the premise that it is challenging for the governments to advance to the higher stages of e-government such as horizontal and vertical integration and participation. As compared to initial stages of information sharing, the later stages require higher levels of interoperability and more sophisticated technology solutions for encryption, information sharing, and interactive communication (Hiller & Belanger, 2001; Moon, 2002). E-participation constitutes of different types of activities with varying levels of complexity across its stages such as information sharing, voicing opinions, or providing suggestions on policy

issues. Anduiza, Gallego, and Cantijoch (2010) studied three different types of online participation in Spain: contacting representatives, donating money, and raising petitions. Their study finds difference in the resources and their magnitude across different types of online participation activities.

The current study argues that the resources required and their impact is not similar across the three levels of e-participation: e-information, e-consultation, and e-decision making (as measured in the UN survey). More sophisticated levels of e-participation will require more sophisticated technological infrastructure and policies. For example, while e-information stage may just require access to computer and internet, e-consultation and e-decision making may require superior education and skills to use social media tools and critique policies. Best and Krueger (2005) argue that faster connections enable users in quick internet search and download facilitating research and information gathering. Krueger (2002) argued that a broadband connection may enhance the likelihood of engaging in political participation. However, more favorable institutional resources may be required at advanced levels of e-participation where public participation aims at empowering citizens in decision making as compared to lower levels considering only one-way sharing of information.

- E-information stage requires resources of skills and technology to upload and communicate information, and to receive and interpret information. These fall in the category of material and human resources. Material resources comprise of technology to upload, technology to communicate, and technology to download. Human resources involve the necessary education and skills to download, read, and interpret the information. The e-information stage is associated with static and one-way communication.

- E-consultation stage resources involve dynamic two-way communication. In addition to the e-information stage resources, this stage additionally requires access to social networking sites and better online skills to communicate on these sites. Variables of internet bandwidth and institutional regulations also become important at this stage.
- E-decision making: This stage is associated with empowerment of residents. Factors of digital divide become important in this stage. This stage requires more sophisticated use of internet and therefore, access to computers and networks is not sufficient but advanced skills are required to use these resources for decision-making. UN studies suggest an elusive relationship between democracy and e-participation. This paper argues that the institutional resources become more important at the higher stages of e-participation.

The paper proposes the following hypotheses:

H6a: There is a difference in the magnitude of the technology variables on different levels of e-participation.

H6b: There is a difference in the magnitude of the institutional variables on different levels of e-participation.

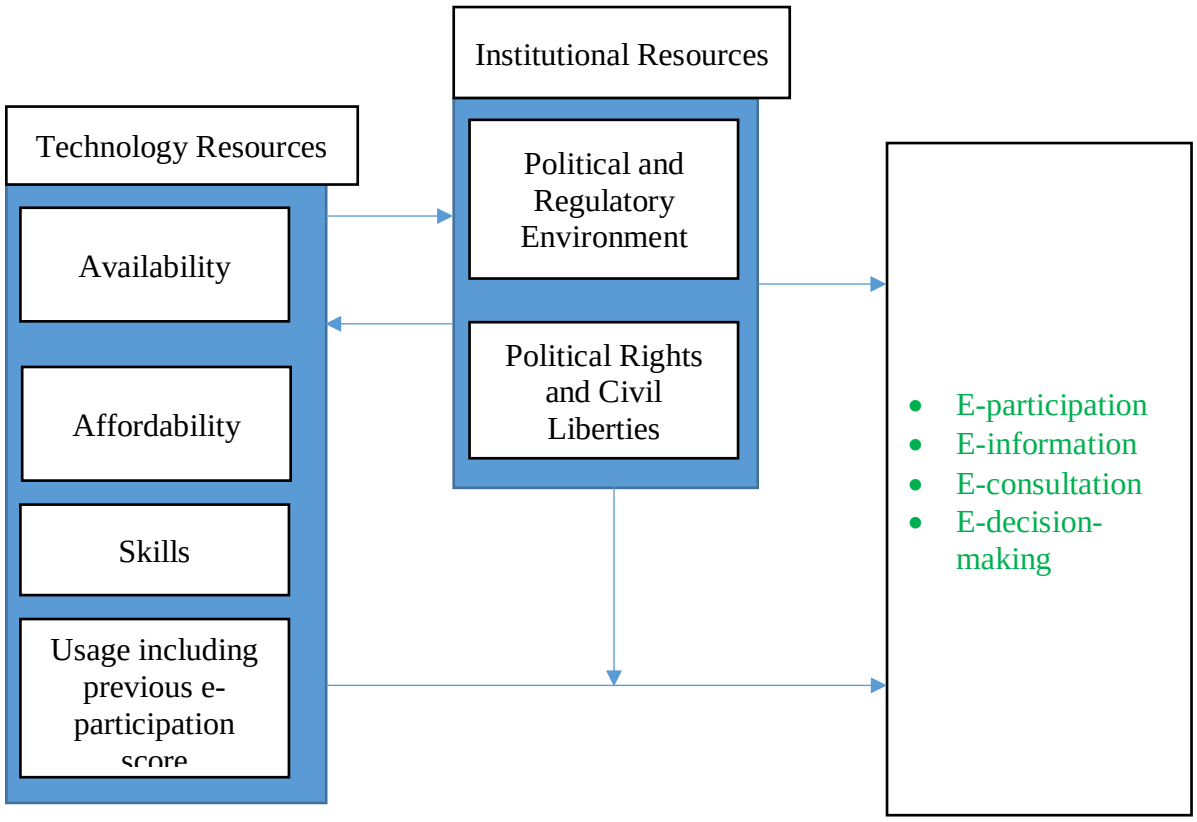

Figure 5: Effect of technology and institutions on e-participation and its stages

Control Variables: Socio-Economic and Demographic Resources

The resources approach of the policy feedback theory has underlined the importance of demographic and socio-economic factors on public participation. Traditional participation studies have explored socio-economic and demographic variables as a factor of public participation. In the online participation literature, two lines of thought contradict the effect of these variables. One set of studies consider the traditional socio-economic variables of income and education irrelevant for explaining online participation (Best & Krueger, 2005), while the other authors consider these as important predictors of online participation (Gulati, William, & Yates, 2014; Hansen & Reinau, 2006). Jho and Song (2015) find a positive relationship between

their socio-economic variable (measured using a composite index that includes national income, level of education, rate of illiteracy, and average citizen lifespan) and e-participation. Be´langer and Carter (2009) use income, education, age, and frequency of internet use and find positive impact of these indicators on the use of e-government services, which they argue is consistent with previous literature. The current study uses national income as a control variable and assesses its impact on e-participation.

The paper uses two demographic indicators: percentage of young in the population, and urban population. An important demographic variable in ICT literature is of age as younger individuals are considered to possess higher levels of internet skills which is also the most influential predictor of online political activity (Best & Krueger, 2005). Therefore, a higher percentage of young in country raises the likelihood of online participation and therefore, greater the e-participation in that country. Urbanization is used because government and private industries are more likely to provide ICT based services in urban areas that have concentrated population, availability of telecom infrastructure, larger areas in size, and where personal contact between citizens and government can be difficult or inconvenient (Gulati, William, & Yates, 2014). Population density in urban areas provides economies of scale for telecom investment. Cost savings do not emerge until enough users start taking advantage of electronic delivery systems (West, 2005). Overall, this study uses the socio-economic and demographic variables as the control variables consisting of: income levels, percentage of young in the population, and urban population. These control variables are expected to have a positive influence on e-participation. The final conceptual model for the current study is depicted in Figure 6. The model shows that it is the interactive effects of institutions and technology resources that impact e-participation and its utilization at different stages.

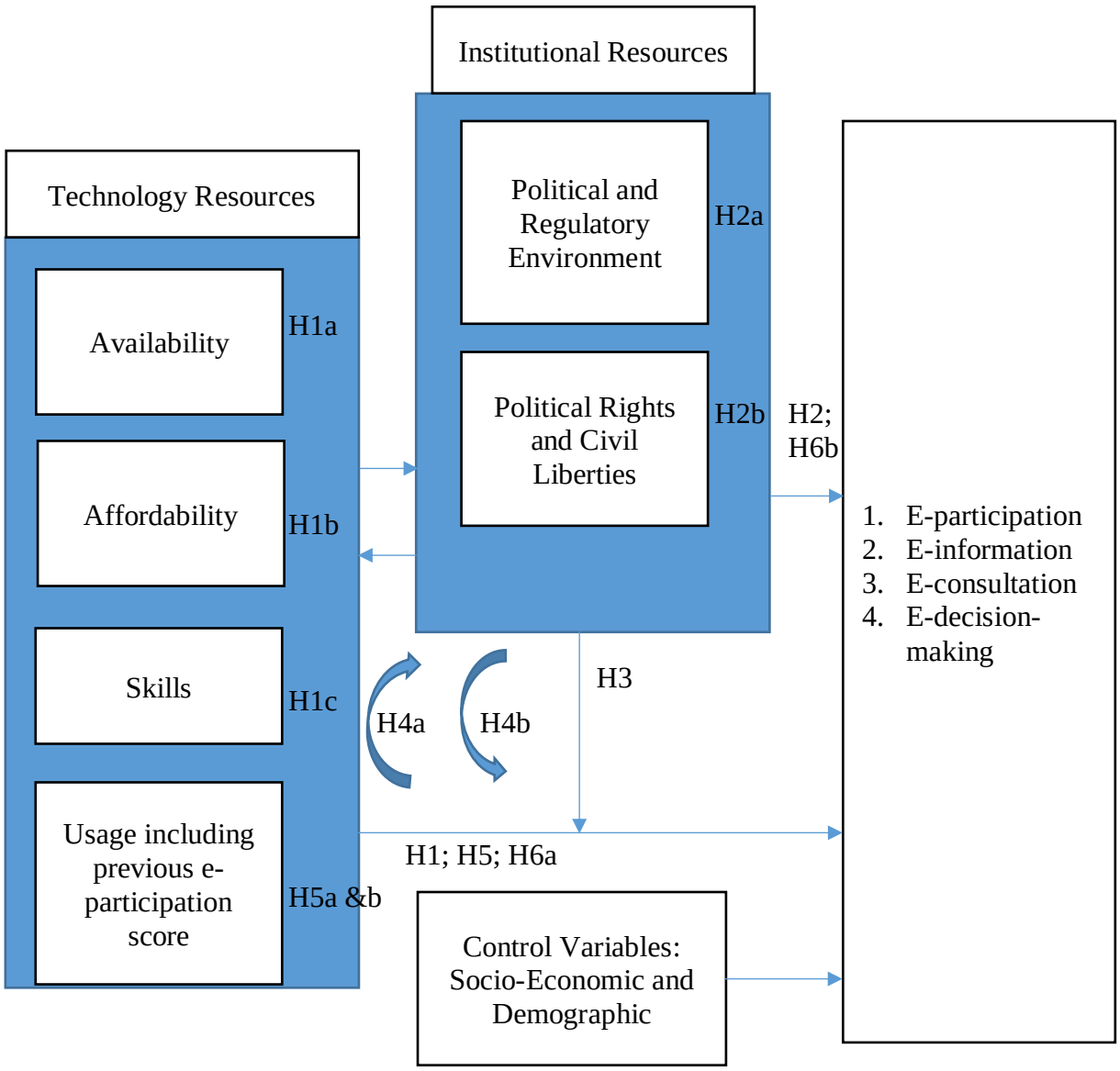

Figure 6: A policy feedback and socio-technical approach to e-participation (PFSTeP)

4. METHODS

The purpose of the current study is to identify and assess the impact of factors that can help explain the difference in the degree and level of e-participation in countries. The previous section laid out the conceptual model for e-participation that is used in the current study. A massive list of variables has been used in offline and online public participation literature to date. Many variables are measured using survey data that suit a study done at a smaller scale and unit of analysis. This study relies on secondary data. The data sources are international organizations of repute and their data are frequently used in studies of e-government and e-participation.

Data - Measures and Sources

Dependent Variable

Note that the research questions seek explanatory factors for both the degree of e-participation as well as for the levels/stages of e-participation in countries. The dependent variables for the current study are e-participation, and its levels of e-information, e-consultation, and e-decision making. These variables are measured using the scores of UN e-participation survey for the year 2014 and 2016. The UN data are considered a legitimate index that is meaningful as it enumerates the different levels of the online activity of civil participation whereas other data merely track the traditional participatory outcome; for example, the voting rate (Norris, 2011; Jho & Song, 2015).

The data are available for 193 countries for each year. The current study uses two years of survey data (2014 and 2016) to increase the number of cases in the study. Although UN has changed its parameters of assessing the countries for e-participation and its utilization by different stages over the years, yet the definitions remain the same – that is to assess the provisions that the national governments have made to encourage online participation in their

countries. The e-participation framework and definitions for the three levels of e-participation are also consistent between years 2014 and 2016 (compare UN, 2014, p. 197 and UN, 2016 p. 141). Åström, Karlsson, Linde, and Pirannejad (2012) have used comparative longitudinal data from the UN e-government surveys for statistical analysis and derived their findings based on it. While using the combined survey data, the current study takes necessary caution and run diagnostics for independent years to detect any meaningful difference in results.

Prior cross-country studies have used the scores of UN measure of e-participation (e.g. Åström, Karlsson, Linde, & Pirannejad, 2012; Gulati, Williams, & Yates, 2014; Jho & Song, 2015; Zhao, Shen, & Collier, 2014). This study is additionally using the percentage scores of e-participation utilizations by levels. UN (2014; 2016) e-participation framework defines e-information as "enabling participation by providing citizens with public information and access to information without or upon demand"; e-consultation as "engaging citizens in contributions to and deliberation on public policies and services"; and e-decision making as "empowering citizens through co-design of policy options and co-production of service components and delivery modalities" (p. 197). UN e-participation survey (2014; 2016) assesses how countries are using online services to promote citizen to citizen and citizen to government interaction and is a qualitative assessment of availability and relevance of participatory services in a country. The survey assesses features such as availability of archived information across the six sectors of finance, health, labor, education, social welfare, and environment for assessment of the e-information stage (UN, 2014). E-consultation is assessed through website features of availability of tools for e-consultation such as social media, online forums, online polls, voting tools, and online petition tools (UN, 2014). Facilities for e-decision-making consist of stated online e-participation policy, an online calendar of participatory events, online procurement

announcements, online citizens' right to government information, and sharing outcome of participation in a new policy, service or decision-making (UN, 2014).

Explanatory Variables

In the current study, the explanatory variables are divided into the two categories of technology resources and institutional resources. The source for the technology variables is the Network Readiness Index (NRI) of the World Economic Forum (WEF). The NRI index is a measure of a countries' ability to utilize ICT for competition and well-being (WEF, 2016b). The indicators are measured using data obtained through surveys and data from other international agencies such as UN and World Bank. It is a cumulative index of a country's ICT infrastructure, usage, and its social and economic impacts. The current study uses the scores for years 2012 and 2014 for the indicators of infrastructure (referred to as ICT availability in the current study), affordability, skills, and individual, business, and government usage. The infrastructure component measures electricity production, mobile coverage, internet bandwidth, and internet servers available for the population (WEF, 2016a). The affordability indicator measures tariffs and competition index for telephony and internet sectors (WEF, 2016a). Skills measure gross enrolment in secondary education, adult literacy, and quality of math and science education (WEF, 2016a). Individual usage data measure percentage of individuals or households having, computers, mobiles, internet, broadband subscriptions, and use of social virtual networks (WEF, 2016a). Business usage measures technology absorption at firm level, use of ICT in business to business and business to customer engagements, and innovation capacity. Government usage data measure importance of ICTs in government's vision, government's online service index (a component of UN's e-government survey), and government's success in promoting ICT (WEF, 2016a). Note that one of the components of usage is the previous year's e-participation score.

