School of Computing
Blekinge Institute of Technology

Smarter City
- A System to Systems

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Thesis submitted for completion of Master of Science (120 credits)
Main field of study: Computer Science
Specialization: Informatics

October 2012

This thesis is submitted to the School of Computing at Blekinge Institute of Technology in partial fulfillment of the requirements for the degree of Master of Science (120 credits) in Computer Science with specialization in Informatics. The thesis is equivalent to 20 weeks of full time studies (30 credits).

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ABSTRACT

Developments in the technological fields have opened doors to sustain quality of life for making cities smarter and democratic by allowing citizens to play active roles rather being just passive participants along with their governments. Therefore, in this study we have proposed an idealized interaction system- a process used for organizational development based on Interactive Planning Approach, where citizen and government adopt more effective and efficient ways to coordinate, collaborate and communicate for the development and growth of different systems in the city, which ultimately serves as "system to systems". By using Delphi methodology- a reaserch approach by Norman Dalkey (1946), we invited 25 people representing a wide variety of interests participated in the series two rounds of surveys to suggest more effective and efficient methods of interaction for the citizens and government. All proposed ways after second round of survey are used to design the Idealized Smarter City model – a model of knowledge-based sustainable development. However, structural and behavioral comparisons suggest the need of further improvement to get the proposed system implemented, in review of rapidly increasing population and resulting deteriorating resource availability to sustain the social and technological needs.

Keywords: Smarter City, Idealized Design, Participation, Systems

ACKNOWLEDGEMENT

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1   INTRODUCTION

The concept of Smarter City (SC) has been widely discussed topic in recent years within different academic disciplines of social sciences, technology, health etc., as cities all over the world are in a state of flux and facing multiple challenges.

One of the important challenges cities facing today is finding effective and efficient ways to engage citizen and government in shaping the society of the future (Callahan, 2007) [1]. To achieve this objective, various approaches are being employed, however, role of ICT solutions remains to be paramount helping citizen and government to get connected and informed, though the problem resolutions still a far cry. The citizens and government interaction may it be direct or indirect in a democratic society is imperative primarily for achieving better governance and also for bringing optimum benefits to citizens. The concept has recently gained further importance mainly for reasons of government having attained close contact with its people to provide services to them in wide variety of ways. In a smart city the first and foremost criteria is the services that are made available to the citizens is mainly possible by the development of the telecommunications, the impact of which give true integrated vision of a city besides other dimensions not related to technology e.g. the social and political ones. The emerging concepts like IoT and ICT give necessary impetus to creating an efficient and effective smart city's government providing environment for sustainable development of economy that culminates to development of other sectors i.e. social and human capital, governance, transport system and ICT, natural resources and above all the quality of life of the people. Good governance coupled with sustained economy go long way solving urban problems to turn problems into an opportunity to reduce costs, to improve services to communities to make cities smarter.

As citizen remains to be nucleus within the system as his involvement in the decision making process of government can least be undermined. This statement collaborates with the writings of Higgins and Richardson (1976) who long time ago said that "greater participation and consultation are now more widely accepted as necessary elements in decision-making at all levels" [2]. This indicates that the concept of democracy and democratic rule is accepted now as everyday life pattern. Therefore both citizens and government are key stakeholders in the development of a smart city but the current research on engaging citizen and government in community development is more government-centric (Loria et al., 2008) [3], not comprehending to, the need for the citizen involvement in the design and the implementation of the society vis-a-vis in decision making government policies. As ICT provide the collaborative and integrating tools for citizens and government, which could have been best used to explore the gaps between citizen's demands and e-government services.

1.1   Purpose and Scope of the Study

The study is focused on the possibilities of improving the interaction methods between citizen and government by using ICT solutions. By a practical approach the citizens and governments both central and local are interconnected that manifest in a system supporting information technology and other channels. For this purpose, we have explored the opportunities for identifying different techniques like mobile SMS web base applications also various discussion forums. The system so used citizens complaints are addressed by the government officials through their elected representatives for citizen services in a democratic set up by methods of coordination, communication and collaboration. We have used an idealized design system [17] approach for proposing interaction that would allow using technology to connect citizen and government into

communities that are information rich, interconnected and able to provide opportunities. This way they would be able to "turn problems into an opportunity to reduce costs, improve services to communities and make cities smarter" [4].

In our study stakeholders are those people like the government officials, the elected government officials or planning authorities, the citizens and the innovative ICT engineers who are affected, may be affected or who may have the ability to affect the decision-making process or policy, and ICT-means are those technological tools which can be used for collaboration, coordination and communication. Therefore, we have come up with a model which allows stakeholders to participate and collaborate for growth oriented society by using different ICT tools and techniques. As there are many complexities in designing such system which includes but not limited to issues like connectivity, storage, privacy, varied devices and operating systems, skilled and unskilled participants etc. Therefore, we assume that participants have easy access to internet, there is no connectivity issue, all interactive devices are supported on the portal etc.

1.2   Discussion of the Problem

The problem is arising when in a city there is lack of interaction and participation by and between the citizen and the local government. People are not even well connected with each other but also with local government. As such they are not able to use a system to get better citizen services from their government authorities. They are not able to connect their elected representatives for their complaints to be addressed. This is because of lack of support of IT channels by means of which they could effectively approach government departments. Likewise, the government should have a system as well to identify measures, monitor the complaints, communicate as well as manage the services to citizens. Problem arises as people do not have timely services from government authorities as they are not easily approaching information. Further, we find local government is running different systems of the city like water, energy, transportation, education, security, waste emissions etc separately. These systems are either very loosely coupled or having no connection can be found in:

- Government departments
- Citizen and government
- Technological tools and techniques

Based on the above discussion there arises need for designing an idealized smarter city, where communities of cross cultures assimilate as one skill-intensive community with ICT as integrating bond aiming to sustain quality of life in collaborative and participatory environments work towards strengthening the system integration of the city.

1.3   Research Questions

What system should be designed for the inhabitants and local governments to collaborate, coordinate, and communicate using ICT tools in order to make the city smarter?

Above question has a broader scope, therefore, we have narrowed and broke down to following sub-questions:

1. What different types of interaction ways are used among the stakeholders to connect them as communities that are information rich and interconnected?

2. In an ideal situation, which ICT tools would benefit both citizens and government for interaction that may turn problems into an opportunity?
3. In what way the centralized system be used to integrate major systems of the city to reduce cost, increase transparency and make cities smarter?

The purpose of the first question is to understand the different types of interaction ways that exist or can be formed for citizens and government. Interactive ways signify modes of engagement within community with definite objectives for successful completion. The second question is to help us understand best utilization of ICT tools, while last question helps in designing conceptual model of the smarter city, which integrates all major systems of the city to make the city as a central system. Conclusively, the city system is designed based on innovative ICTs such as the IoT and web 2.0 to deliver effective services.

2 BACKGROUND AND LITERATURE REVIEW

In a smart city people are always active participants to its sustainable development. They endeavor continuously to raise the quality of life in integrated systems. This is possible which culminates into smarter city that can only be achieved in collaborative and participatory environment through technology use in e-administration flushed with spirit of rendering services to its citizens with political will. This particularly implies to industries and their production processes, smarter education, smarter healthcare, public-safety, smarter transportation and smarter government etc. These elements globally make all cities sustain quality of life. Sustainability is the survival of a smarter city which is possible only if the citizens involve themselves meaningfully directly or indirectly and also remain instrumented / interconnected with a sense of community for the sake of good governance. Sustainable development can be achieved in cities that are resource based. A resource based is one which depends largely on its own natural resources and exploitation of its own natural resources as its main industry, while the other aspects of its sustainability is economic growth and technological progress, as also environmental sustainability. Economic growth is very much possible by bringing people together using the ICTs which ultimately result in technological progress which is an essential factor for sustained development. The educated citizens in a Smart City have learned to learn innovative technological channels that have revolutionized all aspects of life. Citizen participation and their connectivity are imperative component of Smart City. Therefore, they need to be able to use the technology for technological progress of the city. The collaborative and participatory environment through technology tends to foster sense of community amongst the citizens which is key for survival of a Smart City vis-à-vis good governance with true sense of rendering services to the people.

2.1 What has been done

In view heretofore, one can safely conclude that citizens and government are key stakeholders in the smart city. Banathy (1996) claims that it is important that all involved stakeholders are parties make their voice heard when designing systems [16]. These ideas require sustainable technologies and methodologies. One of such approaches is planning. For a smart city to develop the prerequisite is the government transforming itself to become e-government with applications of technologies. The technological infrastructure shall essentially pave the way for a city to become smarter with significant organizational changes. To help support this process the key requirements are sustained changes in technologies required for underlying infrastructure. The administrative policy fields shall automatically provide better e-government at the city level to make it a smarter city. However, the process to work itself needs planning for multiple communication technologies and the infrastructure for e-government to provide e-services to citizens in more and more efficient and effective manner. A holistic system meant to be integrated vision of a city as is composed of parts that are interactive and interdependent for community integration into one organic whole covering all major systems of a city as its components categorized into:

i)	Education
ii)	Transportation
iii)	Energy and Utilities
iv)	Social Services
v)	Healthcare
vi)	Economic Development
vii)	Public Safety
viii)	Other ICT Systems

The approach provides vibrant human bond among people, thanks to ICTs and the phenomenal changes in fundamental nature of a community. The above different components of a city having separate systems with separate infrastructure and data are being developed into an integrated system to systems. The first and foremost criteria for the smart city is application of ICTs besides factors other than technology e.g. the political and social ones that would also smartly play their parts entailing policy vis-à-vis decision making in the fields of industry, education, healthcare etc. for providing quality of life for its inhabitants through collaborative and participatory environment, for sustainable development. A smart city within itself by sustainable development in turn continuously improves upon the quality of life for its inhabitants through collaborative and participatory means. Today, the smart phones suit our everyday needs in large way. It has innumerable applications with endless possibilities from communicating with friends to collaborating with business associates. The device is undertaking banking services for convenience of smart inhabitants of smart cities the world over. This is how a smarter city citizen uses his/her network for social activities thus helping in improving quality of life. The technology is up for deliverance of entirely new ways to save time and lives as also enables effective tracking and delivery. This range of new technologies is increasing on daily basis.