The data for it are obtained from the UN e-participation score of a country for the previous year (year 2012 is the preceding year for e-participation in 2014 and year 2014 is the preceding year for e-participation in 2016). Separately assessing the impacts of the technology dimensions, instead of composite NRI score, provides better actionable feedback to practitioners and helps filter items that are not of interest for the current study.

The data for the institutional variable of political and regulatory environment is also obtained from WEF's NRI study. Some e-participation studies evaluate laws and policies such as implementation of online privacy and security laws (e.g. Chen & Hsieh, 2009). Apart from privacy and security laws, regulatory quality has been used in e-participation model as a governance indicator by Gulati, Williams and Yates (2014). The current study utilizes the scores of political and regulatory environment (World Economic Forum [WEF]) that includes the assessment of laws relating to ICTs in a country as one of the measure for institutions. This index comprises of effectiveness of law-making bodies, intellectual property protection, and software piracy rate in a country amongst other indicators (WEF, 2016a). The second institutional variable of political rights and civil liberties is obtained from the Freedom House index. Freedom House is a US based non-governmental organization, established in 1941, and its data are used in previous studies for measuring the institutionalization of freedom of speech and association or democratic politics in a country (such as by Gulati, Williams, & Yates, 2014; Jho & Song, 2015).

Control Variables

This study uses the socio-economic and demographic variables as the control variables and these consist of: income levels, percentage of young in the population, and urban population. Gulati, William, and Yates (2014) use percentage of residents living in urban areas as a measure for urbanization; Zhao, Shen, and Collier (2014) use World Bank's Gross National Income per

capita to measure economic development in a country to differentiate the impact on e-government between high and low-income countries. There are more than one sources for this data. All variables, measures, and their data sources, used in the current study are aggregated in Table 4.

Table 4: List of variables, measures, and their data sources

Group	Variable	Measures	Source	Years (Number of Countries)
Dependent Variables	E-participation	E-participation score	UN E-government survey	2014; 2016 (193 countries)
	E-information	E-information percentage value	UN E-government survey	
	E-consultation	E-consultation percentage value	UN E-government survey	
	E-decision making	E-decision making percentage value	UN E-government survey	
Technology	ICT availability	Electricity production (kWh/capita), mobile network coverage (as a percentage of population), international internet bandwidth (kb/s per user), and secure internet servers/million population.	NRI- WEF	Data available yearly from 2012-2016 (~140 countries)
	ICT affordability	Cellular and fixed broadband internet tariffs, and internet and telephony competition	NRI- WEF	Data available yearly from 2012-2016 (~140 countries)

Table 4 Continued

Group	Variable	Measures	Source	Years (Number of Countries)
	ICT Usage- individual/ businesses/ government	•Individual Usage - mobile phone subscriptions/100 population, individuals using internet, percentage households w/ personal computer, percentage households w/ internet access, percentage fixed broadband internet subs/100 population, mobile broadband subs/100 population, use of virtual social networks (1-7 best) •Business Usage -Firm-level technology absorption, capac innovation, PCT patent applications per population, ICT use for busi business transactions, Busine consumer internet use, exten training. •Government Usage - importance of ICTs to government vision, (1-7 best), government Online Service Index, 0–1 (best), government success in ICT promotion, (1-7 best)	NRI- WEF	Data available from 2012-2016 (~140 countries)
	Usage - Previous e-participation	Previous year's e-participation score	UN E-government survey	2012; 2014 (193 countries)
	ICT skills	Quality of educational system, (1-7 best), quality of math & science education (1-7 best), secondary education gross enrollment rate (percentage), adult literacy rate, (percentage)	NRI- WEF	Data available yearly from 2012-2016 (~140 countries)

Table 4 Continued

Group	Variable	Measures	Source	Years (Number of Countries)
Institutions	Political and regulatory environment	Effectiveness of law-making bodies, 1-7 (best); Laws relating to ICTs, 1-7 (best); Judicial independence, 1-7 (best); Efficiency of legal system in settling disputes, 1-7 (best); Efficiency of legal system in challenging regulations, 1-7 (best); Intellectual property protection, 1-7 (best); Software piracy rate, percentage software installed; Number of procedures to enforce a contract; Number of days to enforce a contract	NRI- WEF	Data available yearly till 2017 (~140 countries)
	Political rights and civil liberties	Political Rights and civil liberties (Mean of Political Rights and Civil Liberties)	Freedom House	Data available yearly till 2017 (193)
Socio-Economic/ Demographic	National income	GDP per capita (current US$)	World Developmer Indicator (WDI)	Data available yearly till 2014 (~160-180 countries and regions)
	Percentage of young in the population	Population ages 15-24 (% of total)	US-CIS	Data available yearly till 2015 (240 countries and regions)
	Urban population	Urban population (% of total)	WDI	Data available yearly till 2015 (260 countries and regions)

The data used in this study have some limitations associated with a secondary dataset; for example, the data from various sources are not available for all countries (193) covered in the UN survey. However, most data are available for substantial proportion of the UN member countries and for multiple years. The technology and institutions variable data from WEF is available for required years (2012 and 2014) for 143 countries. The secondary data used in this study are from organizations of repute, are used in multiple studies across different fields (as discussed in the analytical framework and measures section), and are updated as they are assessed on a yearly or biennial basis.

Data Collection

Sample

The unit of analysis in the current study is a country. The population for the purpose of the current study comprises of all countries in the world. The sampling frame is the list of countries that are UN members and for which the data for the dependent variable of e-participation are available in the UN survey. It consists of 193 countries. This provides the base list of countries (units of analysis) for the study. Due to the non-availability of the data for the explanatory variables, some countries are removed from the final dataset.

The current study uses panel data that combines data for 143 countries from two different waves of the same surveys on the same countries to create a larger dataset of 286 cases in the sample. Chi2 tests such as in structural or simultaneous equation modeling (SEM) are very sensitive to sample size and require a minimum of 200 cases or more (Kline, 2011) as recommended sample size. By combining two waves of data the sample size has been increased from 143 to 286. The presence of lagged dependent variable (the previous e-participation level) eases concerns of any autocorrelation in the model (Keele, & Kelly, 2005). The presence of a

lagged dependent variable needs to be supported by theory and this requirement is met in the current study (refer the discussion for hypothesis H5b in Chapter 3).

The data were first downloaded, copied, and arranged in a single excel sheet. The data had to be converted from wide to long format i.e. the columns were for Country, Year, Var1, Var2, and so on, in the long format. There are 286 rows of data i.e. 143 countries for each year (2014 and 2016 for dependent variable and 2012 and 2014 for the explanatory variables). The explanatory variables data are from two years ahead of the dependent variable data in order to create a lag that allows adequate time for the explanatory variables to effect dependent variable. However, no longitudinal analysis is conducted in the current study due to the limitation of the number of cases in a year to the large number of parameters to be analyzed in the model. In effect, it is assumed that there are 286 different countries. All the dependent and explanatory variables are continuous variables.

Missing Data

There are six countries for which the explanatory data was not available for 2012 and the study uses year 2013 data for those countries because it still provides a lag of one year with respect to the dependent. There was 1 country for which the explanatory data were not available for 2014 and the study uses year 2015 data in place of that. It still precedes the dependent by one year. In case of Yemen and Burundi, only one data cell had missing information (while the remaining explanatory variables data were available), and the subsequent year's data were imputed. In the control variables, three GDP values of the 286 countries had to be taken from International Monetary Fund (IMF) as WDI data were missing. These missing data cells were 2012 and 2014 GDP per capita values for Libya and year 2014 for Venezuela. IMF GDP data have slight differences as compared to WDI; for example, the WDI reports the US GDP per

capita (in US $) for 2012 as 51433.047 and 2014 as 54539.666 while IMF values are 51403.4 and 54668.1, respectively.

Data Transformation

Political rights and civil liberties data were reverse coded because in the original data set low value of these measures denotes high democracy levels. This is in reverse sense of the other variables such as e-participation where low values denote low e-participation. The mean value of political rights and civil liberties was then used to represent the two variables by a single measure "political rights and civil liberties" as was proposed in the conceptual model. The two terms are highly correlated with a correlation of r=0.93. A single value for these two variables is available in the original dataset from Freedom House but only for the year 2016. Since the current study is using 2014 and 2016 data, the value was calculated by taking a mean of the two scores for the purpose of the current study. Apart from this, log transformation of national income variable is used in the current study.

Data Analysis

This paper hypothesizes complex relationships between technology, institutions, and e-participation than simple bivariate relations and a set of equations are used to assess these relationships. The study uses the following analysis methods for testing the hypotheses.

Mediation Analysis

The study aims to evaluate the mediating role of technology as well as institutional resources. Therefore, there are two models to be evaluated – one each for technology and institution as mediator. Simultaneous equation modeling is used to test the direct and indirect effects hypotheses. Simultaneous equations are analyzed using the structural part of the SEM for each variable used directly in the model that provides the direct, indirect, and total effects of

technology and institution resources. This analysis is performed for testing the following hypotheses:

H1a): The availability of ICT resources has a positive influence on e-participation.

H1b): The affordability of ICT resources has a positive influence on e-participation.

H1c): ICT skills have a positive influence on e-participation.

H2a): Supporting political and regulatory environment in a country is positively associated with the e-participation in that country.

H2b): Political rights and civil liberties influence e-participation positively .

H4a): Institutions mediate the influence of technology on e-participation.

H4b): Technology mediates the influence of institutions on e-participation

H5a): Technology usage (enactment of technology) influences e-participation positively.

H5b): Previous e-participation level influences e-participation positively.

The first simultaneous equation model for e-participation as the dependent variable, and institutions as mediator, can be represented by the set of equations labeled Eq. 1a and 1b. Table 5 lists the models and the hypotheses that the models test for the current study.

$$\text{E-Participation} == f \begin{bmatrix} \text{Technology}_{1,\,2,\,\ldots 5} \\ \text{Institution}_{\,1,2} \\ \text{Control Variables} \end{bmatrix} \qquad \text{Eq. 1a}$$

$$\text{Institution}_{\,1,\,2} = f\,[\,\text{Technology}_{\,1,\,2,\,\ldots 5}] \qquad \text{Eq. 1b}$$

The second model for e-participation as the dependent variable, and technology as the mediator, can be represented by the set of equations labeled Eq. 2a & 2b.

$$\text{E-Participation} == f \begin{bmatrix} \text{Technology}_{1,\,2,\,\ldots 5} \\ \text{Institution}_{1,2} \\ \text{Control Variables} \end{bmatrix} \qquad \text{Eq, 2a}$$

$$\text{Technology}_{1,\,2,\,\ldots 5} = f\,[\,\text{Instituion}_{1,\,2}] \qquad \text{Eq. 2b}$$

Simultaneous equation is a set of equations with joint dependencies of variables wherein one or more of the explanatory variables are jointly determined with the dependent variable (Wooldridge, 2000). Each independent equation, for example Eq. 1a, 1b, and 2a represents a structural equation. Eq. 1a and 1b together represent a system or set of structural equations with e-participation and institutions as the two endogenous variables. Technology and control variables, in the equation set 1, are exogenous variables. Although previous research has provided methods to analyze mediation and moderation effects separately, more recent research investigates how the effects work together (Fairchild & Mackinnon, 2009). Fairchild and Mackinnon (2009) argue that there is utility in simultaneously estimating effects but few have used it in applied research. Simultaneous equation modeling is used in the current study to analyze direct and mediation effects.

Moderator Analysis

Following Jho & Song's (2015) data analysis for interaction effects of technology and institutions, the study uses t-test and ANCOVA for testing the moderator hypotheses:

H3: Technology and Institutions interact to influence e-participation.

Multivariate Regression

The purpose of the current study is to assess the impact of the explanatory variables on distinct e-participation levels as well. For the last two hypotheses of difference in the magnitude of technology and institution variables across the three stages of e-information, e-consultation, and e-decision making, multivariate regression (regression with more than one dependent variable and common explanatory variables) is applied.

H6a: There is a difference in the magnitude of the technology variables at different levels of e-participation.

H6b: There is a difference in the magnitude of the institutional variables at different levels of e-participation.

Table 5: Models for testing hypotheses

	Model 1&2 (Eq.1 , 2)	**Model 3**	**Model 4**
Purpose	Impact of technology, institutions, and their mediation effects on e-participation	Impact of technology, institutions, and their interaction on e-participation	Difference in the magnitude of technology and institution variables across the three stages of e-information, e-consultation, and e-decision making
Hypotheses	H1, H2, H4, H5	H3	H6
Dependent Variable	e-participation (2014 & 2016)	e-participation (2014 & 2016)	e-information/e-consultation/e-decision making (2014, 2016)
Explanatory Variable	ICT Availability	ICT Availability	ICT Availability
	ICT Affordability	ICT Affordability	ICT Affordability
	ICT Usage	ICT Usage	ICT Usage
	ICT Usage- Previous e-participation score	ICT Usage- Previous e-participation score	ICT Usage- Previous e-participation score
	ICT Skills	ICT Skills	ICT Skills

Table 5 Continued

	Model 1&2 (Eq.1 , 2)	**Model 3**	**Model 4**
	Political & Regulatory Environment	Political & Regulatory Environment	Political & Regulatory Environment
	Political Rights & Civil Liberties	Political Rights & Civil Liberties	Political Rights & Civil Liberties
Control Variables	National Income	National Income	National Income
	Percentage of Young in the population	Percentage of Young in the population	Percentage of Young in the population
	Urban population	Urban population	Urban Population
Analysis	Structural component of structural equation modeling	T-test; ANOVA	Multivariate Regression
Sample size (N)	286	286	286

5. RESULTS AND ANALYSIS

Description and Summary

The description of the dataset is provided in Table 6. Note that country name is the only string variable in the dataset. The dependent, explanatory, and control variables have already been discussed in Chapter IV. The "epartpre" variable that represents previous e-participation score records the e-participation score of a country prior to the year in which the dependent variable score is recorded. Thus, when the dependent variable score is recorded for year 2014, "e-partpre" is for 2012 and if dependent variable score is of year 2016, "e-partpre" is for year 2014.

Table 6: Dataset description

Variable name	Data type	Variable label
country	string	Name of the Country
year	byte	Year for which the Dependent Variable is measured
epart	interval	E-Participation Score of a country - UN E-Gov Survey
einf	interval	E-Information Score of a country - UN E-Gov Survey
econ	interval	E-Consultation Score of a country - UN E-Gov Survey
edec	interval	E-Decision-Making Score of a country - UN E-Gov Survey

Table 6 continued

Variable name	Data type	Variable label
clrevcode	interval	Civil Liberties Score of a Country - Freedom House (Reverse coded)
polregenv	interval	Political and Regulatory Environment of a country - World Development Indicator(WDI)
infrastruc	interval	Infrastructure as a measure of ICT Availability in a Country - WDI
afford	interval	ICT Affordability in a Country - WDI
skills	interval	ICT Skills in a Country - WDI
usage	interval	Individual, Business, and Government's ICT Usage in a country - WDI
epartpre	interval	Previous E-Participation Score of a Country - UN
logincome	interval	Log of National Income of a Country - Measured by GDP per Capita (current US$) for a Country - WDI
young	interval	Percentage of Population aged between 15-24 Years of Age – USCIS Data
urbpop	interval	Percentage of Urban Population in a Country
polrcivlib	interval	Mean of political rights and civil liberties (both reverse coded)

Table 6 continued

Variable name	Data type	Variable label
e-partgroup	binary	Dummy variable 0 is equal to epartgroup < .5072951 (mean of the variable)

The data are summarized in Table 7. The number of observations is 286 that is the total number of country-year observations. The range for dependent variable e-participation is from 0.0196 to 1 with a mean almost at the center at 0.51. The range for the three dependent variables that represent the levels of e-information, e-consultation, and e-decision making is from 0-100. Since the scores for these three levels are not used in any model together with the e-participation score, no transformation is required. As the stage of e-participation progresses, the mean value drops drastically from 64 percent in the first stage to 42 percent in the second stage to 13 percent in the final stage. This indicates that countries have better utilized the initial e-information stage as compared to the second e-consultation stage and the countries together have scored the least on the third stage of e-decision making. One can also notice that the mean value of previous year's e-participation score is lower at 0.37 (2012, 2014) as compared to the e-participation score of 0.51 (2014, 2016) indicating that the e-participation for the sample countries has in general improved over the years.