The smarter places are getting smarter by leaps and bounds because of the highly educated individuals attract more skilled high-tech workers employ them in innovative enterprises to reap most benefits to living in a smart city. The education is key component that has the potential to change the fundamental nature of a community. The information rich technologists now foresee future requirements beyond those technologies in vogue related to mobile and fixed networks and have already identified many research challenges. Increasingly active and smart systems should now replace current passive and fragmented networks. Smart networks and infrastructures are the need of the day so as to increase the innovation, improve the quality of life as also standards of living. Further, the key concern of the future research in smart city perspective is the integration of security and privacy-preserving mechanisms. Such developments will create new threats and opportunities to be handled by high-tech workers and as such are a key component as a ICTs team integrated as a system into organic whole in a Smart City.

Increasing access to technology, developing useful Internet content and software solutions and providing training are aptly indispensible, so that people can learn how to use the ICTs as this would open doors to unlimited opportunities to prosperity.

Pamela D. Gibson et al. (2005) cites the work of Morse (1996) who believes that "there are capacities that exist in every community that hold strong potential for building new patterns of interaction that can renew our sense of responsibility and commitment to each other" [5]. In democratic communities the citizens are represented in both local and federal governments by their elected leaders returned in respective legislatures by popular votes. What it means how citizens' participation in e-Government developmental work and receive e-services there from. Citizens with leaders have played vital role in local government reforms in numerous countries. They have indeed worked towards common good. The citizen's voice is being heard that eventually transformed our social order into real democratic society. There is interaction between citizen and government by two way involvement i.e. direct and indirect. Direct involvement suggests that citizens are the "owners" of government [31] which is more preferable these days. Transparent governance has emerged mainly due to empowerment given to the citizen who has given sense that performance and accountability must become everyone's responsibility. The electronically connected citizens of today are vigilant and keep monitoring the government activities for larger interests of the community. The citizens are brought into the government structure through committees and commissions etc. to support local government activities citizens'

community conduct seminars and workshops on variety of issues. Primarily, the ICT can be utilized to facilitate citizen interaction and sharing of information as also knowledge on social issues.

2.1.1   The Importance of the Study

Although, there are many articles written favoring citizen involvement, however, there is little agreement on adopting the methods to engage citizen and government in shaping the society [1]. For instance, some theories support the citizen involvement by using indirect means of communication, while others favor direct and deliberative models of collaboration (Callahan, 2007) [1]. Banathy (2004) are of this view that "even if people fully develop their potential, they cannot give direction to their lives, they cannot forge their destiny, they cannot take charge of their future –unless they also develop competence in taking part directly and authentically in the design of the systems, organizations, and communities in which they live and work" [20]. Direct democracy prerequisites a rare and cultivated competence in taking part in government activities, however, it would be hardly possible to give right direction to well-being of all citizens. Therefore, most theorists are of the view that indirect democracy is the preferable mode of participation being more effective than direct democracy.

Future of a smart city shall, therefore, depend upon quality of human resource it has, as technology economic shifts need innovative, creative and knowledge-based workers. The knowledge of today is now not confined to just high tech sector; all the sectors are depending increasingly on knowledge-based activities.

Prof. Rosabeth Moss Kanter (2009) of Harvard Business School and Stanley S. Litow (2009) of IBM International Foundation in their paper "Informed and Interconnected: A Manifesto for Smarter Cities" [4] emphasize the use of technology to connect people for transportation in communities that are information rich, interconnected and able to provide opportunities to all citizens. This way they would "turn problems into an opportunity to reduce costs, improve services to communities and make our cities smarter". They produced an equation, "A Smarter Planet = Smarter Cities: Smarter Cities = Smarter Communities". The same envisages the vision that smarter cities are composed of smarter communities which support the well-being of all citizens. This bond within the community will ensure for all individuals quality of life and the ability to create and maintain jobs. It is the idealized design process developed by R. Ackoff, whereby citizens' best accrue benefits through participation, collaboration and consensus. With ICTs providing the integrating tools, all major systems of the city integrate into one system. The electronically connected citizens transforming into a community in a smart city are in a state of flux and facing multiple challenges.

The technologically advanced countries are using all possible means to attract highly skilled manpower from abroad which is the key to the development of a knowledge economy. Countries that have invested massively in their human resources have been able to establish high-technology industries with the resulting stupendous impact on their respective economies. The quality of education, availability of world class R&D centers and an environment in which innovation and entrepreneurship can flourish are essential to wealth generation and poverty alleviation.

The motivation to study the subject and the concept of smarter city is how end users benefit by integrating and collaborating mechanisms into government processes. The benefits relate to better customer satisfaction, reduction of costs as also gaining competitions advantages deriving from improvement in business procedures resulting in improved products and services. Timesaving measures are of further advantage as the business transactions are carried out on the web, while e-government social services are provided to citizens with

increased efficiency. Besides, timesaving in the e-government services and to access information that is aptly relevant to end users, download forms and send email on 24/7 basis.

The study further inspires the way a smarter city constitutes a "system of systems" and also set of integrated parts of major components i.e. education, transportation, energy and water, healthcare and other ICT systems planned and completed simultaneously under idealized design and no system is left out to be considered separately at a future date. Again, the study takes up information models of smart city keeping readily available for every citizen to share information with other fellow citizens and the government agencies as well. The interactive planners have treated a smart city as a holistic organization of its different components to make it a system to systems.

3 METHODOLOGY

Being the purpose of the study as to find ways to engage citizens and government using technology networks for city development and sustainable growth, while also integrating the vital components of the city to make the city as a centralized system, we have adopted a research approach whereby inviting opinions, attitudes and factors instrumental in the making of smart city a well-structured questionnaires from participants not known to each other. The answers tangible and meaningful served to design the idealized interaction system for a city to become smarter in a systematic way.

3.1 Adopted Research Approach

The adopted research approach is the combination of two established approaches i.e. Delphi Methodology and Idealized Design as shown in the figure 1 followed by *literature review* of both approaches.
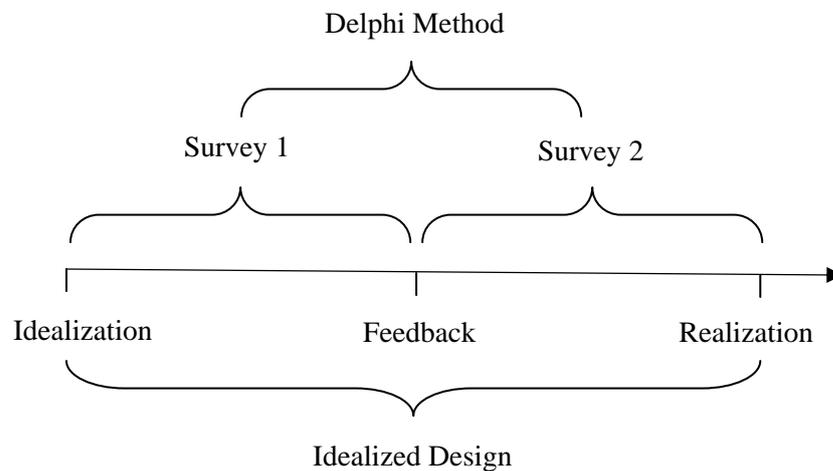
Figure 1: Adopted research approach

3.2 Delphi Methodology

Delphi methodology is used to virtually engage geographically dispersed participants. It was a research approach developed by Norman Dalkey of RAND Corporation for a U.S. military project in the 1946, as it is a flexible, well suited research technique when there is incomplete knowledge about phenomena (Skulmoski, Hartman and Krahn (2007)) [19]. The method is based on a structured process for collecting and synthesizing knowledge from same group of people by sending them several rounds of surveys accompanies by controlled opinion feedback (Adler and Ziglio, 1996) [24]. The complex the issue may be the method sets out both suggestions and also the solutions in a modest way.

The opinions gathered from first survey participants help weed out respondents with luke-warm responses – those who did not answers the questionnaire in full where from no tangible results could be conceived and finally to target only those who gave tangible and meaningful replies to second survey questionnaires. The replies from respondents of round one are duly verified and validated for accuracy to summarize into well-framed round two questionnaires to finally seek expert suggestions to the issues as envisaged therein. The

replies from respondents of round-1 duly verified, validated and synthesized culminating into well framed round-2 questionnaires circulated amongst the same group of respondents.

In this framework we focus on participant's content relating to their work tasks, roles and functions in the work setting. The participants were from varied backgrounds and as such had experience relative to their professional settings and therefore, their experiences reflect on our survey results. For example, engineers have tasks in their environment common and identifiable job descriptions in the use of the ICT tools and related procedures, in structural functions such as social services for public safety by which particular patterns of smart city could be predicted for application of integrating processes and data sharing between the characteristics of a smart city.

In our study, the first round of the survey is used to generate ideas and these ideas are then synthesized to design the second round of survey, which is sent to the same group of people. In the first round of survey our emphasis is to find out social and technological factors that culminate in the formation of smart city and subsequently in the second round of survey, realization of the best ways identified together by all participants for citizen and government to collaborate, coordinate and communicate via ICT means in order to make the city smarter.

3.3   Idealized Design

Idealized design approach is used for designing the system that designer would like to have right now but not at some future date. A system that envisages design execution 'right now' but not at some other future date and is based on Interactive Planning Approach, a process used for organizational development. Idealized Interaction System stems out of Interactive planning approach, which is used in different areas of development. It denotes that the planners idealized design a developmental project with all its major components to be in place for all consideration all at once and completed simultaneously. The idealized design is essential part of Interactive planning and has two parts i.e. Idealization and Realization. It is process for which was initially used only for organizational development when developed by Russell L. Ackoff [17] but later it has been used in different areas. This approach require following conditions and requirements to be fulfilled:

1.   It has to be technologically feasible
2.   It should not be dependent on the technology currently not available
3.   It should be capable of learning and adaptation
4.   Operationally viable i.e. it can sustain or survive with or without modification.

The designers idealize the system and prefer to have "right now, not at future date". It is because the design does not predict a future based projected changes in selected variables. Traditionally planners depend on a projection into the future of key variables. The variables tend to change un-predictably, and then the benefit of long term planning becomes limited. [25]

3.3.1   How it works

Idealized design is a planning in action and as propounded by Ackoff and it is not an act but a process involving five phases that form a cycle that has no arbitrary end point in time, but continues to adapt to changing internal and external conditions. All of the phases interact and can be initiated in any order, but must be completed together as shown in Figure 2:

Source: Adapted from R. Ackoff, *Creating the Corporate Future: Plan or Be Planned For*. New York City: John Wiley and Sons, 1981.
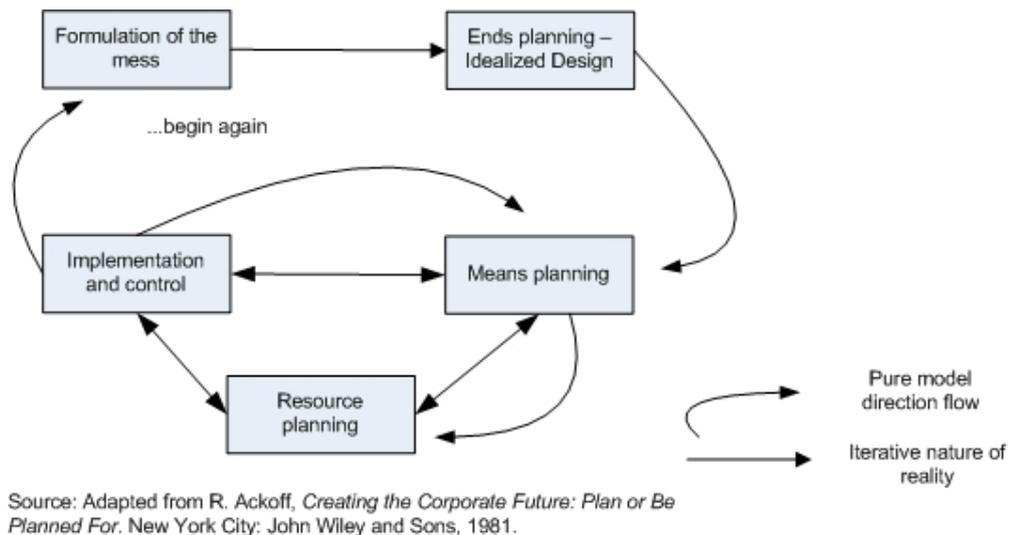
Figure 2: Phases of Idealized Design

3.3.2   Idealization

Phase 1: Formulating the Mess

Mess is the set of interacting threats and opportunities faced by every organization or institution. Formulating is the understanding of the threats which can destroy an organization in a conceivable future in case the threats are continued unchecked and failing to take remedial measures. As such, idealized design can be undertaken to avert feasible destruction.

Formulation or understanding a mess involves four steps:

i)   Prepare a systems analysis

A detailed description of state of operations of the organization or institution. The results are obtained preparing flow charts how material is acquired and processed or used in the organization. Charts for the flow are also helpful to assess the gravity of mess.

ii)   Prepare an obstruction analysis

Factors that obstruct progress of the organization or institution which may be age old furniture, shortage of space in the building for workforce. The factors may include internal conflicts among the owners and workforce as also traditional customs.

iii)   Prepare reference projections

It is fore-sight report revealing at what stage the organization or institution would show signs of its decay or destruction. It may further reveal what changes should be adaptive in changing conditions to prevent obstructions occurring in the organizational progress.

iv)   Prepare a presentation of the mess

A presentation is prepared for projected scenario of the organization's future that it would face, if no changes were to make in current practices, tactics and strategies when the environment changes are expected and predictable.

Phase 2: Ends Planning

The understanding and practice involving four steps of the formulation of mess innately help planners to identify exactly the mess occurs as also to assess the gravity of destruction to be removed in a conceivable period of time. Such is the crux of planning. Here planners identify exactly the mess occurs that needs to be removed by the planning process.

3.3.3   Realization

Phase 3: Means Planning

Here planners determine the courses of action necessary to remedy the self-destruction of the organization. Such is the implementation stage of the design. The idealized design that envisages averting feasible destruction of project comes into play and it becomes incumbent on the planners to determine an action plan to remove destruction. Self-destruction of an organization projected in a foresight report revealing at what stage would an institution show signs of decay or destruction.

Phase 4: Resources Planning

Necessary resources for each type like money, material and services and other facilities are arranged for utilization to fill the gaps or to remove obstructions that have emerged in the organization or institution.

Phase 5: Design of implementation and control

The design specifies duties allocation to respective employees, not necessarily experts or professionals. Whereas, controls and monitoring of work processes is carried out which involves identification of failures from time to time of schedules envisages in the planning.

3.3.4   Order of Phases

The above phases of the interactive planning are interdependent; however, the last four steps do not necessarily have to be completed in order, and ideally should be worked on simultaneously (Ackoff, Magidson & Addison, 2006). One of the key principles of idealized design is to keep the participants focused on what they desire, not the problems they have with the current system (Ackoff, Magidson & Addison, 2006) [17]. The idealized planners are emphatic with what they want now, not at some future time. There could however, be contingency planning to be carried out in future which could be invoked [17].

The idealized design is especially powerful when the environment in which the organization exists is turbulent. The idealized is a powerful tool of a management that can foresee a precipitating mess viz. decay and destruction in the organization [17]. The operations of an organization remain under close surveillance at intervals envisage in the design process. Therefore, the reports reveal at what stage the turbulence or decay would occur. The oncoming crises is predictable within the projected scenario of organization's future that would be embedded in the periodical fore-sight reports. The design is an effective tool not only for organization, but is also effective equally for functional division, department or even sub-department level [25]. Idealized planning from the realm of it removes professionals. The interactive planning process embeds in itself key principle removing the professional from its realm. The authors of the idealized design consider the on the job employees of the organization as more knowledgeable about the nature of turbulent environment as also the ways to remedy it. It is only when the citizens in a smart city engage in idealized design

process they accrue certain benefits that are difficult to accomplish through other techniques which are:

a. Participation b. Collaboration c. Consensus d. Commitment e. Creativity [25]

While the subject of idealized design will be dealt with at length in chapter 5 within the context of smart city; special emphasis shall be laid on the process of interactive planning and implementation on complex system in smart city framework.

3.4 Selection of Participants

It was challenging for us to involve a large number of respondents to our structured questionnaire eliciting their opinions and ideas enabling us to design the idealized design system, the reason being there geographically dispersed living locations. Therefore, we had to select a small group as representative sample providing us data by answering our questionnaire to solve our primary purpose of designing the system for a city to become smarter, which although sample group cannot be considered representative of all people' ideas, which is not our primary goal. The primary goal was to design the idealized interaction system for a city to become smarter.

The participants' selection was done through the courtesy of our 5-friends/acquaintances living abroad who helped us reaching the right number of well-informed respondents to serve our project. Finally, globally dispersed participants from UK, France, Kuwait and Pakistan were selected. They were 25 in number; 5 females and rest were males. However, we consider no gender discrimination and our prime consideration was to seek valued information in keeping with the questionnaires supplied serving our purpose i.e. to collect smart city issues. The select participants chosen from different background were eventually registered solely on the basis of their seriousness which was largely evident from their respective professions. The respondents were selected in keeping with their professional backgrounds, like IT, public and private organizations, students, teachers, engineers as also other professionals, but essentially with criteria of basic knowledge of information technology. The selection of participants was based on their experience in their respective fields of work for both males and females. Therefore, we had people from different backgrounds like IT, IS, Business, Economics, Social Sciences and other disciplines; yet all of them had at least basic knowledge of information technology, as in the field of information system the key concept is participatory design meaning that design is neither, done for, or by, the users, but with the users (Ehn and Kying, 1987) [35]. This is done in order to find out how selection of these participants can facilitate us to stem out a criteria for interaction ways between stakeholders i.e. citizen and government.