Table 7: Data summary

Variable	Obs	Mean	Std. Dev.	Min	Max
epart	286	.5073	.2549	.0196	1
einf	286	64.4330	26.0736	7.41	100
econ	286	41.5299	29.2707	0	100
edec	286	13.2991	24.868	0	100
polrcivlib	286	4.8427	1.7912	1	7
polregenv	286	3.8216	.8802	2.2970	5.9559
infrastruc	286	4.0315	1.4413	1.3858	6.9036
afford	286	4.8531	1.3262	1	7
skills	286	4.6326	1.1539	1.8924	6.5487
usage	286	3.7402	.96351	2.0518	6.0611
epartpre	286	.37426	.2790	0	1
natincome	286	16008.37	21495.12	244.1965	116612.9
logincome	286	8.7526	1.4917	5.4980	11.6666
young	286	16.6997	3.6854	9.6	23.1
urbpop	286	.5990	.2219	.1119	1

The D'Agostino, Belanger, and D'Agostino's (1990) skewness and kurtosis tests for normality results are shown in Table 8. The chi2 probability tells that for each of these variables, the hypotheses that the variable is normally distributed can be rejected. The skewness of a normal distribution is zero and the first variable e-participation has a negative value of -0.006 (as obtained by detailed summary not shown here) meaning that it is negatively skewed. Negative

skewness in this case indicates that there is more concentration of countries toward lower value of e-participation scores. Kurtosis for a normal distribution is 3. The kurtosis of 2.03 (i.e. less than 3) for the variable e-participation indicates light tailed distributions meaning lack of outliers. The mean for this variable (0.51) is also slightly smaller than the median (0.53), which suggests negative skewness, but the difference is small which supports the kurtosis showing lack of outliers.

Table 8: Normality tests results

Variable	Obs	Pr(Skewness)	Pr(Kurtosis)	adj chi2(2)	Prob>chi2
epart	286	0.9664	0.0000	35.13	0.0000
einf	286	0.0003	0.0000	34.78	0.0000
econ	286	0.0084	0.0000	64.05	0.0000
edec	286	0.0000	0.0000	.	0.0000
polregenv	286	0.0000	0.1347	16.95	0.0002
infrastruc	286	0.0680	0.0000	21.83	0.0000
afford	286	0.0000	0.1972	18.34	0.0001
skills	286	0.0000	0.0087	20.06	0.0000
usage	286	0.0000	0.0494	17.30	0.0002
epartpre	286	0.0012	0.0000	27.57	0.0000
prrevcode	286	0.0053	0.0000	.	0.0000
clrevcode	286	0.1143	0.0000	.	0.0000

Measurement Validity

To test the construct validity of the explanatory variables, a simple correlation analysis is conducted. There is an underlying understanding in the conceptual model that the political rights and civil liberties, and political and regulatory environment constitute the institutional resources. Similarly, the infrastructure, affordability, skills, usage, and previous e-participation constitute the technology resources. Table 9. displays the correlation matrix between the variables. The technology variable of ICT infrastructure, skills, usage, and previous e-participation score show large (>0.5) correlation coefficient indicating a good convergent validity but the variable afford shows a moderate (>0.3) convergent validity with the other technology variables. The two institutional variables of political rights and civil liberties and political and regulatory environment also show a moderate convergent validity of 0.046. Although convergent validity is moderate to large, the discriminant validity is lacking in the variables used. The technology variables of ICT infrastructure and usage have large correlation coefficients with political rights and civil liberties. However, if one recalls the discussion in Chapter IV, the measures for technology variables are distinct from the political rights and civil liberties. While the measures for technology variables are quantitative such as mobile phone subscriptions and percentage of individuals using internet, the measure for the institutional variable are response to survey questions.

The face validity of the political rights and civil liberties and political and regulatory environment as measures of institution is much more convincing as compared to them being dimensions of technology. Same, holds true for the face validity of the technology variables where all measures are related to ICT and for the purpose of the current study make sense to be considered as dimensions of technology. Furthermore, other studies (e.g. Åström, Karlsson,

Linde, & Piranejad, 2012; Gulati, Williams, & Yates, 2014; Jho and Song, 2015) also use these variables in the same manner such as political rights and civil liberties as institutional variable and price of telecommunication or number of internet connections as technology variable.

Table 9: Correlation matrix for the explanatory variables

	polrcivlib	polregenv	infrastruc	afford	skills	usage	epartpre
polrcivlib	1.0000						
polregenv	0.4611	1.0000					
infrastruc	0.5887	0.7423	1.0000				
afford	0.2900	0.2502	0.4352	1.0000			
skills	0.4863	0.6454	0.8403	0.4510	1.0000		
usage	0.5383	0.8513	0.9152	0.4689	0.8100	1.0000	
epartpre	0.3139	0.5074	0.6023	0.4673	0.5252	0.7113	1.0000

Mediation Analysis

The study aims to evaluate the mediating role of technology as well as institutional resources. Therefore, there are two models to be evaluated – one each for technology and institution as mediator. Simultaneous equation modeling (SEM) is used to assess the direct and mediation effects of the technology and institutional resources on e-participation. The current study's interest is in the structure rather than the measurement model. Since, there is no latent variable, a measurement model is not required (Acock, 2013) in the current study. The variables

used in the current study are indexes on their own. Maximum Likelihood estimation is used. It is the default in Stata as well as the most frequently used estimation method (Ullman, 2006).

Technology as Mediator

Figure 7. represents the SEM model that is run for technology as mediator of institutions. There are five exogenous variables: political rights and civil liberties, political and regulatory environment, national income, young, urban population. There are five endogenous mediator variables: infrastructure (ICT availability), affordability, skills, usage, and previous e-participation score. There is one endogenous variable of e-participation in the model. Table 10. provides the standardized estimates of the model. The standardized results indicate the change in the dependent variable given the explanatory variable, where both are measured in standard deviation units. The standardized coefficient (or beta weights) help to compare the magnitude of impact for each variable. The raw (unstandardized) coefficients cannot be used for the purpose since all variables are not measured on same scale of measurement. The institutional resources variable of political rights and civil liberties has a positive and significant impact (all $p < 0.000$) on ICT availability, affordability, skills, and usage at 95 percent confidence level. The political and regulatory environment has positive and statistically significant effect on ICT availability ($p < 0.05$), affordability ($p < 0.018$), skills ($p < 0.05$), and usage ($p < 0.05$) at 95 percent confidence level. Political and regulatory environment has positive and statistically significant effect even on e-partpre: ß = 0.46, $z = 9.8$, $p < 0.05$ where e-partpre is the e-participation score of a country prior to the dependent variable e-participation score. The effect of political and regulatory environment on ICT infrastructure, skills, and usage is larger with ß = 0.60 ($z = 18.03$, $p < 0.05$), ß = 0.54 ($z = 12.94$, $p < 0.05$), and ß = 0.77 ($z = 33.26$, $p < 0.05$), respectively when compared to the effect of political rights and civil liberties.

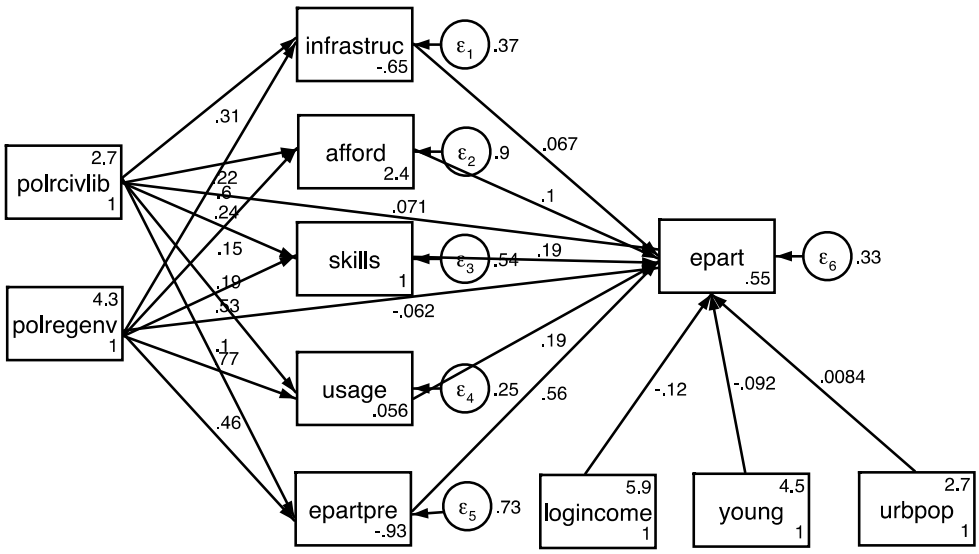

Figure 7: Technology as mediator of institutions' effect on e-participation

Table 10: Standardized estimates of the model with technology as mediator

Standardized	Coef.	Std.Err.	z	OIM P>|z|	[95% Conf. Interval]	
Structural						
infrastruc <-						
polrcivlib	0.3130	0.0387	8.08	0.0000	0.2371	0.3890
polregenv	0.5979	0.0332	18.03	0.0000	0.5329	0.6629
_cons	-0.6462	0.1461	-4.42	0.0000	-0.9327	-0.3598
afford <-						
polrcivlib	0.2217	0.0613	3.61	0.0000	0.1014	0.3420
polregenv	0.1480	0.0624	2.37	0.0180	0.0257	0.2702
_cons	2.4219	0.3060	7.91	0.0000	1.8221	3.0216

Table 10 Continued

Standardized	Coef.	Std.Err.	z	OIM P>|z|	[95% Conf.	Interval]
skills <-						
polrcivlib	0.2397	0.0475	5.05	0.0000	0.1466	0.3327
polregenv	0.5348	0.0413	12.94	0.0000	0.4539	0.6158
_cons	1.0467	0.2278	4.59	0.0000	0.6002	1.4932
usage <-						
polrcivlib	0.1852	0.0327	5.66	0.0000	0.1211	0.2493
polregenv	0.7659	0.0230	33.26	0.0000	0.7208	0.8110
_cons	0.0562	0.1350	0.42	0.6770	-0.2083	0.3207
epartpre <-						
polrcivlib	0.1015	0.0568	1.79	0.0740	-0.0098	0.2128
polregenv	0.4606	0.0502	9.18	0.0000	0.3622	0.5589
_cons	-0.9340	0.2080	-4.49	0.0000	-1.3416	-0.5264
epart <-						
infrastruc	0.0669	0.1066	0.63	0.5300	-0.1420	0.2758
afford	0.1015	0.0428	2.37	0.0180	0.0176	0.1854
skills	0.1876	0.0694	2.7	0.0070	0.0516	0.3235
usage	0.1912	0.1461	1.31	0.1910	-0.0951	0.4775
epartpre	0.5636	0.0469	12.02	0.0000	0.4717	0.6555
polrcivlib	0.0715	0.0432	1.65	0.0980	-0.0133	0.1562
polregenv	-0.0620	0.0785	-0.79	0.4300	-0.2160	0.0919
logincome	-0.1247	0.0973	-1.28	0.2000	-0.3153	0.0659
young	-0.0918	0.0597	-1.54	0.1240	-0.2087	0.0252
urbpop	0.0084	0.0613	0.14	0.8910	-0.1117	0.1285
_cons	0.5515	0.5497	1	0.3160	-0.5258	1.6289

Table 10 Continued

Standardized	Coef.	Std.Err.	z	OIM P>|z|	[95% Conf.	Interval]
var(e.infrastru)	0.3719	0.0289			0.3194	0.4330
var(e.afford)	0.8987	0.0330			0.8363	0.9657
var(e.skills)	0.5383	0.0379			0.4689	0.6180
var(e.usage)	0.2483	0.0201			0.2119	0.2911
var(e.epartpre)	0.7345	0.0417			0.6572	0.8209
var(e.epart)	0.3317	0.0309			0.2764	0.3981

LR test of model vs. saturated: chi2(25) = 1087.31, Prob > chi2 = 0.0000

The three explanatory variables that have a statistically significant positive effect on the dependent variable of e-participation are all technology resource variables, namely, ICT affordability ß = 0.10, z = 2.37, p < 0.05, skills ß = 0.19, z = 2.7, p < 0.05, and previous e-participation score ß = 0.56, z = 12.02, p < 0.05. The previous e-participation score has the largest effect on subsequent e-participation score.

The model fails to satisfy any of the goodness of fit statistics (results table not included in the document). The fit informs how well does the model reproduce the data, that is, it is consistent with the data and does not require respecification (Kenny, 2015). The model fails to pass the significance tests to reproduce the co-variance matrix with chi2(25) = 1087.13, p < 0.05 where 25 is the degrees of freedom. A significant chi2 indicates that the model has failed to account for the covariances among the variables (Acock, 2013). This chi2 result is for the model versus saturated test. A saturated model fits the covariances perfectly. A chi2 that is small compared to the degrees of freedom and that is not statistically significant is required. Chi2 is sensitive to correlations and larger correlations generally result in poorer fit (Kenny, 2015).

Therefore, the alternative tests of goodness of fit are also available in STATA. The root mean squared error of approximation (RMSEA) is 0.385, much above the ideal standard of less than or equal to 0.05. The RMSEA compares the lack of fit of a model as compared to a perfect model that is a model with zero degrees of freedom (Ullman, 2006). This indicator is less preferred with smaller samples as it has tendency to over reject true models (Hu & Bentler, 1999). The significant p value ($p < 0.05$) of this test statistic means that the close fit hypothesis can be rejected; the model's fit is worse than close fit. The comparative fit index (CFI) is 0.55 that is much lower compared to the ideal standard of 0.95 and even the acceptable standard of 0.90 (Hu & Bentler, 1999). The comparative fit index places a model on a continuum where at one end is 0 meaning awful fit and at the other extreme is 1 indicating perfect fit (Ullman, 2006). The standardized root mean squared residual (SRMR) at 0.161 is also above the acceptable values of 0.08 or lower. This absolute fit statistic measures the standardized difference between the predicted and observed correlation and has no penalty for complexity of the model (Kenny, 2015). A perfect fit has an SRMR of 0. The coefficient of determination(CD) is like the R square for a model and a value of 1 indicates a perfect fit. The CD for the current model is 0.87. It is not uncommon to find conflicting evidence of fit like this for a model and it is a good practice to report multiple indexes of fit (Ullman, 2006). To create a better fitting model, the modification indices are examined and reported in Table 11. Each modification index represents the amount of chi2 that will be reduced if the indicated path is added. For example, the infrastructure ← skills path would reduce the chi2 by 130.516 and infrastructure ← usage path would reduce the chi2 by 174.926. However, any such causal path addition needs to be substantiated with theory. Although the paths indicating the causal flow from skills ← infrastructure, usage ← skills, and usage ← previous e-participation do make sense and have substantial impacts on the chi-square.