3.4.1 Survey Distribution

Both surveys 1 and 2 were designed using Google Docs (https://docs.google.com) and were given to the participants on June 1, 2011 and June 23, 2011 respectively. For both surveys participants were given two weeks time to respond, whereas, we sent them feedback of the surveys within three days after response deadline. The tasks assigned by us to answer questionnaires in the meaningfully analytical manner. The first survey was carried out on June 1, 2011 ending on June 15, 2011 and the second survey starting from June 23, 2011 ending July 8, 2011. Other features/insights of the surveys conducted are given in the appendix at the end.

The survey questionnaires were very educative and informative, and were devoid of any ambiguity. The format of the surveys contained some of the questions which were explanatory seeking details of critical issues but the mostly were pertinent questions seeking selective answers. Our main focus on survey 1 was to invite opinions and ideas of the participants regarding the effective and efficient ways to engage citizen and government in case they asked to design a system whereby stakeholders to coordinate, communicate and collaborate via ICT means for benefit to become a city to become a smarter city. There were 7 mandatory questions to be answered in this survey, the second survey was based on the summary of survey-1, focus question and how we could implement and design the identified solution. Survey 2 focused on Realization of the best-ways identified together by all participants for citizens and government to collaborate, coordinate, and communicate via ICT-means in order to make the city smarter. The contact list was further systemically drawn up from the different sections of the community at large. Also it was observed that the personal contacts of those globally available worked well. So that each number of participants could understand the requirements sought for in the project under taken. The communication process was mainly online that really produced results within the time line. We found out potential for our purpose for continuing participation in the survey 2, weeding out non-serious participants.

4   SYSTEM OF A CITY

> *"…systems or their parts are purposeful if, by their choices, they can produce (a) the same outcome in different ways in the same environment and (b) different outcomes in the same and different environments." (Russell L. Ackoff, 1971) [37]*

4.1   What is a System

The concept of system is not a new phenomenon as it has varied meanings due to the fact that different authors and researchers have described it according to their findings. According to Austrian Biologist Ludwig von Bertalanffy (1975 cited by Mark Davidson, 1983) [21] "a system is an entity which maintains its existence through the mutual interaction of its parts", whereas some systems engineers describe it as a set, which is composed of different interrelated components working towards a common goal. In a city the mechanistic, animate, social and ecological systems are interconnected and between them a web of interconnection exists as none of the systems can operate in isolation. For instance the transport, education, business and other components of smarter city exist only in close interaction by connectivity processes and if connectivity links are broken, the cut off link disturbs the whole. The common goal if the interconnectivity is to attain the sustainable development of a smarter city which is possible if people, in connected system, participate actively in e-government projects aiming to raise the quality of life in an integrated system. Systems can be further elaborated by components, relationships and attributes. Components are operating parts of a system and are of various kinds, such as individuals, business firms, social norms etc. Attributes are the characteristics of the components that may be perceived or measured, whereas, relationships are association that occur between components and attributes. City itself is a system. City as a system is centralized system to varied systems.

4.1.1   System Concepts

Environment and Boundaries:
A system works within a range of boundary which means it has entities inside the system and also outside-part its environment. So as to understand a system models are drawn up that simplify its structure and also its function. Fig 3 shows basic boundary and surroundings concepts of a system.
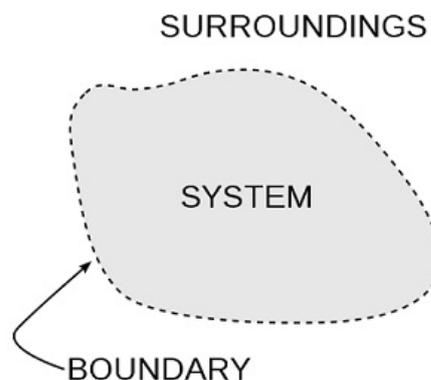
Figure 3: System boundary and surrounding

Natural and Man-made systems:
The natural systems apparently may not have an objective, but can be interpreted to have a purpose. On the contrary man-made systems have definite purpose as specific and planned results are obtained on their operations [38]. As explained above the natural systems have a purpose but not of its own. However, it contains social and animate systems while on the contrary man-made systems have definite purposes that with definite operations produce definite results.

Theoretical Framework:
Theoretically, there are two systems (a) open and (b) closed. Most systems are open systems; which exchanges matter and energy with its surroundings like car, coffee maker, computer etc. while closed systems are neither matter nor energy. A theoretical example of such system is the universe.

Sub-system:
A subsystem is although a system itself and is a component of larger system.

System model:
Models are essentially man-made systems specific to understand and to predict or impact their future behavior. The major systems of a smarter city i.e. education, transportation, energy and water, healthcare, other ICT systems are planned and completed simultaneously and all being man-made having each of which multiple views. The architects of respective systems describe their views in system models. Man-made systems require planning, design, implementation, deployment, operational, structure, behavior, input data are output data view. These models with their multiple views are imperatively required. The system architecture describing the views is system model [38].

4.1.2   Types of systems

There are sociological models advanced by Walter F. Buckley (1967) [39] who define social systems in sociology in terms of mechanical, organic and process models. Natural systems need not be mixed up or confused with designed systems. A key consideration among the systems is how much freedom the system has seen with purpose, goals, methods, tools. George J. Klir (1969) [40] differentiates between hard and soft systems. Hard systems are result of research and quantitative system analysis, such as engineering systems, whereas, soft systems as claimed by Peter Checkland (1981) involve method such as action research and participatory designs [8], which is aimed to resolve immediate problems with collaboration to benefit the community at large. Table 1 explains the types of systems approach developed by the researchers at University of Pennsylvania [18]. They have categorized systems into four kinds of systems as shown in the Table 1.

Type of System Model	Parts	Whole	Example
Mechanistic	No choice	No choice	Machines
Animate	No choice	Choice	Persons
Social	Choice	Choice	Corporations
Ecological	Choice	No choice	Nature

Table 1: Types of System Models [18]

4.1.3 City as System of Systems

System of a city is composed of several mechanistic, animate and social systems such as people, government, ICT tools etc. System theorist views the *system of a city* as a complex system of interconnected parts, where each of the system is separated from its surroundings or environment by a boundary.

Indeed a city is a system and it is a complex system of systems (Wladawsky-Berger 2009) [7]. City as a system holistically embodies in itself all major systems as its sub-systems with different entities making the city a system to systems. The components are inter-related working towards common goal which is to open doors to unlimited opportunities to prosperity. Connectivity of the systems by ICT means is the key factor. According to John Post (2009), currently we have separate systems for managing different components of the city like water, energy, transportation, security, waste emissions and ICT, and these systems have separate data, infrastructure, responsibilities, tasks, projects, etc. In addition, we also miss a holistic view at city level; therefore, an integrated system is desirable, which brings together all data and infrastructure for different city to make it a system of systems [9].

A city delivers a variety of key areas that promote it to be attaining the status as such education, healthcare, ICT solutions to energy and power sectors, transportation including aviation and rail, oil and gas, industries amongst others.

4.2 Smarter City System

Generally the definitions of smart city tend to suggest that the concept of smart city is based on innovative ICTs such as the internet of things (IoT) and Web 2.0 to deliver effective public services [12]. All in all the definitions point to transformation of our social structure being rapidly organized into a network society. The intensive use of technology has transformed the contemporary governments into e-governments which are more transparent to the best advantage and preference to citizens offering online services. Such administration activities have given rise to importance of citizen-centricity in e-government within the concept of Web 2.0. The informational development provides conducive environment for a city to transform itself into e-city which in turn combines infrastructure and information technology needed to transform our social structure to organize into network society. This new trend of cities' development based on information technology infrastructure successfully gives impetus to the cities develop in a hi-tech sustainable way, much needed for economic development through industrialization. The network society using ICTs excessively builds an efficient electronic business system. It is smart city government that can provide public service system that resultantly improves the quality of life of citizens while also promoting the sustainable development of the city itself and its government into e-government. Making the government functions to at its best consistently remaining at the beck and call of the citizens as service provider. This is possible in an integrated environment through technology use in e-government with political will.

A smarter city constitutes a "System of Systems" and also a set of private and public systems that the city integrates for good governance and to achieve better services for citizens [6]. Further, as being key criteria of ideal system all major components of smart city i.e. education, transportation, energy and water, healthcare, other ICT systems must be planned and completed simultaneously as each element of process does not appear feasible when considered separately but becomes feasible when considered collectively. Seen in the wider context, the concept of Smart City explains how the Information Communication Technology (ICT) plays an important role in the development of a smart system.

4.2.1 Connected systems

A city is a place where all mechanistic, animate, social and ecological systems are connected with each other, as "no system operates in isolation; instead, a web of interconnection exists" [12]. For instance transport and business systems are closely interrelated, as both are key users of energy. Connectivity of these systems is an essential factor for "The Web of Life" [36], which cannot be destroyed, even if many of the connected links are broken, yet cutting any link disturbs the whole. The Web of Life, describes connectivity of communities through the technology. Every day routine work and personal life our generation depends mostly on connectivity, so much so that survival of today's citizen in this competitive world while also keeping up with personal commitments connectivity is key to problem solutions. Any urgent tasks; performing online banking transactions, sending email messages, checking flight information and the urgent healthcare facilities etc. are just a click away. The importance of electronic connectivity can least be undermined in business organizations and in state affairs at the highest level down to the ordinary citizen, they have to be integrated into effective networks by ICT means to mutually share problems and their solutions for the sustainable development of smarter city.

Therefore, in the connected systems people have to actively participate for the sustainable development of a smarter city. They endeavor continuously to raise the quality of life in an integrated system. This is possible in a sustainable system of development and solutions to local problems which culminate into smarter city having the boon of smarter education, smarter healthcare, smarter safety, smarter economy, smarter transportation, smarter system of taxation etc. The results can be achieved in a given time-line provided to the inhabitant of the place besides having the political will and the essential characteristic of education as also if they are flushed with spirit to keep up sustained the collaborative and participatory environments by use of technology.

Again, for a city to become smarter it is incumbent to create unified information models to keep available for every citizen to share information with other citizens and government agencies. Safe and refined models need to be developed for users benefit.

4.2.2 ICT as Integrating Bond

"An intelligent city or e-city is where information technology and communication technologies are utilized to improve government efficiency, industrial growth and social development" [26].

A smarter city is that urban location where communities of cross cultures assimilate as one skill-intensive community with ICT as integrating bond aiming to sustain quality of life in collaborative and participatory environments. The smart cities by and large are emerging mainly to provide technology access to the public through social networks, with a view to extend improved services to communities so as to make our communities smarter as well as our city with reduced costs. As in a democratic set up local government officials have closed contact with people, therefore, in an idealized smart city there is an integrated smart community actively working to resolve the urban issues like housing, transportation, healthcare, environmental condition, economy etc. the issues are taken up with holistic approach as such a smart city is treated as an organic whole. The technology that binds the city holistically with its components requiring integrated vision is not only because of ICTs, it is beyond that as they have incorporated factors both the social and political. Such is economy, people, governance, mobility, environment and the quality of life. To think that a smart city emerges as the formation of technology is a fallacy, as IT (Information Technology) in fact is to use as a means to deliver aims and objectives. Each smarter city is taken in its own right as an organic whole, as a network i.e. as a linked system. This study

offers to establish a new holistic approach for community integration into one organic whole discussing urban issues like housing, transportation, health services, economy and environmental conditions. This approach will provide informed and vibrant human bond among people. We venture to build a community network for better services through technology media to produce a smarter world, skilled and innovative community network. Today's digital world has provided an integrated vision of a city and its infrastructures impacting an informed and vibrant human bond. The citizen of a smart city is able to link physical capital with that of social one together technology, information and political perspective, the essentials prerequisite to provide e-government in a smart city.

ICTs tools are key instruments in improving our lifestyles and behavior patterns and power the growth of trade and commerce. The ICTs are major means of providing accessible and affordable information and education as also a key factor in economic development thus helping the government eliminate the social divide.

The key characteristic of smart community is the sustainable investment capability in the ICT tools, and to educate as to how to use these tools so as to keep up with providing improved services to communities and make our cities smarter. The lives of the children in rural areas can be transformed if the rural schools are connected to the internet. This is how we can effectively bridge the digital divide; thereby broadening opportunities for better life to the under-privileged dispersed communities.

4.2.3   Smart Urban Environment

As a smart city incorporates in itself key characteristics like smart economy, smart people, smart governance, smart mobility, smart environment and smart living. These components are composed of parts that are interactive and interdependent but each has its own infrastructure, which being integrated into one organic whole e.g. the smart city, therefore, development of cities is categorized on account of their infrastructure that represents its economic, technological and social development. As the population further grows in volumes by the passage of time, these cities must have the capacity to absorption of such influx from time to time. Today's technology is a universal phenomenon that serves the humanity without being biased to communities, it is for everyone without discrimination and is available who have the ability to acquire and retain skills, knowledge and creativity. The redeeming feature of information technology is that it is available who has the ability to acquire its knowledge and operability without discrimination of color, cast and creed, rich or poor. Computer education imparted to community people can help decrease the digital divide.

The demand for new cities is fast gaining ground, these days basically for economic reasons. New cities emerge that have natural resource all to say are resource-based and have resource exploitation for use as the main industry. Resource-based cities are contributory factor for country's development as a whole. The resource-based cities generally transform themselves to sustainable development giving way for absorption of influx of immigrants seeking better living standards. Louis Wirth (1938) describes cities as having four characteristics i.e. Permanence, Large population size, High population density and Social heterogeneity [41].
We take example of India, which is reported to rapidly increasing its population where as per the estimated figures every minute during the next two decades 30 Indians will leave rural India for urban areas [10]. The situation though is alarming, but at this rate of mass migration, India will need to have 500 cities in 20 years to come. However, the question remains to be answered whether country with its present day resources would by then be able to provide industrial and technological base, besides demands for employment opportunities affordable housing and minimal options for senior citizens [11]. Mass migration from rural to urban areas continues un-abated, as such a large number of smart cities with smart

integrated information systems are aimed for development of smart communities for smart citizens. We all venture to be a community for better services through technology to produce smarter world.

4.2.4   Smart Governance

"E-government is relatively new area of study in the Information Systems (IS) field that is concerned with the use of ICT by the government agencies to electrically deliver its services (The World Bank Definition)" [13].

The development of e-government in turn attained the objects of "good governance". ICT has been considered promising for improving the exercise of democratic processes and political participation [14]. In smart city people are always active participants to its sustainable development. They are active participants because of one prime factor that they are educated and education they have acquired aligns with the needs of the smart city. These qualified individuals attract more skilled high-tech workers. These educated people have the potential of bringing about fundamental changes in the community and opening door to unlimited opportunities to prosperity. They are taking keen interest in the education of their kids too, who will prove hugely beneficial for sustained development through to next generations. The imperative is to cultivate the citizen to actively participate in the social arena (Gronlund 2006a, 2006b) [15] to work along with the government institutes. Banathy (1996) claims that to be involved in design the stakeholders of a system need to acquire knowledge about design i.e. to develop what he calls a design culture [16]. The basic, therefore, is the participation of citizen through e-government platforms.

The e-government deals with the perspectives for development of cities which pointing towards issues of better education, greener programme, transportation, health care etc. for citizens. The objective is to identify smarter metropolises for smarter growth and extend comparative advantages considering the key resources against other cities of the same level to help produce a smarter world. The first and foremost criteria for the smart city is the application of ICT which smartly implies in the fields of industry, education, health care etc. A smart city in itself continuously improves upon the quality of life for its inhabitants through collaborative and participatory environment.

Increasing access to technology, developing useful internet content and software solutions and providing training so that people can learn how to use technology are aptly indispensable as it will open doors to unlimited opportunities to prosperity.

4.2.5   Smart Education and Healthcare

The term smart city is also used regarding education of its inhabitants as the benefits to living in a smart city have increased for all workers over the past two decades. "*But in a break from the past college graduates – not high school drop outs – now appear to gain the most from living in smart cities. This supports the view that highly educated entrepreneurs are increasingly innovating in ways that employ similarly skilled people*" [11]. This has since led to rising investment trend in education with tendency has subsequently pushed skilled populations to flock to smart regions that provide them higher rates of wages in a skilled city with far better living conditions. The skilled workforce in a region would transform its skill intensive industry to higher level economic growth.

Since the highly educated individuals are particularly concerned about their kids education they drive the communities elected heads to invest in primary to graduate level education through legislation and other means.

There is strong link between education and health as good quality education helps people get better care of themselves. For example there is a patients call from a far flung area, computer is automatically activated, a list of doctors on duty pop-up as also ambulance services, blood banks and pharmacies that are located in immediate vicinity appear on the screen. This way a patient is assisted faster and effectively. Besides, teachers can integrate technology in their daily lectures by giving the students special tasks in science, enhance their writing skills, help them create blog, web pages and various disciplines of computer science. The need to acquire smart education to produce doctors who have the latest knowledge of online surgery and use of modern gadgetry at distant locations from their diagnostic terminals.

Lack of education is a great barrier to effective communication with world at large. In a policy brief entitled "Why Are Smart Places Getting Smarter?" by Edward L. Glaeser, Harvard University and Christopher R. Berry, University of Chicago (2006), lay more emphasis on education than any other characteristic that attributes to emergence of smart city. They state that "low-skilled metropolitan area in which less than 10% of adults had college degrees in 1980 grew on average by just 13 percent over the next two decades. Meanwhile, highly skilled regions—those where more than 25 percent of adults had college degrees in 1980 saw their population surge by 45 percent over the next twenty years." [11] They produce an example of Boston to prove their view point saying that, "a quarter century ago, the area was dying factory region with a declining population and rock-bottom real estate values. Over the next two decades though the city and its suburbs experienced an economic renaissance marked by rising incomes, soaring housing prices and an influx of new residents. Many of these new comers came armed with bachelor's degrees: the share of college graduates in the Boston metropolitan area jumped from 14 percent in 1980 to 34 percent in 2000. Only seven other metropolitan areas in the country registered greater growth in bachelor's degree attaining over the same period" [11].

4.2.6 Smart Economy

Economy is yet another hallmark of smart city which described a city with smart industry. The key to smart city transformation is that it has to be resource-based which criteria makes tangible contribution to country's development. Sustainable development can be achieved in resource-based cities. The economy is directly associated with quality of life of the inhabitants as also the congenial environment providing mass migration, modern transport system, safety, efficient and social services etc.