However, adding any such causal path also requires the lag of time between the cause and effect. Note that each additional path consumes one degree of freedom. There are 25 degrees of freedom.

Table 11: Modification indices for the model with technology as mediator

		MI	df	P>MI	EPC	Standard EPC
Structural infrastruc <-						
	afford	32.478	1	0.0000	0.2356	0.2168
	skills	130.516	1	0.0000	0.7014	0.5615
	usage	174.926	1	0.0000	1.4316	0.9570
	epartpre	42.152	1	0.0000	1.4114	0.2732
	epart	142.189	1	0.0000	5.0200	0.8183
	logincome	156.744	1	0.0000	0.6180	0.6395
	young	117.632	1	0.0000	-0.1940	-0.4949
	urbpop	79.917	1	0.0000	2.4142	0.3717
afford <-						
	infrastruc	32.478	1	0.0000	0.4820	0.5238
	skills	36.26	1	0.0000	0.5288	0.4601
	usage	64.043	1	0.0000	1.2390	0.9002
	epartpre	45.097	1	0.0000	2.0881	0.4392
	epart	93.994	1	0.0000	5.9195	1.0487
	logincome	24.211	1	0.0000	0.3473	0.3907
	young	25.38	1	0.0000	-0.1286	-0.3573
	urbpop	11.32	1	0.0000	1.2996	0.2174
skills <-						
	infrastruc	130.516	1	0.0000	0.6506	0.8127
	afford	36.26	1	0.0000	0.2398	0.2756
	usage	108.995	1	0.0000	1.0884	0.9089
	epartpre	23.074	1	0.0000	1.0058	0.2432
	epart	64.982	1	0.0000	3.3758	0.6873
	logincome	132.147	1	0.0000	0.5465	0.7065

Table 11 Continued

	MI	df	P>MI	EPC	Standard EPC
young	92.085	1	0.0000	-0.1649	-0.5268
urbpop	61.143	1	0.0000	2.0338	0.3911
usage <-					
infrastruc	174.926	1	0.0000	0.4272	0.6391
afford	64.043	1	0.0000	0.1807	0.2488
skills	108.995	1	0.0000	0.3501	0.4193
epartpre	109.789	1	0.0000	1.2443	0.3603
epart	211.466	1	0.0000	3.3901	0.8266
logincome	147.493	1	0.0000	0.3274	0.5069
young	100.626	1	0.0000	-0.0978	-0.3740
urbpop	99.527	1	0.0000	1.4717	0.3389
epartpre <-					
infrastruc	42.152	1	0.0000	0.1044	0.5395
afford	45.097	1	0.0000	0.0755	0.3590
skills	23.074	1	0.0000	0.0802	0.3318
usage	109.789	1	0.0000	0.3085	1.0655
epart	126.495	1	0.0000	3.2085	2.7021
logincome	45.267	1	0.0000	0.0903	0.4830
young	22.423	1	0.0000	-0.0230	-0.3036
urbpop	48.938	1	0.0000	0.5139	0.4087
cov(e.infrastruc,e.afford)	32.478	1	0.0000	0.3711	0.3370
cov(e.infrastruc,e.skills)	130.516	1	0.0000	0.5009	0.6755
cov(e.infrastruc,e.usage)	174.926	1	0.0000	0.3289	0.7821
cov(e.infrastruc,e.epartpre)	42.152	1	0.0000	0.0804	0.3839
cov(e.afford,e.skills)	36.26	1	0.0000	0.3776	0.3561
cov(e.afford,e.usage)	64.043	1	0.0000	0.2847	0.4732
cov(e.afford,e.epartpre)	45.097	1	0.0000	0.1189	0.3971
cov(e.skills,e.usage)	108.995	1	0.0000	0.2501	0.6173
cov(e.skills,e.epartpre)	23.074	1	0.0000	0.0573	0.2840
cov(e.usage,e.epartpre)	109.789	1	0.0000	0.0709	0.6196

EPC = expected parameter change

At the bottom of the table are the path that can be added between the error terms to allow the error terms to be correlated; for example, allowing the error terms of ICT infrastructure (availability) and skills would reduce the chi2 by 130.516. These error terms are represented by ε_1 and ε_3, respectively, in the Figure 7. Allowing these error terms to be correlated makes sense and one does not have to make a causal argument as one would for the causal path infrastructure ← skills or vice versa. Correlated errors mean that there exist some variables that are not in the current model and that influence both infrastructure and skills. This is quite possible at a country level. Exogenous variables such as a country's geographical resources can influence both these variables. Allowing these error terms to be correlated is similar to accepting partial correlation meaning the unexplained variance in infrastructure is correlated with the unexplained variance in skills in the current model. The equation level statistics for the endogenous variables in Table 12 informs that the model has not explained about 37 percent of the variance (R-squared is 0.63) in infrastructure and 54 percent (R-squared is 0.46) of the variance in skills; it is not very unlikely that there can be some covariance in the two by variables outside the model. Same holds true for the other error terms.

Table 12: Explained variance for the endogenous variables

	Variance					
depvars	fitted	predicted	residual	R-squared	mc	mc2
observed						
infrastruc	2.0702	1.3003	.7699	.6281	.7925	.6281
afford	1.7525	.1776	1.5750	.1013	.3183	.1013
skills	1.3268	.6126	.7142	.4617	.6795	.4617
usage	.9251	.6954	.2297	.7517	.8670	.7517
epartpre	.0776	.0206	.0570	.2655	.5153	.2655
epart	.0550	.0368	.0182	.6683	.8175	.6683
overall				.8695395		

mc = correlation between depvar and its prediction
mc2 = mc^2 is the Bentler-Raykov squared multiple correlation coefficient

Therefore, a modified model that allows the error terms to be correlated is assessed. Refer Figure 8. The standardized coefficients are reported in Table 13. The standardized results are almost the same as in previous Table 11. Additionally, there are covariances reported at the bottom of the Table 13. In a standardized solution, covariances are correlation coefficients; for example, the correlation between ICT availability (infrastructure) and affordability is $r_{infratsruc,\ afford} = 0.34$ ($z = 6.43$, $p < 0.05$).

The comparative tests of goodness of fit in the modified model improve considerably as shown in Table 14. However, the model still fails to pass the significance thresholds for the tests of goodness of fit. The CFI goes up from 0.55 to .841 but is still below the acceptable standard of 0.90. The Akaike's information criteria, that is used to compare models, shows a lower value (5444.576) for the modified model as compared to the initial model (6118.396) indicating that the modified model is a better fit. Another run of modification indices tests does not inform any further changes that can be made to the model. Scholars have signaled that focusing too much on

the model fit instead of testing models hampers research (Hayduk, Cummings, Boadu, Pazderka-Robinson, & Boulianne, 2007).

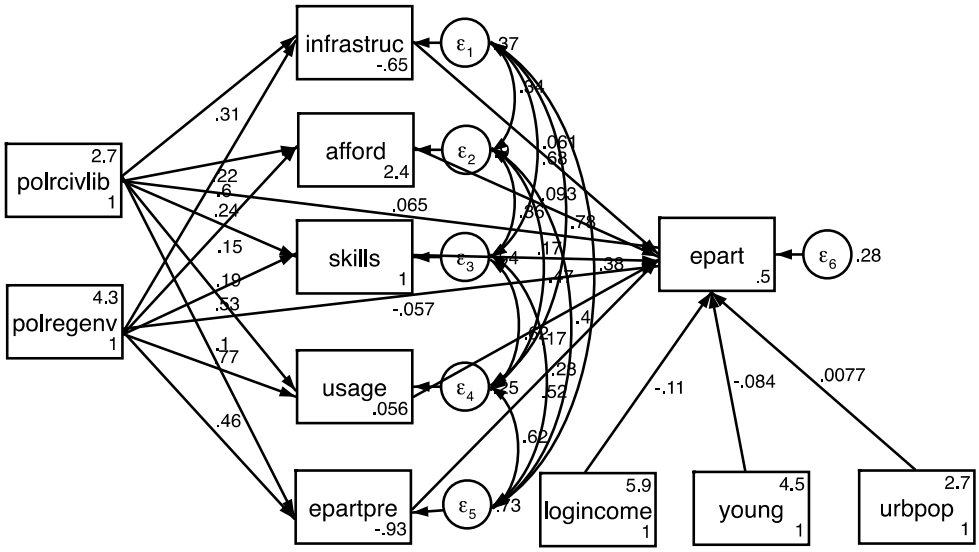

Figure 8: Modified model for technology as mediator

Table 13: Standardized estimates of the modified model for technology as mediator

Structural equation model — Number of obs = 286
Estimation method = ml
Log likelihood = -2680.2882

Standardized	OIM Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
Structural						
infrastruc <-						
polrcivlib	0.3130	0.0387	8.08	0.0000	0.2371	0.3890
polregenv	0.5979	0.0332	18.03	0.0000	0.5329	0.6629
_cons	-0.6462	0.1461	-4.42	0.0000	-0.9327	-0.3598
afford <-						
polrcivlib	0.2217	0.0614	3.61	0.0000	0.1014	0.3420
polregenv	0.1480	0.0624	2.37	0.0180	0.0257	0.2702
_cons	2.4219	0.3060	7.91	0.0000	1.8221	3.0216
skills <-						
polrcivlib	0.2397	0.0475	5.05	0.0000	0.1466	0.3327
polregenv	0.5348	0.0413	12.94	0.0000	0.4539	0.6158
_cons	1.0467	0.2278	4.59	0.0000	0.6002	1.4932
usage <-						
polrcivlib	0.1852	0.0327	5.66	0.0000	0.1211	0.2493
polregenv	0.7659	0.0230	33.26	0.0000	0.7208	0.8110
_cons	0.0562	0.1350	0.42	0.6770	-0.2083	0.3207
epartpre <-						
polrcivlib	0.1015	0.0568	1.79	0.0740	-0.0098	0.2128
polregenv	0.4606	0.0502	9.18	0.0000	0.3622	0.5589
_cons	-0.9340	0.2080	-4.49	0.0000	-1.3416	-0.5264
epart <-						
infrastruc	0.0611	0.0969	0.63	0.5280	-0.1288	0.2511
afford	0.0927	0.0389	2.38	0.0170	0.0165	0.1689
skills	0.1714	0.0628	2.73	0.0060	0.0483	0.2945
usage	0.1747	0.1310	1.33	0.1820	-0.0820	0.4315
epartpre	0.5151	0.0481	10.71	0.0000	0.4208	0.6093
polrcivlib	0.0653	0.0398	1.64	0.1010	-0.0127	0.1433
polregenv	-0.0567	0.0709	-0.8	0.4240	-0.1956	0.0822

Table 13 Continued

Standardized	Coef.	OIM Std. Err.	z	P>|z|	[95% Conf.	Interval]
logincome	-0.1140	0.0877	-1.3	0.1940	-0.2858	0.0579
young	-0.0839	0.0555	-1.51	0.1310	-0.1926	0.0249
urbpop	0.0077	0.0560	0.14	0.8910	-0.1021	0.1175
_cons	0.5040	0.5040	1	0.3170	-0.4838	1.4918
var(e.infrastruc)	0.3719	0.0289			0.3194	0.4330
var(e.afford)	0.8987	0.0330			0.8363	0.9657
var(e.skills)	0.5383	0.0379			0.4689	0.6180
var(e.usage)	0.2483	0.0201			0.2119	0.2911
var(e.epartpre)	0.7345	0.04168			0.6572	0.8209
var(e.epart)	0.2770	0.0301			0.2239	0.3428
cov(e.infrastruc, e.afford)	0.3370	0.0524	6.43	0.0000	0.2343	0.4397
cov(e.infrastruc, e.skills)	0.6755	0.0321	21.01	0.0000	0.6125	0.7385
cov(e.infrastruc, e.usage)	0.7821	0.0230	34.05	0.0000	0.7371	0.8271
cov(e.infrastruc, e.epartpre)	0.3839	0.0504	7.61	0.0000	0.2851	0.4827
cov(e.afford,e.skills)	0.3561	0.0516	6.9	0.0000	0.2549	0.4573
cov(e.afford,e.usage)	0.4732	0.0459	10.31	0.0000	0.3833	0.5632
cov(e.afford,e.epartpre)	0.3971	0.0498	7.97	0.0000	0.2995	0.4947
cov(e.skills,e.usage)	0.6173	0.0366	16.87	0.0000	0.5456	0.6891
cov(e.skills,e.epartpre)	0.2840	0.0544	5.23	0.0000	0.1775	0.3906
cov(e.usage,e.epartpre)	0.6196	0.03643	17.01	0.0000	0.5482	0.6910

LR test of model vs. saturated:chi2(15)=393.49, Prob > chi2 = 0.0000

Table 14: Goodness of fit statistics for the modified model with technology as mediator

Fit statistic	Value	Description
Likelihood ratio		
chi2_ms(15)	393.493	model vs. saturated
p > chi2	0.000	
chi2_bs(45)	2426.778	baseline vs. saturated
p > chi2	0.000	
Population error		
RMSEA	0.297	Root mean squared error of approximation
90% CI, lower bound	0.272	
upper bound	0.323	
pclose	0.000	Probability RMSEA <= 0.05
Information criteria		
AIC	5444.576	Akaike's information criterion
BIC	5598.128	Bayesian information criterion
Baseline comparison		
CFI	0.841	Comparative fit index
TLI	0.523	Tucker-Lewis index
Size of residuals		
SRMR	0.130	Standardized root mean squared residual
CD	0.824	Coefficient of determination

Finally, the direct, indirect, and total effects of each predictor are assessed that provide a clearer picture of the effects of each variable on the final endogenous variable of e-participation. The direct, indirect, and total effects of the variables in the model are estimated and the standardized coefficients are reported in Table 15. The three technology variables of affordability, skills, and previous e-participation score have a statistically significant direct effect

of the magnitude .09, .17, and .52 on e-participation. Note that previous e-participation score has the most impact on the subsequent e-participation activity. These direct effects represent the unit change in e-participation for a unit change in the explanatory variable, ignoring all simultaneity. Therefore, a unit standard deviation change in ICT affordability is associated with a positive 0.09 standard deviation change in e-participation, conditional on all other variables in the equation. This 0.09 is the coefficient of ICT affordability in the equation for e-participation. The total effect of an explanatory variable takes all simultaneity in the model into consideration. The total effect of the two institutional variables of political rights and civil liberties and political and regulatory environment on e-participation is 0.23 and 0.46, respectively. Therefore, for a unit standard deviation change in political rights and civil liberties, the e-participation changes positively by 0.23 standard deviations, accounting for all simultaneity in the system. Similarly, a unit standard deviation change in political and regulatory environment is positively associated with a 0.46 standard deviation change in the e-participation, accounting for all simultaneity in the system. Although the two institutional variables do not have a statistically significant direct effect on online participation, they have a statistically significant indirect and total effects on e-participation. The indirect effects represent the amount of mediation (Kenny, 2016). The institutional variables have statistically significant direct effect on all the technology variables (except for effect of political rights and civil liberties on e-participation score or epartpre). However, only affordability, skills, and epartpre scores have statistically significant effect on e-participation and mediate the effect of institutional variables on e-participation. The total effect is the sum of direct and indirect effect. To calculate the specific indirect effects of the institutional variable on e-participation as mediated by a given technology variable, the coefficients on individual path need to be multiplied. For example, the coefficient on the path from political

rights and civil liberties → affordability is .22, and the coefficient on the path from affordability → e-participation is .09. The product of these two path coefficients is 0.02 and this the specific indirect effect of political rights and civil liberties on e-participation as mediated by affordability. Similarly, the specific indirect effect of political and regulatory environment on e-participation as mediated by ICT affordability is 0.15 x 0.09 = 0.014. The technology variables of affordability and skills mediate the effect of political rights and civil liberties on e-participation. The technology variables of affordability, skills, and previous e-participation score mediate the effect of political and regulatory environment on e-participation. None of the three control variables have a statistically significant effect on e-participation.