Safety:
As a city starts to grow in size and development, priority for investment becomes imperative. Policing of the place must take priority for crime reduction and for keeping peace ensuring protection of lives and properties of citizens.

Housing:
Housing schemes with all civic amenities need to be constructed for comfort living of the citizen enabling them to make these permanent living abodes for the residents.

Taxation:
People of the smart city are to be reasonably taxed ensuring economic growth by providing them best civic conveniences. All earning individuals need to be brought under tax net with lowest rates of taxation in proportion to volume of earnings by each citizen under the specific legislation. Those evading taxation must be brought to justice.

5   IDEALIZED DESIGN OF THE SMARTER CITY

In this section, we present a description of idealized interaction model of a city where both major stakeholders play an important role while interacting using different interaction ways and ICT tools. This conceptual model explains how public sector's performance can be enhanced while saving public resources and achieving better governance for bringing optimum benefits to its citizens.

5.1   Interaction Ways

There are various interaction ways whereby citizens and government can play significant role in incorporating and re-structuring public administration which in turn benefits them in delivery of better services. The identified interactive ways can be categorized into following three types:

    1)   Citizen to Citizen Interaction (C-C)
    2)   Government to Government Interaction (G-G)
    3)   Interaction between Citizen and Government (C-G)

Interaction is exchange of information while interactive ways signify modes of engagement within community with definite objectives for successful completion.

5.1.1   Citizen to Citizen Interaction (C-C)

The topic pertains to specific role of the citizen in a democratic society which is debated for centuries. The topic is being deliberated ever since the days of Plato, the Greek philosopher, on to this day. The governments always had firm linkages to citizens primarily through electoral politics polls, forum debates and even individual contacts.

Citizens are a group inside a larger holistic system that confirms systems with separate infrastructure, construction and environment in each. The city with its own components infrastructures linked together with technology give perfect integrated vision culminating to development of e-government in smarter city. These activities are aimed to raise the living standards of inhabitants of a smarter city while also they are encouraged to involve themselves directly in the affairs of the government that suggest citizens being "owners" of government where they partake in decision making [31]. Though today citizen has emerged as nucleus and partner in the governing process but still plays a secondary role in community governance [27], there is now a strong realization that community leaders must find different methods to engage all citizens to make their participation more meaningful. This has since been made possible by the development of ICTs to demonstrate and communicate by effective use of development and knowledge platforms.

A process works only in a particular environment that is flexible to alter the model. Within the community environment citizens have conflicting views over issues, it is hardly possible for all to voice their complaints or grievances altogether and seek desired results, as such selected leadership may build successful engagement process.

Citizens with leaders have played vital role in local government reforms in numerous countries [28]. Involving themselves indirect participation electing their representatives to local and federal assemblies they have indeed worked towards common good. The citizen's voice is being heard that eventually transformed our social order into real democratic society. Transparent governance has emerged mainly due to empowerment given to the

citizen who has given sense that performance and accountability must become everyone's responsibility. The electronically connected citizens of today are vigilant and keep monitoring the government activities for larger interests of the community. This is possible only in an integrated society where people involve themselves meaningfully through direct or indirect participation with a sense of community and political will. The citizens are brought into the government structure through committees and commissions etc. to support local government activities citizens' community conduct seminars and workshops on variety of issues.

5.1.2   Government to Government Interaction (G-G)

The local governments system runs mostly on federal legislators', laws, rules, regulations and policies framed by the democratic governments. Accordingly representatives of the citizens are elected to provincial and municipal levels local governments to take active part in their respective communities. During election periods the citizens have substantial influence over political parties and have the representatives elected of their own choice to federal and provincial assemblies who in turn influence civil servants decision processes in line with policies of the political parties in power. The decisions so taken impact local public e-services to individuals, and overall effects different systems of the city being managed by the local governments.

Federal and municipal governments keep integrated to carry out various public policy initiatives. The governments keep full interactivity for providing variety of public services and for performance of necessitated at local and national levels. Internal municipal transactions like payments among agencies are carried out amongst them in settlement of mutually agreed projects and services.

In a smart city environment different government departments integrate to perform as organic whole where citizens and government participate in direct collaboration which facilitate evolving major policy initiatives based on the city development network portals (CDNP) and for the transparency in carrying out the state activities. The same concept is defined and described under section 5.2.

5.1.3   Interaction between Citizens and Government (C-G)

The citizen's participation is most debated subject over the years. It is termed as "contested concept" stemming out questions how much participation is enough? [30]. The citizen in a democratic culture has since gained paramount importance in an environment of informed and vibrant human bond, as such he has irrefutable influence over political affairs of both local and federal government. Should the involvement allowed be direct or indirect? Indirect participation behooves involvement through elected representatives and deliberative collaborations, whereas, the direct involvement suggests that citizens are the "owners" of government and their involvement in the decision making process is imperative [31]. However, both modes of involvement are in practice, but most theorists argue that representative democracy is preferable, being more effective than direct democracy.

In a smart city people have more active role to play for sustainable development of the city. The people of a smart city have multifarious roles to play to keep the sustained development of the city which are described in the realms of decision-making and city management sites. They have influence over administration control as well as city management modes. They endeavor continuously to raise the quality of life in integrated systems. This is possible which culminates into smarter city that can only be achieved in collaborative and participatory environment through technology use in e-administration flushed with spirit of

rendering services to its citizens with political will. This particularly implies to industries and their production processes, smarter education, smarter healthcare, public-safety, smarter transportation and smarter government etc. These elements globally make all cities sustain quality of life. Sustainability is the survival of a smarter city which is possible only if the citizens involve themselves meaningfully directly or indirectly and also remain instrumented / interconnected with a sense of community for the sake of good governance. A city system is composed of parts that are interactive and interdependent for community integration into one organic whole covering all major systems of a city, providing vibrant human bond that open door to unlimited opportunities to prosperity.

The conceptual model used in this paper indicates that more and more citizens can participate on varied issues on which make possible to create forum on the Internet for discussion.

5.2   Idealized Smart City Interaction Model

The above identified development interaction ways and major systems of the city are integrated into following model which signify the kind of services the users (citizens and government) seek that culminate in the making of city smarter:
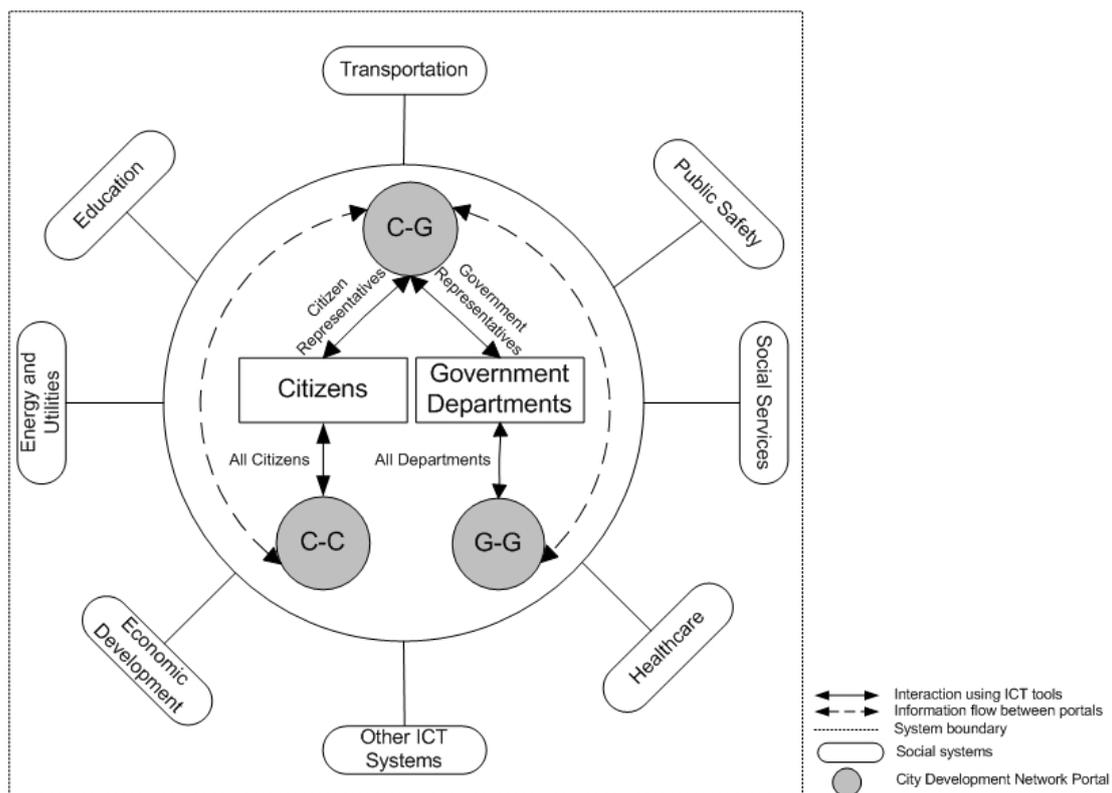
Figure 4: Idealized Smart City Interaction Model

The model above shows that a smarter city constitutes a "System of Systems" as it is composed of several mechanistic, animate and social systems like people, citizen, government departments, ICT tools, educational system etc.

The City Development Network Portals (CDNP) elicit in totality of a holistic system, in which the idea is fostered direct collaboration and integration between citizen and government in a democratic culture, where they participate for the development of every

system rather focusing on single system growth and development. CDNP supports three types of interaction ways i.e. modes of engagement within community with definite objectives for successful completion, which are citizen to citizen (C-C), government to government (G-G) and between citizen and government (C-G).

Further, as being key criteria of idealized design all major components of smart city i.e. education, transportation, energy and water, healthcare, other ICT systems must be planned and completed simultaneously as each element of process does not appear feasible when considered separately but becomes feasible when considered collectively.

Again, for a city to become smarter it is incumbent to create unified information models i.e. integrated community infrastructure to keep available for every citizen to share information with other citizens and government agencies. Safe and refined models need to be developed for users benefit.

The model shows smart city constitutes a set of inter-dependant public and private systems and explains various processes through which the citizens and government interact, while citizens engage themselves with fellow citizens and also how the government department connects with other government departments. The information flows into these three inter-connected levels, the bonds of which are so firmly inter-linked that when information flow changes at one level, the other two levels are typically affected to some extent. For instance if citizen and government representatives design and get agreed on a certain city development policy at C-G portal, this information would flow on other two portals to update all other citizens and government departments to keep informed and connected.

The citizens both directly and indirectly involve themselves in decision making processes at the government level and are considered the owners government in democratic societies. The governments in turn are also seen rendering of services with political will. The citizens always remain instrumented with a sense of community for perceiving benefits in a smarter city.

At the C-G interaction portal, the citizens and government with their chosen representatives have played vital roles towards common good and keep monitoring the government and citizen activities with a sense of accountability. Thanks to ICTs advances which are indeed vital communication tools i.e. the internet and the handheld devices like the mobile phones that have made possible easy connectivity of citizen to citizens whereby users express with greater confidence their ideas, opinion etc. These cutting-edge technologies are growing much faster than what ICTs of older times such as television, radio; newspapers etc. Mobile phones have overtaken landline telephone systems providing world-wide coverage with convenience and inherent affordability, while internet-users have grown manifold in a matter of days with affordable global connectivity. With the interactive and decentralized nature of ICT tools, new opportunities have emerged evolving patterns of work and study of their wide-range effects.

Also, the government connects, with component provincial level governments down to local governments in various ways: codification of laws and regulations to run the state affairs, flow of information at the organizational and inter-organization levels, use of processes and systems for smooth running of public and private affairs to the best interests of state permeate to citizen's preferences. The demand for new cities where population is rapidly increasing is fast gaining ground basically for economic reasons. The world at large will be known on the ground in smarter cities composed of smarter communities with smart integrated information system which is aimed for betterment of all the citizens.

5.3 City Development Network Portal Architecture (CDNP)

It is very important for the application of smarter city system to have flexible IT environment at reduced costs with accelerating processes and simplifying management. Today's governments, educational institutes and business organizations are facing ever increasing need of computing and storage problems, and to solve these they are adopting different solutions, such as Cloud Computing [32].

5.3.1 Cloud Computing

National Institute of Standards and Technology (NIST) [34] describes cloud computing as a model which allows ubiquitous, convenient and on-demand network access to a shared pool of configurable computing resources like networks, servers, storage, applications, services etc. In our study, we will not conduct in-depth study on the concept of cloud computing because this is not our topic of discussion in this study. However, we would briefly discuss the three service models and four deployment models as categorized by NIST.

5.3.1.1 Services Models

Software as a Service (SaaS)

It is a software delivery model that allows the consumer to use the service provider's applications running on a cloud infrastructure. They can access these applications from various devices through either thin client interface or program interface [34]. User does not have to manage or control the underlying cloud infrastructure except the user-specific application configuration settings. It is a common place within an organization where the stakeholders meet and exchange information. In order to provide services to key stakeholders i.e. citizen and government, ICTs are employed effectively and efficiently.

Platform as a Service (PaaS)

On this service layer, consumer is capable to deploy onto the cloud infrastructure consumer-created or acquired applications. In a smart city, we use CDNP Architecture to instantiate the SC platform without the cost and complexity of buying and managing the underlying hardware and software layers. The citizen does not have to allocate resources manually and the will be provided with services in this layer.

Infrastructure as a Service (IaaS)

This layer provides the consumer the capability to control "processing, storage, networks, and other fundamental computing resources where the consumer is able to deploy and run arbitrary software, which can include operating systems and applications" [34]. This base layer offers infrastructure as services, such as storage, server, network provisions, laptop, security for organizations. We use Idealized Design Smart City Interaction Model offering for IaaS to help make the city as an interconnected system to systems.

All above mentioned three service models fall between users and deployed cloud infrastructure. In our study, users are citizen and government departments who are communicating, collaborating and coordinating by using different devices and connecting anytime/anywhere to make systems of the city like Education, Transportation, Energy and

Utilities, Social Services, Healthcare, Economic Development, Public Safety and Other ICT Systems smarter.

5.3.1.2 Deployment Models

Private Cloud

This cloud infrastructure is provisioned for the users of a single organization or closed group of people like in our study representatives of citizens and government as shown in the table 2.

Community Cloud

This cloud infrastructure is provisioned for the users of specific community from different organizations, as they have shared concern and objectives. It is a collaborative effort with common concerns, as in our model citizen and government have common concerns.

Public Cloud

This deployment model is used when the users are general public and anyone is allowed to use the services. It is provisioned via internet with unlimited data access such as smart phone and laptop computer.

Hybrid Cloud

It is the combination of two or more distinct cloud infrastructures, which remain unique in nature but are bound by standardized or propriety technology [34].

Deployment Models for CDNP

Table 2 shows how CDNP can be deployed by using standards of cloud computing deployment models.

City Development Network Portals	Cloud Computing Deployment Model	Description
C-G	Private Cloud	Private cloud infrastructure would allow only representative of both citizens and government to interact effectively. It is privately owned IT infrastructure exclusively controlled and operated by the organization. The ownership in case of this portal infrastructure is deployed with the government privately owned while all its operational rights are with the government.
C-C	Public Cloud	Public cloud infrastructure is available to all citizens of the city for interaction. These services are offered on the portal and allow everyone to participate in the development process.
G-G	Community Cloud	Community cloud infrastructure which is shared by several government departments to collaborate,

		communicate and coordinate for specific and shared objectives (e.g., mission, security requirements and policy). The portal envisages its own responsibility for IT operations amongst government departments for interaction.
C-C, G-G and C-G	Hybrid Cloud	Hybrid cloud infrastructure allows all clouds of the smart city system to bind together by standardized technology that enables data and application portability. This network portal provides operations of IT infrastructure in a shared facility, to a centralized and secure relationship for smarter work.

Table 2: Deployment models of CDNP

The impetus simulating idealized smart city can well be achieved through cloud computing with rapid decrease in hardware cost as it would help increase computing power which in turn increases information storage capacity that would simultaneously drive the multi-core system into modern super-computers. Multi-core architectures are a new trend in computer architecture and the next step in processor evolution [33]. The instrument (super computer) with exceptional storage capacity shall absorb volumes of data and will change the entire horizon of present day internet incalculably. Let there be wide spread use of services computing as well as 2.0 application to achieve our ends.

6   RESULTS AND ANALYSIS

In the first section of this chapter, we have discussed the results of surveys conducted and these surveys effects on the idealized model, whereas, second section deals with structural and behavioral analysis of the real world and idealized model.

Results from the research shows that all participants responded in both rounds of surveys and mostly they relied on email as a contact tool for making clarity regarding the surveys questionnaires. Some demographics observed during the surveys are summarized in the Table 3, which shows good diversity breakdown for such a small group of people, from those who are professionally linked to the study, but yet are unknown to each other.

Gender	Total participants were 25, in which female participants' ratio to male participants was 1:4
Age Group	32% of participants belonged 18-29 44% were within the age group of 30-39 16% were within the age group of 40-49 and 8% belonged to 50+ years of age group
Location	Most of the participants belonged to developing countries. According to our finding 64% of participants were from developing countries, whereas, 36% were from developed countries.
Government sector	32% participants had a direct/indirect link with government sector or political setup, whereas, rest were linked with private sector or any other non-governmental area
Specialty	48% of the participants were related to IT background 7% from Business/Economics 19% from Social Sciences 26% from other backgrounds

Table 3: Statistical characteristics of the participants

It is the experience which counts in a learning process which is taken as a paramount factor. The Delphi Method used as research approach was assessed as suitable for the purpose of our study. The method worked well as structured interview questions were responded to with desired details while provided basis to analyze the answers for the second round of survey. Though both surveys 1 and 2 were results oriented but as all methods have pros and cons yet Delphi Method provided better basis for the conclusions as far as our study is concerned.

The Delphi survey was preferred as against other methods for a number of reasons:-
    i.   By this method we can use both approaches qualitative as well as quantitative for the study.
    ii.   The Delphi method is flexible in its design and has a capacity to accommodate conveniently to follow up our interviews surveys strategy to seek ideas, opinions and suggestions from geographically dispersed people at distant location by use of internet.
    iii.   However, complex issue it is, the respondents' experiences in their respective fields reflect in surveys results that eventually translate into patterns of smart city and could be predicted for application of integrating processes vis-à-vis data sharing between the characteristics of a smart city.
    iv.   The complex issues which embody our study require knowledge from people who understand economic, social and political issues, thus proved highly appropriate for our purpose.

v.   It is simple survey method and can be easily employed while element of delay is virtually eliminated.

vi.   More significantly the Delphi is a forecasting procedure as also discussed above.

vii.   Delphi methodology is simple to understand which quality is attributable to its popularity amongst researchers.

viii.   The redeeming feature of the Delphi method is that its participants are unknown to each other.