Table 15: Standardized coefficients of direct, indirect, and total effects for the modified model with technology as mediator

	Direct effects	Indirect effects	Total effects
Structural |			
infrastruc <- |			
polrcivlib |	.3130*		.3130*
polregenv |	.5979*		.5979*
afford <- |			
polrcivlib |	.2217*		.2217*
polregenv |	.1480*		.1480*
skills <- |			
polrcivlib |	.2397*		.2397*
polregenv |	.5348*		.5348*
usage <- |			
polrcivlib |	.1852*		.1852*
polregenv |	.7659*		.7659*
epartpre <- |			
polrcivlib |	.1015		.1015
polregenv |	.4606*		.4606*
epart <- |			
infrastruc |	.0612		.0612

Table 15 Continued

	Direct effects	Indirect effects	Total effects
afford	.0927*		.0927*
skills	.1714*		.1714*

Table 15 Continued

	Direct effects	Indirect effects	Total effects
usage	.1747		.1747
epartpre	.5151*		.5151*
polrcivlib	.0653	.1654*	.2307*
polregenv	-.0567	.5130*	.4563*
logincome	-.1140		-.1140
young	-.0839		-.0839
urbpop	.0077		.0077

* $p<0.05$; The significance levels shown here are for the unstandardized coefficient

The study hypothesizes that the technology variables of availability, affordability, skills, and usage of information and communication technology along with the previous e-participation levels in a country influence the e-participation in a country positively. The findings support the hypotheses that the technology resources of, affordability of ICT resources and ICT skills have a positive effect on e-participation. The previous e-participation levels also have statistically significant positive association with e-participation in subsequent years. Additionally, the study hypothesizes that technology mediates the institutional resources. The findings support that ICT affordability and skills mediate the effect of political rights and civil liberties on e-participation and the technology variables of affordability, skills, and previous e-participation score mediate the effect of political and regulatory environment on e-participation. The study also had three control variables in the model - national income, percentage of young (aged 18-24), and

percentage of urban population in a country. None of these three are found to have a statistically significant influence on e-participation.

Institution as Mediator

The model with institutions as mediator for technology variables' impact on online participation is depicted in Figure 9. There are eight exogenous variables of ICT infrastructure (availability), affordability, skills, usage, previous e-participation score, national income, percentage young in the population, and percentage urban population. There are two endogenous mediator variables of political rights and civil liberties and political and regulatory environment and one endogenous variable of e-participation. The standardized coefficients of the model estimates are provided in Table 16.

Infrastructure that represents ICT availability is the only technology dimension that has a positive and statistically significant impact on the institutional variable of political rights and civil liberties. The magnitude of coefficient is large with one unit standard deviation change in infrastructure associated with 0.59 standard deviation change in political rights and civil liberties. A country that has greater electricity production, wider mobile network coverage, internet bandwidth, and secure internet servers (measures of infrastructure in WEF Report, 2016) will have improved public participation in the government, education, and free economic activity (measures of political rights and civil liberties in the Freedom House Report, 2012) due to availability of improved online infrastructure.

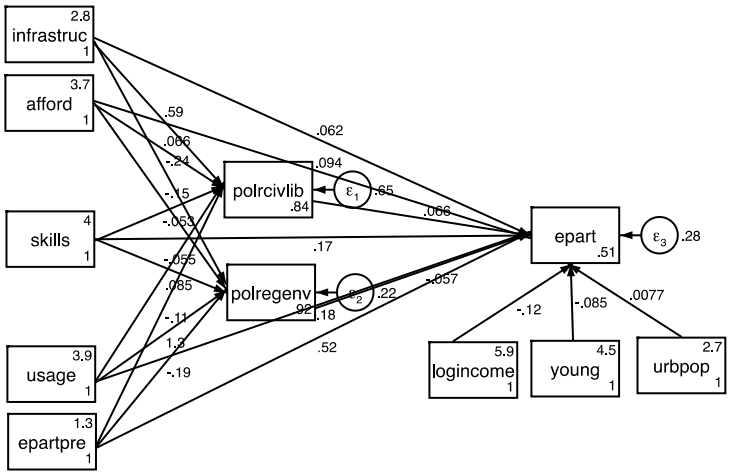

Figure 9: Institutions as the mediator for technology's effect on e-participation

The infrastructure, affordability, usage, and epartpre have negative and statistically significant coefficient on the political and regulatory environment. Theoretically, these technology resources should positively influence the measures of political and regulatory environment such as improve ICT laws, efficiency of the legal system, and intellectual property protection. The average duration of legal proceedings is found to be lower and judges' productivity is higher in countries that spend on computerization (as cited in Cusatelli & Giacalone, 2014). This is even stronger in countries that have higher ICT skills as electronic document management and exchange reduces the cost and time of bureaucracy (Cusatelli & Giacalone, 2014). It is however possible that an increase in the ICT infrastructure and its affordability and use are associated with a far greater increase in other measures of political and regulatory environment such as the software piracy rate leading to a decline in score and a

negative association between the technology resources and political and regulatory environment. For example, China that has highest number of internet users in the world and has above average affordability and usage of ICT, is also a country listed as top three country with highest software piracy rates (Business Insider, 2016; Huffpost, 2017). Previous studies argue that ICTs promise to transform the legal and public sector in general leading to better transparency (Cusatelli & Giacalone, 2014), and transparency improves public participation (Rowe & Frewer, 2000). In this model as well, only affordability, skills, and previous year's e-participation have a statistically significant (and positive) impact on the subsequent e-participation activity. Any of the institutional variables or control variables have no statistically significant impact on e-participation.

Table 16: Standardized estimates for the model with institutions as mediator

Structural equation model
Estimation method = ml
Log likelihood = -2513.0617

Number of obs = 286

Standardized	OIM Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
Structural						
polrcivlib <-						
infrastruc	0.5898	0.1271	4.64	0.000	0.3408	0.8388
afford	0.0664	0.0558	1.19	0.234	-0.0430	0.1758
skills	-0.0531	0.0906	-0.59	0.557	-0.2306	0.1244
usage	0.0852	0.1385	0.61	0.539	-0.1864	0.3567
epartpre	-0.1051	0.0705	-1.49	0.136	-0.2432	0.0331
_cons	0.8359	0.3012	2.78	0.006	0.2456	1.4262

Table 16 Continued

Standardized	Coef.	OIM Std. Err.	z	P>|z|	[95% Conf. Interval]	
afford	-0.1519	0.0325	-4.67	0.000	-0.2157	-0.0881
skills	-0.0547	0.0532	-1.03	0.304	-0.1589	0.0496
usage	1.3230	0.0715	18.51	0.000	1.1829	1.4631
epartpre	-0.1872	0.0412	-4.55	0.000	-0.2679	-0.1065
_cons	0.9158	0.1843	4.97	0.000	0.5546	1.2770
epart <-						
polrcivlib	0.0659	0.0403	1.63	0.102	-0.0131	0.1450
polregenv	-0.0572	0.0720	-0.8	0.427	-0.1983	0.0838
infrastruc	0.0617	0.0983	0.63	0.53	-0.1310	0.2544
afford	0.0934	0.0387	2.42	0.016	0.0176	0.1695
skills	0.1730	0.0646	2.68	0.007	0.0464	0.2996
usage	0.1764	0.1334	1.32	0.186	-0.0852	0.4379
epartpre	0.5199	0.0458	11.34	0.000	0.4301	0.6097
logincome	-0.1150	0.0901	-1.28	0.202	-0.2915	0.0615
young	-0.0847	0.0548	-1.54	0.123	-0.1921	0.0228
urbpop	0.0077	0.0565	0.14	0.891	-0.1030	0.1185
_cons	0.5087	0.5072	1	0.316	-0.4854	1.5029
var(e.polrcivlib)	0.6465	0.0412			0.5705	0.7326
var(e.polregenv)	0.2230	0.0182			0.1900	0.2616
var(e.epart)	0.2822	0.0227			0.2411	0.3304

LR test of model vs. saturated: chi2(7) = 59.04, Prob > chi2 = 0.0000

The equation level goodness of fit in Table 17 informs that the model explains overall 92 percent of the variance in the endogenous variables. The model explains 35 percent of variance in political rights and civil liberties, 78 percent in political and regulatory environment, and 72 percent in e-participation. The model goodness of fit results in Table 18 show model versus

saturated chi2 statistic of 59 with seven degrees of freedom. The model satisfies the comparative fit index statistic which is at an ideal level of 0.95 for this model and greater than the acceptable value of 0.90. The SRMR value at 0.018 is also very close to the perfect fit value of 0 and much lower than the acceptable limit of 0.08. Thus, the model with institutions as mediator was estimated and fit well, Chi2 (7) = 59.04, p< 0.0000, CFI= 0.95 and SRMR=0.018.

Table 17: Equation level goodness of fit for the model where institution is the mediator

depvars	fitted	Variance predicted	residual	R-squared	mc	mc2
observed						
polrcivlib	3.1973	1.1304	2.0669	0.3535	0.5946	0.3535
polregenv	0.7721	0.6000	0.1721	0.7770	0.8815	0.7770
epart	0.0646	0.0464	0.0182	0.7178	0.8472	0.7178
overall				0.9243		

mc = correlation between depvar and its prediction

mc2 = mc^2 is the Bentler-Raykov squared multiple correlation coefficient

Table 18: Goodness of fit statistics for the model where institution is the mediator

Fit statistic	Value	Description
Likelihood ratio		
chi2_ms(7)	59.04	model vs. saturated
p > chi2	0.000	
chi2_bs(27)	975.278	baseline vs. saturated
p > chi2	0.000	
Population error		
RMSEA	0.161	Root mean squared error of approximation
90% CI, lower bound	0.125	
upper bound	0.200	
pclose	0.000	Probability RMSEA <= 0.05
Information criteria		
AIC	5078.123	Akaike's information criterion
BIC	5173.179	Bayesian information criterion
Baseline comparison		
CFI	0.945	Comparative fit index
TLI	0.788	Tucker-Lewis index
Size of residuals		
SRMR	0.018	Standardized root mean squared residual
CD	0.924	Coefficient of determination

The direct, indirect, and total effects of the explanatory variables are shown in Table 19. The direct effects of affordability, skills, and previous e-participation score on the subsequent e-participation are statistically significant and positive. These results are exactly the same (in

magnitude, direction, and significance) as observed in the previous technology as the mediator model. There is no statistically significant direct effect of institutions on e-participation. This result is the same as observed in the model with technology resources as mediators. The indirect effects of technology variables on e-participation are not statistically significant. Thus, the mediation role of institution is not supported by the model. This does not mean that institutions do not impact online participation. It only means that rather than a direct impact, the significant impact of institutions on online participation is through the presence of (mediation of) technology resources. The result indicate that online participation mandatorily requires technology resources as the mediator mechanism for translating the effects of institutions on e-participation. Some studies, in the past, have suggested that technologies determine the level of e- participation while the institutions determine the pattern (Jho & Song, 2015).

Table 19: Standardized coefficients of direct, indirect, and total effects for the modified model with institutions as mediator

	Direct effects	Indirect effects	Total effects
Structural			
polrcivlib <-			
infrastruc	.7330*		.7330*
afford	.0897		.0897
skills	-.0825		-.0825
usage	.1583		.1583
epartpre	-.6745		-.6745
polregenv <-			
infrastruc	-.1488*		-.1488*
afford	-.1008*		-.1008*
skills	-.0417		-.0417
usage	1.2086*		1.2086*
epartpre	-.5908*		-.5908*

Table 19 Continued

	Direct effects	Indirect effects	Total effects
epart <-			
polrcivlib	.0094		.0094
polregenv	-.0166		-.0166
infrastruc	.0109	.0093	.0202
afford	.0180*	.0025	.0205
skills	.0382*	-.0001	.0381
usage	.0466	-.0185	.0281
epartpre	.4747*	.0035	.4781
logincome	-.0196		-.0196
young	-.0059		-.0059
urbpop	.0089		.0089

* $p<0.05$; The significance levels shown here are for the unstandardized coefficient

The study hypothesizes that institutional resources of supporting political and regulatory environment and political rights and civil liberties positively influence e-participation in a country. The findings did not support these two hypotheses. Based on the test results, the two variables of institutional resources have no significant impact on e-participation in a country. The study also hypothesizes that institutions mediate the influence of technology on e-participation but the results did not support this hypothesis either.

Both models of technology and institution as mediator were also run with cluster robust standard errors (Huber/White/sandwich estimator), where cluster is country. Such a test does not affect the coefficients but allows unobserved variables in the cluster(country) to correlate and is robust to heteroscedasticity of errors. Using cluster robust standard errors assumes independence of errors within the country. The same variables that were found to be statistically significant earlier remained significant in the clustered models as well (refer Stata user manual for details on default and other standard errors). Although, most of the discussion around heteroscedasticity involves OLS regression and the SEM tests here use maximum likelihood method, nevertheless a

test for heteroscedasticity was conducted. A Breusch-Pagan / Cook-Weisberg test for heteroscedasticity for e-participation and the explanatory variable was rejected (chi2 10, 16.14; p = 0.0957) indicating that the data do not have issues of heteroscedasticity.

Moderator Analysis

The current study wants to explore the influence of interaction effects of technology and institutions on the online participation. Following the study by Jho and Song (2015), first a t-test and then a two way- ANCOVA is conducted for assessing the interaction effects of technology and institutions on e-participation.

T-Test

To conduct the t-test, the countries are grouped into two categories of high and low e-participation (those below and above the mean value as in the study by Jho & Song, 2015). Next a two-sample t-test is run to assess the difference in mean for the two groups of countries by each explanatory and control variable to examine if differences exist in the two groups by these variables. The results are presented in Table 20. The group of countries with high e-participation score also score high on political rights and civil liberties, political and regulatory environment, infrastructure, affordability, skills, usage, previous e-participation score, national income, and percentage of urban population. The difference in means between the two group of countries is statistically significant for each variable. Only the percentage young in a country do not follow this directional pattern. The countries with lower e-participation show higher percentage of young.

Table 20: T-test results for groups of countries with below and above average e-participation

Variable		Classification	Mean	t-test t	p
E-participation	Pol rights and civ lib	Low (N=136) High (N=150)	4.2279 5.4	-5.8	0.0000
	Pol and reg env	Low (N=136) High (N=150)	3.4278 4.1786	-7.9	0.0000
	Infrastructure	Low (N=136) High (N=150)	3.1643 4.8178	-11.8	0.0000
	Affordability	Low (N=136) High (N=150)	4.1961 5.4488	-9.0	0.0000
	Skills	Low (N=136) High (N=150)	3.9546 5.2474	-11.4	0.0000
	Usage	Low (N=136) High (N=150)	3.1196 4.3030	-13.1	0.0000
	Previous e-part	Low (N=136) High (N=150)	.1709 .5586	-16.3	0.0000
	National income	Low (N=136) High (N=150)	7.8889 9.5358	-11.1	0.0000
	Percentage youth	Low (N=136) High (N=150)	18.7279 14.8607	10.3	0.0000
	Percentage urban	Low (N=136) High (N=150)	.4960 .6924	-8.3	0.0000

Two-Way ANCOVA

A two-way ANOVA is used where there is a need to understand the interaction effect between two independent variables on the dependent variable. A two-way ANOVA in the current study is analyzed for a total of ten separate interactions of explanatory variables (2 institutional x 5 technical = 10 interactions). Each explanatory variable is divided into two

groups of above and below mean value (as in Jho & Song, 2015). The two-way ANOVA results inform whether the two levels (low and high) of explanatory variables have any effect on e-participation and whether the interaction of two explanatory variables is significant. The test looked for statistically significant interaction between all the ten pairs of institutional and technology variable combination. The model has control variables and they are used in the analysis. Where ANOVA is augmented by allowing for the presence of one or more covariates in the analysis, it is called analysis of covariance (ANCOVA).

Two-way ANOVA assumes the dependent variable to be continuous and the two explanatory variables to be categorical (Laerd Statistics, n.d.). Since all the variables are continuous, the countries are divided into two groups (categories) for each of the explanatory variables in the model. For example, the mean score for political rights and civil liberties is 4.8427. The countries in group 0 for this variable, are those that scored below 4.8427 and in group 1 are those that scored equal to and above 4.8427. To satisfy another ANOVA assumption, the current study verified whether the dependent variable is approximately normal for each combination of the groups of the two independent variables by using Shapiro Wilk test. The results supported the assumption in 22 cases, that is more than half of the forty combinations (Note each explanatory variable is divided into a low and high group based on the mean value which leads to a total combination of 2 X 2 X 10 interactions = 40). Nevertheless, ANOVA is quite robust to any violations of normality (Laerd Statistics, n.d.).

Before ANOVA is carried out, a boxplot of the e-participation by the various institutional and technology explanatory variables provides a feel of the data distribution. The countries are grouped as 0 and 1 by dividing them into two groups where, group 0 is below the mean value (i.e. low score) and group 1 is above the mean value (i.e. higher score) for the particular

explanatory variable. Figure 10 shows the that the median value of e-participation in countries that are in group 0 is below those that are in group 1 for all explanatory variables. Thus, different levels of the explanatory variables do make a difference on e-participation. For example, the first boxplot in the set of graphs shows that the e-participation median score is 0.4 for countries that scored below 4.8427 on political rights and civil liberties (the average score for the variable) and is higher at 0.6 for countries that scored 4.8427 or greater for political and civil rights.

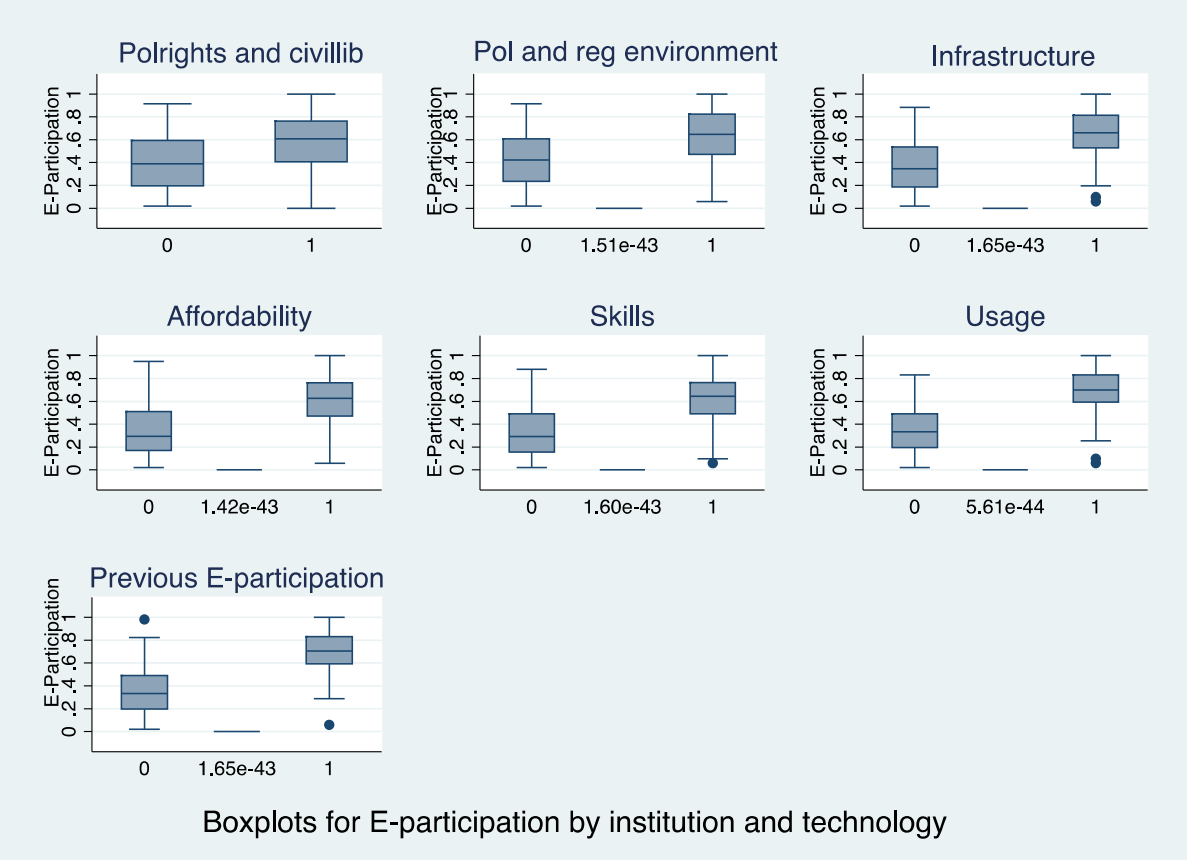

Figure 10: A boxplot of the e-participation level by the institutional and technology explanatory variables

Further, ANCOVA assumes that there is a linear relationship between the response variable and the covariate. This assumption is verified and Figure 11 provides a scatterplot

showing that the relationship is linear between e-participation and the three covariates of national income, percentage young, and percentage urban population. The results of the ten interactions are presented in Table 21.

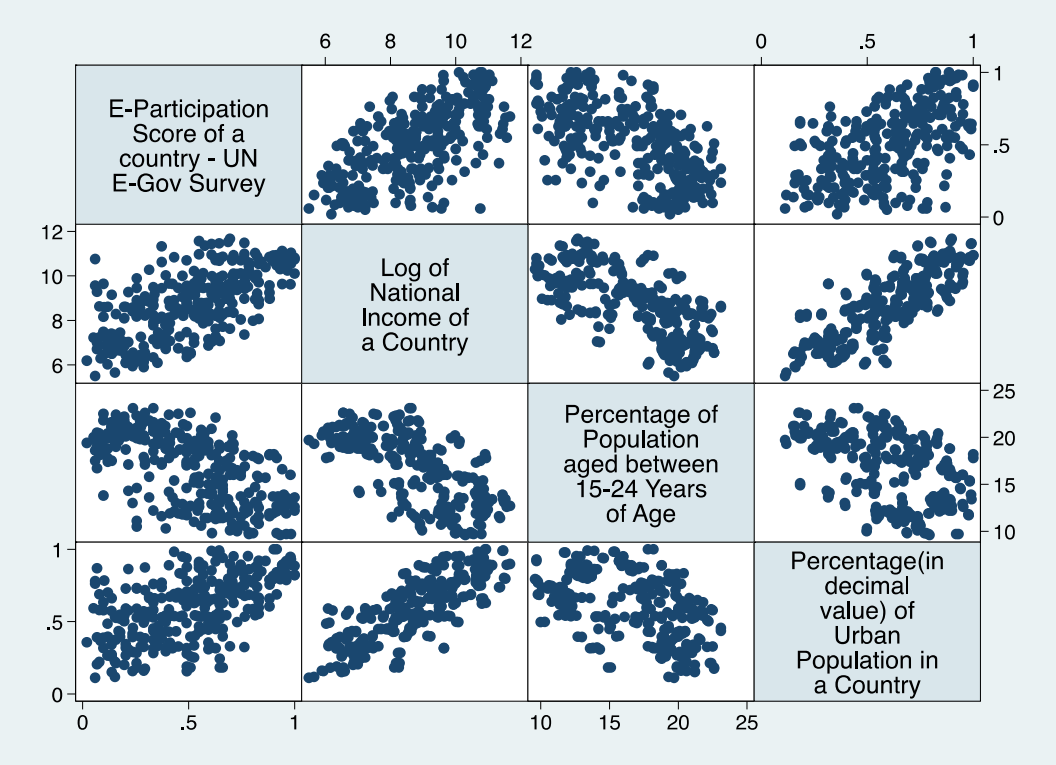

Figure 11: Linear relation between the response variables and the covariates

Table 21: Results of ANCOVA analysis for interaction effect of technology and institutions

Model	Partial SS	df	MS	F	Prob > F
Polrcivlib X infrastructure	.0151	1	.0151	0.43	0.5148
Polrcivlib X affordability	.0092	1	.0092	0.29	0.5914
Polrcivlib X skills	.1738	1	.1738	5.07	0.0252
Polrcivlib X usage	.0688	1	.0688	2.18	0.1411
Polrcivlib X pre e-participation	.0016	1	.0016	0.07	0.7987
Polregenv X infrastructure	.00004	1	.00004	0.00	0.9729
Polregenv X affordability	.00002	1	.00002	0.00	0.9788
Polregenv X skills	.0030	1	.0030	0.09	0.7699
Polregenv X usage	.0007	1	.0007	0.02	0.8795
Polregenv X pre e-participation	6.3293e-06	1	6.3293e-06	0.00	0.9873

The interaction term, in Table 21, that results in a statistically significant effect on e-participation is of political rights and civil liberties with ICT skills. This means that political rights and civil liberties have a correlation with e-participation ($p < 0.05$). Earlier in the mediation analysis, it was observed that none of the institutional variables had any direct effect on e-participation. However, the moderator analysis shows that when the institutional variable of political rights and civil liberties is interacting with ICT skills, they influence e-participation. The F statistic and the p value (Prob) corresponding to the interaction terms are significant. The interaction effects of political rights and civil liberties with skills is analyzed separately and results presented in Table 22. The ANCOVA results in Table 22 show that the effect of ICT skills and political rights and civil liberties on e-participation can be enhanced in the presence of each-other. They together create a complimentary effect meaning that the interaction effect of ICT skills and political rights and civil liberties on e-participation has a greater impact (partial SS = 0.174, $p < 0.05$) as compared to when they act independently. This has a great message for

the policy makers informing that political rights and civil liberties are required to enhance e-participation and not just ICT development.

Table 22: ANCOVA results for the interaction effect of political rights and civil liberties and ICT skills

Number of obs = 286 R-squared = 0.4832
Root MSE = .185212 Adj R-squared = 0.4720

Source	Partial SS	df	MS	F	Prob > F
Model	8.9472	6	1.4912	43.47	0.0000
polrcivlib	.0665	1	.0665	1.94	0.1649
skill	.1388	1	.1388	4.05	0.0452
polrcivlib#skill	.1738	1	.1738	5.07	0.0252
logincome	.2229	1	.2229	6.50	0.0113
young	.4403	1	.4403	12.84	0.0004
urbpop	.1049	1	.1049	3.06	0.0815
Residual	9.5707	279	.0343		
Total	18.5179	285	.0650		

E-participation at Different Levels

Stages of E-participation

Multivariate regression is used to assess the impact of the explanatory variables on the three levels of e-information, e-consultation, and e-decision making. Multivariate regression is used where there are more than one dependent variables but the explanatory variables are common. One can use separate OLS regression for each dependent variable, but multivariate regression allows testing of coefficients across the equations, which is the purpose of the test in the current study. The correlation between the dependent variables and explanatory variables is assessed separately. The multivariate regression requires the dependent variables to be at least

moderately correlated with each-other (Institute for Digital Research and Education [IDRE], n.d.). The dependent variables in the current study are moderately to highly correlated as seen in Table 23. The explanatory variables such as usage is highly correlated with political and regulatory environment (r=0.8513), infrastructure (0.9152), and skills (0.81).

Table 23: Correlations between the dependent variables

	einf	econ	edec
einf	1.0000		
econ	0.7280	1.0000	
edec	0.4187	0.6353	1.0000

First a MANOVA command is run in STATA to verify if all equations taken together are statistically significant (refer IDRE, n.d.). The test results provide F-ratios and p-values for four multivariate tests of Wilks' lambda, Lawley-Hotelling trace, Pillai's trace, and Roy's largest root. The results show that affordability, skills, and previous e-participation score are statistically significant predictors across all multivariate criteria ($p < 0.05$ for all tests). The table on the top shows that the test for the overall model is statistically significant regardless of the type of multivariate criteria used ($p < 0.001$ for all). Since, the overall model is significant, the model does not need any modification before running the multivariate regression command (IDRE, n.d.) to obtain the coefficients for each of the predictors in each part of the model.

Table 24: Multivariate tests of the model with three levels of e-participation

Number of obs = 286

W = Wilks' lambda L = Lawley-Hotelling trace
P = Pillai's trace R = Roy's largest root

Source	Statistic		df	F(df1, df2) =	F	Prob>F	
Model	W	0.2243	10	30.0 802.0	17.75	0.0000	a
	P	0.9024		30.0 825.0	11.83	0.0000	a
	L	2.9165		30.0 815.0	26.41	0.0000	a
	R	2.7297		10.0 275.0	75.07	0.0000	u
Residual			275				
polrcivlib	W	0.9899	1	3.0 273.0	0.93	0.4284	e
	P	0.0101		3.0 273.0	0.93	0.4284	e
	L	0.0102		3.0 273.0	0.93	0.4284	e
	R	0.0102		3.0 273.0	0.93	0.4284	e
polregenv	W	0.9913	1	3.0 273.0	0.80	0.4953	e
	P	0.0087		3.0 273.0	0.80	0.4953	e
	L	0.0088		3.0 273.0	0.80	0.4953	e
	R	0.0088		3.0 273.0	0.80	0.4953	e
infrastruc	W	0.9971	1	3.0 273.0	0.26	0.8524	e
	P	0.0029		3.0 273.0	0.26	0.8524	e
	L	0.0029		3.0 273.0	0.26	0.8524	e
	R	0.0029		3.0 273.0	0.26	0.8524	e
afford	W	0.9218	1	3.0 273.0	7.72	0.0001	e
	P	0.0782		3.0 273.0	7.72	0.0001	e
	L	0.0848		3.0 273.0	7.72	0.0001	e
	R	0.0848		3.0 273.0	7.72	0.0001	e
skills	W	0.9698	1	3.0 273.0	2.83	0.0389	e
	P	0.0302		3.0 273.0	2.83	0.0389	e
	L	0.0311		3.0 273.0	2.83	0.0389	e
	R	0.0311		3.0 273.0	2.83	0.0389	e
usage	W	0.9869	1	3.0 273.0	1.21	0.3081	e
	P	0.0131		3.0 273.0	1.21	0.3081	e
	L	0.0132		3.0 273.0	1.21	0.3081	e
	R	0.0132		3.0 273.0	1.21	0.3081	e

Table 24 Continued

Source	Statistic		df	F(df1,	df2) =	F	Prob>F	
epartpre	W	0.6533	1	3.0	273.0	48.30	0.0000	e
	P	0.3467		3.0	273.0	48.30	0.0000	e
	L	0.5307		3.0	273.0	48.30	0.0000	e
	R	0.5307		3.0	273.0	48.30	0.0000	e
logincome	W	0.9835	1	3.0	273.0	1.53	0.2073	e
	P	0.0165		3.0	273.0	1.53	0.2073	e
	L	0.0168		3.0	273.0	1.53	0.2073	e
	R	0.0168		3.0	273.0	1.53	0.2073	e
young	W	0.9843	1	3.0	273.0	1.45	0.2273	e
	P	0.0157		3.0	273.0	1.45	0.2273	e
	L	0.0160		3.0	273.0	1.45	0.2273	e
	R	0.0160		3.0	273.0	1.45	0.2273	e
urbpop	W	0.9996	1	3.0	273.0	0.04	0.9902	e
	P	0.0004		3.0	273.0	0.04	0.9902	e
	L	0.0004		3.0	273.0	0.04	0.9902	e
	R	0.0004		3.0	273.0	0.04	0.9902	e
Residual			275					
Total			285					

e = exact, a = approximate, u = upper bound on F

The results of multivariate regression are presented in the Table 25. The table on the top gives the details of number of observations (286 as there are no missing values) and other details for each of the three models. Parms indicates the number of number of parameters in the model which is 11 as there is one constant and ten explanatory variables (including the three control variables). The column P indicates that each of the three univariate models for the three dependent variables are statistically significant ($P < 0.001$). The R-sq column indicates that the predictor variables in the model together explain 59 percent, 68 percent, and 38 percent of the

variance in the dependent variables of e-information, e-consultation, and e-decision making levels, respectively. The RMSE indicates the root mean square error which is the error in prediction or the precision of the estimate, that is, how close the predicted values are to the observed values. The RMSE of 17.02 in the e-information model tells that the average distance of the data points from the fitted line is about 17 percent of e-information units. This error is always in the units of the dependent variable. The second part of the table has predictor variable coefficients grouped by the dependent variables.

Table 25: Multivariate regression results for e-information, e-consultation, and e-decision making

Equation	Obs	Parms	RMSE	"R-sq"	F	P
einf	286	11	17.0215	0.5888	39.373	0.0000
econ	286	11	16.8809	0.6791	58.1882	0.0000
edec	286	11	19.9922	0.3764	16.5965	0.0000

	Coef.	Std. Err.	t	P>t	[95% Conf.	Interval]
einf						
polrcivlib	.8942	.7222	1.24	0.217	-.5275	2.3159
polregenv	-.6042	2.6249	-0.23	0.818	-5.7717	4.5633
infrastruc	1.0534	2.1901	0.48	0.631	-3.2581	5.3648
afford	3.1485	.9410	3.35	0.001	1.2960	5.0010
skills	4.9000	1.8041	2.72	0.007	1.3485	8.4515
usage	3.2469	4.4496	0.73	0.466	-5.5128	12.0065
epartpre	33.1047	5.6404	5.87	0.000	22.0008	44.2086
logincome	-.6807	1.9394	-0.35	0.726	-4.4985	3.1372
young	-.3316	.4777	-0.69	0.488	-1.2721	.6089
urbpop	-1.1013	8.1733	-0.13	0.893	-17.1915	14.9889
_cons	7.8066	16.1913	0.48	0.630	-24.0682	39.6813
econ						
polrcivlib	1.0546	.7162	1.47	0.142	-.3554	2.4646
polregenv	-3.7756	2.6032	-1.45	0.148	-8.9004	1.3492

Table 25 Continued

	Coef.	Std. Err.	t	P>t	[95% Conf.	Interval]
infrastruc	1.1394	2.1720	0.52	0.600	-3.1365	5.4152
afford	1.4652	.9332	1.57	0.118	-.3720	3.3024
skills	3.3216	1.7892	1.86	0.064	-.2006	6.8438
usage	5.9881	4.4129	1.36	0.176	-2.6992	14.6754
epartpre	65.8460	5.5938	11.77	0.000	54.8339	76.8582
logincome	-3.7557	1.9233	-1.95	0.052	-7.5420	.0307
young	-.5992	.4738	-1.26	0.207	-1.5320	.3335
urbpop	1.7783	8.1058	0.22	0.827	-14.1790	17.7356
_cons	18.5330	16.0576	1.15	0.249	-13.0784	50.1445
edec						
polrcivlib	.4271	.8482	0.50	0.615	-1.2427	2.0970
polregenv	-3.1148	3.0830	-1.01	0.313	-9.1842	2.9545
infrastruc	1.9177	2.5723	0.75	0.457	-3.1462	6.9816
afford	-3.2871	1.1052	-2.97	0.003	-5.4629	-1.1113
skills	.08731	2.1189	0.04	0.967	-4.0841	4.2587
usage	8.7193	5.2262	1.67	0.096	-1.5691	19.0078
epartpre	37.5850	6.6248	5.67	0.000	24.5432	50.6269
logincome	-3.4692	2.2778	-1.52	0.129	-7.9535	1.0150
young	-1.0925	.5611	-1.95	0.053	-2.1971	.0122
urbpop	-.1438	9.5998	-0.01	0.988	-19.0422	18.7546
_cons	32.9675	19.0172	1.73	0.084	-4.4703	70.4053

The results are OLS regression for three different dependent variables that is three equations of e-information, e-consultation, and e-decision making. Each of the three equations is interpreted in the same manners as output from an OLS regression but separate OLS regression does not allow for testing of coefficients across equations. The results show that the technology variables of affordability, skills, and previous e-participation are statistically significant and have a positive influence on e-information. A one unit change in affordability is associated with 3.1485 unit change in e-information, controlling for all other variables in the model. Similarly, a one unit change in skills is associated with 4.9 units change in e-information. These two

technology variables are not statistically significant in the e-consultation stage. In the final stage of e-decision making, the affordability of ICT gains statistical significance again but this time the coefficient is negative meaning that an increase in one unit of affordability is associated with a reduction of 3.2871 units in e-decision making. Previous e-participation score remains significant throughout the three stages. Its magnitude is most for the e-consultation stage. A one unit change in previous e-participation score is associated with 33.1047 units change in e-information but this magnitude increases to 65.8460 units change in e-consultation and drops again to 37.5850 in e-decision making.

One of the advantages of using multivariate regression in this study is that tests of coefficients can be performed across the three levels of e-information, e-consultation, and e-decision making. The current study hypothesized that the magnitude of technology and institutional variables is different for different levels of e-participation. The multivariate regression allows to test for these hypotheses. Each explanatory variable is tested to verify if the difference in the coefficients is statistically significant across the three levels of e-information, e-consultation, and e-decision. Only the coefficients of two technology variables - affordability ($F_{2, 275} = 11.02$, p=0.0000) and previous e-participation score ($F_{2, 275} = 18.06$, p=0.0000)- are found to be significantly different across the three stages of e-participation.

Next, the significance of all the explanatory variables jointly on all the equations is tested. The results indicate that even though the explanatory variables are independently not statistically significant in either of the equations of e-information, e-consultation, and e-decision-making, they are jointly significant. The seven explanatory variables (two institutional resources and five technology resources) and the three control variables as a whole are strongly significant

($F_{30, 275} = 26.73$, p=0.0000) for all the equations, simultaneously. This test provides one p-value for the overall model.

One drawback of multivariate regression in Stata (version 13.1 used for data analysis in the current study) is that it requires separate OLS regression to be performed for each dependent variable, meaning three different equations in the current case. That takes away the advantage of comparing the coefficients across the three dependent variables which is the aim in the current study. Nevertheless, separate OLS were performed for each of the dependent variable followed by heteroscedasticity tests. Though a Breusch-Pagan / Cook-Weisberg test for heteroscedasticity for e-consultation was rejected (chi2 10, 16.01; p = 0.0992) indicating homoscedasticity, the same test could not be rejected for e-information and e-decision making (chi2 10, 37.67; p = 0.0000; and chi2 10, 129.05; p = 0.0000, respectively) indicating heteroscedasticity. In the current study, this means that the variability of error terms is not constant across all values of the explanatory variables. Note that heteroscedasticity does not bias the coefficients but effects the variance meaning that the standard errors are no longer unbiased (Berry & Feldman, 1985). Heteroscedasticity is likely when the unit of analysis is an aggregate (Berry & Feldman, 1985) such as the "country" in the current study. However, the heteroscedasticity has to be very severe to cause any bias in standard errors and unless heteroscedasticity is marked, OLS regression can be used without concern of distortion as significance tests are unaffected (Williams, 2015).

A summary of all hypotheses test results across mediation, moderation, and multivariate regression is presented in Table 26. The hypotheses that are supported in the current study are H1b), H1c), and H5b). The affordability of ICT resources, the ICT skills, and previous e-participation level have a statistically significant and positive impact on e-participation. Additionally, the hypotheses of H3, H4b, and H6a) are partially supported. In case of H3,

political rights and civil liberties and ICT skills have positive and statistically significant interaction effect on e-participation. This is the only interaction between the technology and institutional resources that is statistically significant. Although, the results do not support that the institutional resources mediate the technology resources' effect on e-participation, it does support that technology variables of affordability; skills; and previous e-participation mediate the influence of institutional resources on subsequent e-participation (i.e. H4b). In the analysis of data for the difference in the magnitude of the technology variables at different levels of e-participation (H6a), the support is found only for affordability and previous e-participation scores. The difference in the magnitude across the three stages is statistically significant for these two variables.

Table 26: Summary of hypotheses test results

Hypotheses	Test result
H1a): The availability of ICT resources has a positive influence on e-participation.	Not supported
H1b): The affordability of ICT resources has a positive influence on e-participation.	Supported
H1c): ICT skills have a positive influence on e-participation.	Supported
H2a): Supporting political and regulatory environment in a country is positively associated with the e-participation in that country.	Not supported
H2b): Political rights and civil liberties influence e-participation positively.	Not supported
H3): Technology and Institutions interact to influence e-participation.	Political rights and civil liberties and ICT skills have positive and statistically significant interaction effect on e-participation.

Table 26 continued

Hypotheses	Test result
H4a): Institutions mediate the influence of technology on e-participation.	Not supported
H4b): Technology mediates the influence of institutions on e-participation	Supported - affordability; skills; and previous e-participation scores mediate the influence of institutions on subsequent e-participation
H5a): Technology usage (enactment of technology) influences e-participation positively.	Not supported
H5b): Previous e-participation level influences e-participation positively.	Supported
H6a: There is a difference in the magnitude of the technology variables at different levels of e-participation.	Supported for affordability and previous e-participation score.
H6b: There is a difference in the magnitude of the institutional variables at different levels of e-participation.	Not supported

6. DISCUSSION AND CONCLUSION

This dissertation aims at explaining the difference in the degree of e-participation across countries using institution and technology variables. It further looks at how the factors differ in their influence across the three levels of e-information, e-consultation, and e-decision making levels.

Effect of Technology and Institutional Resources and their Interactions

The technology variables of ICT affordability, skills, and previous e-participation score come out as strong explanatory variables of e-participation. The results also support the role of these technology resources as the mediator for institutional variables of political rights and civil liberties and political and regulatory environment. The countries that are high on political rights and civil liberties enjoy a wide range of opportunities such as free and fair elections, competitive political parties, strong opposition, public participation in the government through formal and informal consensus processes even by minorities, freedom of expression, assembly, association, education, and religion, a fair system of the rule of law, free economic activity, and equality of opportunity for everyone, including women and minority groups (Freedom House Report, 2012). Better political and regulatory environment means effective law-making bodies and laws relating to ICTs, intellectual property protection, software piracy rates, efficient legal system, independent judiciary, and better enforcement of contracts (WEF Report, 2016a). Such countries are bound to have better ICT resources. For example, free economic activity in political rights and civil liberties means more competition leading to improved and more affordable ICT infrastructure (refer Gulati, Williams, & Yates, 2014). Similarly, efficient judiciary promotes effective contract enforcement that leads to expansion of trade (Cusatelli & Giacalone, 2014).

The election rights, and rights of equality mean more participation, be it online or offline, leading to more ICT usage, better skills, and improvement in e-participation scores (refer studies by Verba et.al. 1972, 1978, 1995). Rule of law, intellectual property protection, and countermeasures for software piracy ensures better measures of business usage of ICT such as innovation, patents, ICT absorption, and business to consumer internet use. Freedom of expression and education in civil liberties measure implies better quality of education system, including math and science education, and adult literacy rates in general (measures of ICT skills). The availability and quality of government online services, which is a measure of government usage, is positively impacted by the presence of competitive political parties and strong opposition, effective law-making bodies and laws relating to ICTs, as well as better scores in contract enforcement. In the analysis, the magnitude of political and regulatory environment on the technology resources is larger in most cases as compared to the political rights and civil liberties impact on technology resources. The reason for this difference probably lies in the measures of the two variables. The political and regulatory environment measures are more direct and can have an influence in short term as compared to political rights and civil liberties that are subtle and may take small increments and a longer time to influence the technology resources.

Based on the test results, the two variables of institutional resources have no significant direct impact on e-participation in a country and neither do institutional resources mediate the effect of technology on e-participation. This result is not surprising given that previous studies (e.g. Gulati, Willimas, & Yates, 2014) also found a negative impact between democratic institutions and e-participation or no significant relation between freedom of speech and e-participation (e.g. Jho & Song, 2015). Institutions did not significantly impact e-participation

directly, but they have statistically significant and positive indirect effect when mediated by technology variables of ICT affordability, ICT skills and previous e-participation score. This is the most significant finding of this study as well. Institutions are the antecedents to technology resources impact on e-participation. Previous cross-country studies have not looked at this aspect of institutions and focused on interaction between technology and institutions. The path analysis in current study has brought out this aspect of institutions as antecedents and technology as the mediator for institutions to impact e-participation. Looking at the direct impact of institutions on e-participation (such as in Gulati, Willimas, & Yates, 2014; and Jho & Song, 2015) it may appear that the institutional variables are not important. The study of indirect effects of institutions, as in the current study, clearly brings out the role of institutions as antecedents for technology's impact on e-participation. None of the control variables came out as significant in the mediator models. However, scholars advise to be wary of statistical significance in the results especially in social science research developing and validating theory (Henkel, 1976).

The study hypothesizes that technology and institutional resources interact to influence e-participation. The results of a t-test support that countries with high e-participation level also score high on political rights and civil liberties, political and regulatory environment, infrastructure, affordability, skills, usage, previous e-participation. The t-test also supports that countries with high e-participation level have high national income, and a greater percentage of urban population. The only interaction term that results in a statistically significant effect on e-participation is that of political rights and civil liberties with ICT skills. Thus, the findings support that the political rights and civil liberties and ICT skills interact to influence e-participation positively and significantly and generate a larger effect than their independent effect.

However, the mean percentage youth in a country is at significantly lower levels for countries with high e-participation levels when compared to those with low e-participation levels. The current study has included those in the age group of 18-24 as a measure for the percentage of youth in a country. Hannsen (2008) did not find any significant effect of age on use of ICT but education mattered. Young, especially millennials are not known to engage in political activities. Saglie and Vabo (2009) found that the municipal internet facilities were most used by the 25–44 age group and not by those below 24 years of age. The current study had limitation of data as data were either available for 15-24 years of age or 15-54 (too broad). The current study used the former group and did not find any statistically significant impact of young age on e-participation. This is even though, they are considered as more technology savvy (Saglie & Vabo, 2009). It is possible that by including slightly older group of people in the model may change the picture.

Lastly, the study hypothesizes that there is a difference in the magnitude of technology resources and institutional resources at different levels of e-participation. The results support that the magnitudes of the technology resources of ICT affordability and previous e-participation score are significantly different across the three levels of e-information, e-consultation, and e-decision making. No statistically significant difference was found for any of the institutional resource variables. While the magnitude of influence of ICT affordability is most in the first level of e-information, its magnitude of influence reduces in the higher levels of e-consultation and e-decision making. This is in consensus with the current discussion for the related hypotheses that institutional variables are more important for e-decision making level as compared to the technology variables. Previous e-participation score's magnitude increases (almost doubles) from e-information level to e-consultation level. However, it reduces again in

the e-decision making stage, although the magnitude still remains larger than that for e-information stage. This indicates that previous e-participation experience boosts the e-information level of a country and has a much larger influence on the next (advanced) level of e-consultation. A country's marginal benefit due to previous experience of e-participation at the basic level of e-information in the subsequent year is lesser as compared to the advanced level of e-consultation. The marginal benefit of the previous e-participation score (i.e. previous experience) almost doubles for attaining the level of e-consultation in subsequent year. There is clearly a decreasing margin of improvement in e-participation based on its previous score as a country moves from e-consultation to e-decision making stage.

In the beginning of the study, two research questions were posed. The first research question asked: What factors explain the difference in the degree of e-participation across countries? The results of the current study support that ICT affordability, ICT skills, and previous e-participation level have significant positive influence on e-participation. Additionally, political rights and civil liberties and supporting political and regulatory environment have a significant positive indirect influence on e-participation with technology resources of ICT infrastructure, ICT affordability, ICT skills, and previous e-participation scores as mediators. ICT skills and the political rights and civil liberties interaction also has a positive and significant effect on e-participation.

Analyzing by Levels of E-participation

The second question posed in the study was: How do the factors differ, if at all, in their influence on e-information, e-consultation, and e-decision making levels?

At the e-information level, ICT affordability, skills, and previous e-participation score are statistically significant. At the e-consultation level, only the previous e-participation score is

statistically significant. At the e-decision making level, ICT affordability and previous e-participation score are statistically significant. At the same time, the seven explanatory variables of technology and institutional resources and the three control variables together are strongly statistically significant for all the three levels, simultaneously. Each explanatory variable was tested to verify if the difference in the coefficients is statistically significant across the three levels. The coefficients of ICT affordability and previous e-participation score have statistically significant difference in their coefficients across the three levels.

Thus, ICT affordability and previous e-participation score are the two technology resources where the magnitude of influence varies significantly across the three levels of e-information, e-consultation, and e-decision making. ICT affordability has a decreasing magnitude of influence as a country progresses from e-information to more sophisticated levels of e-consultation and e-decision making. Previous e-participation score has increased marginal utility for e-consultation level as compared to the basic e-information level. This marginal utility however decreases as one moves to the highest e-decision making level. This indicates that previous e-participation score is able to help boost the subsequent e-information stage which is availability of the archived information. This makes sense as new any new information is an addition to the previous archived information available on government websites. Its utility in boosting the e-consultation stage increases almost two-fold (magnitude doubles). E-consultation is the availability of online tools such as social media. This again makes senses as any new online tool added is an addition to the previous available tools. However, even though it boosts the e-decision making score, the magnitude of influence drops in this stage. This is because the type of measures used for e-decision making are such as online e-participation policy and sharing outcomes of participation with the public. These are complex requirements, not a linear addition

of tools or information to existing ones, and these are the dimensions that most countries struggle most with. Note that previous e-participation score also stands out as a variable that has strong and positive influence on the subsequent e-participation directly and also as a mediator for the institutional resources.

Digital Divide

As mentioned in the beginning of the study, this dissertation aimed at raising the issue of digital divide and its impact on e-participation. The findings in the paper highlight that the two important dimensions of digital divide - ICT affordability and ICT skills – are significant in determining the level of online public participation. At the same time the findings highlight that it is the institutions of political rights and civil liberties and the political and regulatory environment that act as the antecedent to these technology resources. ICT affordability and skills are the medium/approach through which institutions effect e-participation. Besides ICT skills and political rights and civil liberties complement each other's effect on e-participation.

In the current study, the ICT availability (infrastructure) did not come out as a significant predictor of e-participation. Leigh and Atkinson (2001) had argued that in future the differences in access (or the digital divide) may not be between having access to the internet or not, but between those who have high-speed access and those without. In the current study, the availability of ICT infrastructure that measured the mobile and internet coverage in a country did not come out as a statistically significant explanatory variable of e-participation. However, the ICT affordability that measured the broadband internet tariffs has statistically significant influence on e-participation corroborating to some extent that affordability of ICT, especially broadband internet, is significant explanatory factor for e-participation than the mere availability of internet.

Lack of digital skills is considered a barrier to ICT access (Van Dijk & Hacker, 2003). In the seminal study, Van Dijk and Hacker (2003) argued that the digital divide concept is shifting from possession of computers and network connections to gap in digital skills and usage. The current study supports and augments this argument as the availability of ICT infrastructure is not a significant predictor of e-participation but the ICT skills is a significant explanatory variable for e-participation. Thus, better the ICT skills, more the e-participation in a country and lower the ICT skills, lesser the e-participation in a country. This study has thus highlighted that the dimensions of digital divide that are significant for e-participation are ICT affordability and ICT skills.

Contributions to Practice

The biggest learning for practice is that e-participation not only requires technology resources but also supporting institutional framework. The most novel contribution of this study is to establish the role of institutions as antecedents of technology for e-participation in a cross-country analysis. Freedom House (2017) reported that for eleven consecutive years (up till 2016) the number of countries that have seen a deterioration in political rights and civil liberties has outnumbered the countries that have shown progress on these indices. At the same time the access to information using ICTs has increased in the past two decades with the number of internet users increasing from one billion in 2005 to three billion in 2014 (Internet Live Stats, 2017). The growth in technology resources has to be supported with institutional resources for a positive effect on e-participation. The absence of institutional resources such as lack of political rights and civil liberties and regulatory support such as ICT laws will be detrimental to the adoption of available ICT infrastructure for the purposes of e-participation. An example is a country like India that, despite an extensive mobile network coverage and extremely competitive

telecommunication market, has low e-participation score due to lack of e-participation policies. Since India developed a policy on Digital India and developed a platform for sharing and commenting on policies in 2014, thus promoting ICT usage by government agencies for public participation, its e-government score went up in 2016 (compare UN Survey 2014 and 2016).

The three technology variables that are found to have a statistically significant and positive association with e-participation are ICT affordability, ICT skills, and previous e-participation. The moderation analysis has informed that the group of countries that have higher e-participation also have higher levels of political rights and civil liberties, political and regulatory environment, ICT availability, affordability, skills, and usage. Therefore, countries need to engage in development of various dimensions of technology such as affordability and skills. Mere availability of ICT is not sufficient for e-participation. Having ICT available, at affordable rates, developing necessary skills, and promoting its use across the sectors of government, business, and society are all important dimension of technology resources that facilitate e-participation.

Citizen engagement is a fundamentally knowledge building exercise with profoundly positive benefits to the policy development (Lukensmeyer & Torres, 2006). In the current study ICT skills and previous e-participation score have emerged as dominant factors with significant positive impact on e-participation and are a reflection of knowledge building. ICT skills is an important factor that has direct positive influence, mediates institutional resources, and has a positive significant interaction with political rights and civil liberties in promoting e-participation. Previous e-participation score has a positive direct influence on e-participation and additionally its magnitude varies significantly across the three levels of e-information, e-consultation, and e-decision making it an important factor in explaining subsequent e-

participation at each level. For every unit increase in previous e-participation score, a country will have 33 units more of e-information and the impact is most, 65 units more, at the e-consultation stage. However, the margins of benefit of previous e-participation score decrease to 38 units in e-decision making stage.

Contributions to Theory

The current study uses novel combination of policy feedback and socio-technical approach to develop a conceptual model of e-participation. The policy feedback, even though have been used in offline public participation context has not been utilized in the online participation studies. The theories of policy feedback, structuration, and technology-in-practice lens have been used in a novel way in this study to evaluate the difference in e-participation across countries.

Mettler (2002) argues that the policies bestow resources on citizens that provide them the capacity to participate. The current study explored the influence of technology resources on e-participation. Although the current study did not find statistically significant support at $p<0.05$ level for the influence of ICT availability and ICT usage on e-participation, it did find strong support for direct and positive influence of ICT affordability and ICT skills on e-participation. Jho and Song (2015) found a statistically significant support for their technology variable, as measured by online population, on e-participation. The online population is one of the several measures that constitute the ICT usage variable in the current study and ICT usage, as a composite variable of individual, business, and government usage, did not come out as a statistically significant explanatory variable for e-participation in the current model. However, previous e-participation score, one of the dimensions of ICT usage in the current study that is explored separately, has come out to be the most significant of the explanatory factors for

subsequent e-participation. Based on Orlikowsky's (2000) work, the current study argued that mere availability of the technology is not enough to promote e-participation. Instead the available technology needs to be used recurrently in order to effect e-participation. The finding that previous e-participation score is a statistically significant and strong explanatory variable for e-participation supports Orlikowsky's (2000) technology-in-practice argument. Further, the previous cross-country e-participation studies have not looked at multiple dimensions of technology resources. The current study brings forth the aspects of technology resources, such as its affordability and skills that have a feedback effect engendering subsequent e-participation. Affordability in the current study is measured using tariffs of internet and mobile, and the competition in the internet and telephony sectors that drives the prices down (measures of ICT affordability) and promotes e-participation. This result is consistent with the results of the study by Gulati, Willimas, and Yates (2014), who argue that countries with more open competition in their telecommunication and related industries have greater e-participation opportunities than countries with a more regulated sector. Previous studies have also shown strong support for the positive influence of education on e-participation (e.g. Gulati, William, & Yates, 2014). The findings of the current study are in consensus with previous studies as ICT skills have statistically significant and positive direct influence on e-participation. ICT kills act as a mediator for the indirect effects of political rights and civil liberties as well as political and regulatory environment. Additionally, the current study shows the statistically significant influence of the interaction, between ICT skills' and political rights and civil liberties, on e-participation. The ICT skills in the current study are measured using enrollment in secondary education as well as the quality of the math and science education in a country.

Mettler (2002) argues that the policies and administrative rules shape citizen's perceptions about their roles in community and their predisposition to participate. The current study did not find a statistically significant direct influence of political rights and civil liberties on e-participation. Past studies have found similar results for the direct influence of democratic culture on e-participation. Gulati, Willimas, and Yates (2014), who measure democratic political culture using a composite scale including Freedom House scores in combination with other indicators of democracy, find that a more democratic political structure has no effect on the extent of a country's e-participation. Same result for the democracy scores are observed in the study by Astrom et.al.(2012) who argue that the results are such because of rise in e-participation amongst non-democratic countries and not because of a negative trend amongst the democratic countries. The political and regulatory environment in the current study also failed to show a statistically significant direct influence on e-participation. Gulati, William and Yates (2014), on the other hand, do find a support for their hypotheses that an efficient and effective public sector, as measured by the Worldwide Governance Indicators (WGI) (Kaufmann, Kraay, & Mastruzzi, 2009), has a strong and statistically significant relationship with e-participation. The current study uses Freedom House data as a measure for the political rights and civil liberties in a country and the same data is used by Jho and Song (2015) to measure freedom of speech and association. Jho and Song (2015) did not find the interaction of freedom of speech and association with online population as a statistically significant influence on e-participation. The current study, however, found that the interaction for the political rights and civil liberties with ICT skills has a statistically significant and positive influence on e-participation, an influence that is greater than their individual influences. Even though direct influence of the two institutional resources on e-participation is not supported in the current study, the findings

support the interpretive effects of the policy feedback theory by showing statistically significant and positive indirect and total influence of institutional resources on e-participation. The institutional resources of political rights and civil liberties and political and regulatory environment, when mediated by the technology resources of ICT affordability and skills, have a positive and statistically significant influence on e-participation. The current study has established that institutions are the antecedents to technology resources' impact on e-participation. Previous cross-country studies have not looked at this aspect of institutions and focused only on the interaction between technology and institutions. It can be inferred from the results of the current study that the government policies create resources and interpretive effects that promote public participation, an argument made by Mettler and Sorrelle (2014).

The study contributes to the e-participation literature by conducting a cross-national analysis to explored the effect of technology and institutional resources on e-participation. By doing so, the study has provided insights about the factors and their relationships that influence e-participation. The study highlights specific technology resources that promote e-participation and those are affordability, skills, and previous e-participation. These technology resources are also significant in their role as the mediator for institutional resources. The institutional resources on the other hand do not have a significant direct effect but when modeled as antecedents to technology resources, they have statistically significant indirect effects through technology resources of affordability, skills, and previous e-participation. The most significant finding of this study is the role of institutions as the antecedents to technology resources impact on e-participation. Previous cross-country studies have not looked at this aspect of institutions and focused on interaction between technology and institutions and/or found insignificant direct impact of institutions on e-participation. The path analysis in current study has brought out this

aspect of institutions as antecedents and technology as the mediator for institutions to impact e-participation.

The study brought together theories of policy process and information technology in one conceptual model for analysis. The importance of resources for participation, even though common and extensively used in public participation and e-participation literature, was under various heads such as resources approach, resources effect of policy feedback theory and resources mobilization. The current study shows that in the development of all these approaches, there is a common literature, such as that of Verba et.al. (1993) and Lazarsfield et.al. (1948) that ties these together. Some of these theories are often used and referred in conjunction by scholars such as Giddens (1984) work with Orlikowsky's (2000) practice lens. However, the current study uses the technology and institutions' interconnection with the policy feedback effect. In the current study the existing policies in a country are seen as the ones that shape technology and institutional resources in a country and these resources provide a complex intertwined context in which the human action of e-participation takes place. The current study uses the theories together in a novel manner for studying e-participation.

Limitations

The current study had large number of parameters to be assessed using limited countries' data. Due to a limitation on the number of countries for which the data were available, the study used two consecutive survey data to form one dataset. This hinders the independence of observations. To overcome the concerns, some measures like use of lagged dependent variable, robust errors, and tests of heteroscedasticity are reported in the analysis. Survey data are often combined for analysis in policy studies where multiple years of survey data are combined to form one dataset, and it is assumed that the cases are exclusive, although it may not be so.

Additionally, some variables in the dataset have moderate to large correlations. There is poor discriminant validity amongst the variables considered as institutional variables and those considered as technology variables. These are again the reality of datasets in the real world. However, all the measures are from reputed sources also used in other scholarly studies, the data on these measures have been collected for multiple years in the original studies, and the measures are used in the same sense as measured in the original studies. Thus, measures used in the current study are valid and reliable.

Internal and External Validity

The key issue in internal validity is the causal one. Use of literature to establish the explanatory variables, use of theories to establish the relationships and model design, use of control variables to take care of exogenous variables, using explanatory variables that occur prior to the dependent variable, and also the measurement validity that is discussed in the methods chapter—these all contribute to the internal validity. However, the slight survey instrument change in the UN survey between the two years of data used is a threat to the internal validity. Also, the current study is not an experiment and there is no random allocation of countries into test and control groups that strengthens the internal validity of a study. A random selection of sample helps strengthen external validity or generalizability of the study results. In the current study the set of countries used in the analysis are based on the availability of data for dependent and explanatory variables and is not a random selection of countries. Nevertheless, all countries for which data is available are included in the analysis.

Future Studies

The current study has highlighted the complex and intertwined nature of the technology and resource variables and their impact on e-participation. instead of composite scores such as those

used in previous studies, the current study tried using separate dimension of technology and institutions to provide better understanding and actionable feedback. The future studies can take two paths. One path for the prospective studies to take is to add even more complexity to the model. Future studies can refine the model by deconstructing each variable into further discrete components. This can be done based on the survey questions and indicators used in the sources of data. This will help in creating a discrete set of technology and institutional resources, however, it will also increase the number of parameters to be assessed in a model. Therefore, more data points will be needed leading to pooling of more years of data and advanced statistical techniques are required to evaluate such data, especially in one single model. Further, a time series analysis can be done with such pooled data to analyze the effect of the explanatory variables over time. The second course to take in future studies is to drop or combine variables in the current model and make the current model simpler. Such a model can then be analyzed using cross-section data at any given year. A challenge for future studies is to select the variables that they want to keep or add, and the ones that they want to drop in a model, given the vast number of variables that have been analyzed in public participation literature- both online and offline.

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