6.1   Survey 1: Idealization

As the study focus is to identify more effective and efficient ways for citizens and government to collaborate, coordinate, and communicate via social media and other ICT-means i.e. combining social internet with IoT, therefore, in the first round of survey results we identified centralized portals that behooves CDNP which represents totality of holistic system as the main hub of interactions. Almost all participants supported the concept of centralized system for city development and growth. However, their responses regarding criticality was different for all three CDNP, for instance 72% considered C-C & G-G portals as critical and 92% considered C-G as the most critical way of interaction, which can be seen in the idealized model also where citizen and government representatives are participating through C-G portal.

In order to determine the scale of importance of each level of interaction the participants were asked to rate the same as per their judgment. Accordingly, the summary of respondents is shown in Table 4 below:

Variables	Not very important (%)	Moderately Important (%)	Important (%)	Very important (%)	Extremely Important (%)
One-way Interaction level	0	8	40	36	16
Two-way Interaction level	0	8	0	32	64
Cooperation level Interaction	0	0	20	32	48

Table 4: Level of Interaction

None of the participants denied the importance of one-way interaction, as 92% of them ranked it between important and extremely important. To exemplify, that the government not only must provide updated information about its political and social activities, but keep satisfied the citizens with respect to service quality and handling their demands efficiently.

In response to the question as to how important is the existing "Two-Way Interaction level", 8% were moderately in favor. To exemplify, forms provided by the institutions on the internet for the user to fill and print the requisite antecedents regarding his/her personal data or that of his businesses etc. are automated back over the internet. The questionnaires from institutions are like-wise filled in by answers and returned via the internet by the users.

Again to the question "Cooperation Level Interaction" as to its importance? All in the first place seek government services 24/7 while saving time and convenient accessibility on internet. All participants found unanimous on this type interaction as rating between important to extremely important. Real time services for users are envisaged in this level. These services are readily made available by poly clinics. Cash transactions are made easy round the clock by use of automated teller machines. Internet is widely used in processing of applications of all sort and decisions thereupon taken on merit almost simultaneously.

Further, the participants were sought to select one or more following interactive modes that are critical in bringing change in the existing system:

i) Government Centric E-services ii) Citizen-Centric E-Services iii) G-G collaboration iv) G-C Collaboration and v) C-C Collaboration

We have sought opinions and ideas about the various modes and have been answered in the description as government should device its own strategies whereby e-services to citizens are perceived in keeping with the best interests of the state. Further, the citizen-centric e-services are promoted by the government with the citizen assistance and active participation in the decision-making by direct or indirect representation. Other three collaborative modes are described under section 5.1. Overwhelming majority of 92% participants perceive G-C collaboration as being critical to bring about change in the existing system. Again 60% of whom opine as citizen-centric e-services having vital role in bringing change in the existing system yet 48% perceive C-C collaboration can have high expectation in achieving the desired changes. The vital change is the citizen through his elected leader has been empowered to be heard effectively and forcefully which has eventually transformed our social order. The electronically connected citizens have also brought in local government reforms wherein by their representation has been ensured through committees, commissions, workshops on supporting local government activities on variety of issues. However, there is a group comprising 40% of government-centric services having high satisfaction. Yet 24% favored seeking G-G collaboration who seems generally satisfied with government efforts to bring about changes in existing systems. Again, prescribed forms of various descriptions; may that be applications for job opportunities, income tax returns, admissions to educational institutions, payment of utility bills or even for library memberships should be 24/7 available for down loadings to be used by the citizens.

The study supports as how the users' participation and involvement bring about opportunities for development of public e-services? In the first place user needs are to be identified by making efforts to increase awareness, motivation and above all the interest in public issues among citizens. This will create a designing community to design public e-services, as also the citizens shall have a proper forum established to facilitate themselves to transform into a designing community. The designing community will operate in a collaborative and informed environment while remaining vigilant to play role in decision making as and when required. The modern inter-connected world has mutually designed life patterns to remain engaged in pursuing joint corporate social responsibility for sustainable development of the community that ensures its business conducts and higher living standards. It is for certain that people are at the centre of the city transformation and simultaneously the smarter city together with its citizens is both important sources of data. For example, citywide internet connection and through the mobile use, number of socio-economic issues can well be assessed quantitatively and qualitatively. The internet provides pervasive connectivity used for efficient and effective collaboration and utilize for interaction for sharing information between people. The means of communication i.e. ICT have revolutionized our life patterns attributing certain benefits otherwise difficult to accomplish by other techniques. All aspects of life benefit from electronic interconnection and instrumentation. A businessman collects data of items to be delivered to supply-chains. Another time-saving and also cost-saving hand-held device is the mobile phone serving to connect major manufacturers in order either to seek business intelligence on deliver the same. The mobile-phones owned by the citizens move around in millions of location to location in different environments both within social and business context bringing on new opportunities.

Likewise, in a smart city citizens and the government are key stakeholders each of them collaborate and interact electronically for reasons of perceiving benefits in the shape of e-services and engage in the development processes of the government.

Finally, as to the question that if they (participants) are given a task to design a system what effective and efficient tools would they use for citizen and government collaboration, coordination and communication vis-à-vis what methods would they suggest for such cooperation? The responses were largely identical such as:

a) Collaboration as experience based blog.
b) Social media pages for every government department through the interactive web portal, like social networking website, i.e. the pages provisioned by intelligent networks designed to support machine to machine interaction over a network which has separate design for specific standard description of jobs assigned. For example, weblogs, wikis, internet forums etc. Complete online application in which issues and problems are mentioned and the responsible persons in these departments quickly respond.
c) Use of social media by government to provide information to citizens like face book. A system where government lays its advisory for its citizens, and citizens may file their applications, which government should process them e.g. government related services like passports, income tax returns etc. and the citizens would be able to view the status of their applications online. This would save government large amounts of money and time.
d) Some perceive complete website system to collaborate at governmental administrative level to citizen at online application as being best way for the engagement, where citizens can give their opinions and feedback to express their ideas as to how to make the country better as also openly tell their feelings about the laws and administration of the society.
e) Video conferencing and online lectures to bring about better understanding between government and citizen, using means like Youtube, Skype and supplementary material to understand the objectives and goals to design a system whereby besides ICT means meaningful and face to face interaction between people are key. This would reduce corporation workload as many users will get good advice from each other.

All in all comments mostly impacted on the use of internet being inevitable to social interactions. The internet is a great useful communication tool where integration between people has become possible without physical contact by means of instant messaging, emails, chat rooms, blogs etc. where people discuss and share ideas without knowing each other. Citizens use e-participation for management activities through participatory interaction modes. The internet in smart cities is utilized for participatory activities and as being indispensible system to collaborate with government seeking variety of benefits leading to sustainable economic development and to attaining higher living standards. Without ambiguity the internet has a critical role to play in the distribution of knowledge to every corner of world as shall remain an effective tool for development of knowledge based prosperous economies with social benefits leading to the citizens life in urban as well as in the rural areas. There will eventually, be smarter networks for smarter life.

6.2   Survey 2: Realization

All participants agree on following fundamentals of Idealized model of a smart city:

Planning:
To start with planning is to be comprehensive viz. technologically feasible/viable within estimated costs and time-frame.

Threats/Risk Factors:
The project plan should spell out in advance, the risk factors that may occur within the course of implementation and also provide for remedies to mitigate.

Compliance of Legal Bindings:
The project should strictly conform to global rules and regulations for E-government project sites facilitating exchange of information between the government and the citizens.

Public, Private Coordination:
Set procedures may be formulated for public, private coordination with equal level of responsibility, but without hindrance to free flow of information between citizen and government organizations.

Implementation of ICT:
In order to keep the citizen satisfied the cardinal factor suggested is to remove digital divide by making the Internet connections affordable for low income groups and to provide basic skills to use the ICTs, thus encouraging the private sector to participate in political process. This can further be ensured when everyone has access to Internet.

Services More citizen-centric:
Services should be more citizen-centric than government focused, as the citizen remains to be nucleus within the social system. This largely depends on the quality, efficiency and effectiveness of the use of ICTs that impact e-government services to the citizen, as such PCs, telephones, emails stimulate decision making imperative for improved administrative procedures, directed towards citizens benefits.

Economic Growth; A Prerequisite:
ICTs do not alone make a city smarter but unless a city has the necessary potential for the sustainable economic growth it would hardly posses the criteria to entitle itself for being smarter.

Action Plan:
Government and the citizens work together with a sense of ownership and responsibility. The development projects and political processes must be thoroughly transparent for public comments at regular intervals. Skilled manpower should participate in planning and designing of future e-society while, citizens must receive training to use technology which should be available to everyone.

Break up of Project Structure:
It is imperative to allocate each sector of project to the expertise of work job with a view to achieve best results.

As far the importance of government's role in the realization of the project, none of the participants believe that government needs not to have its role in the realization of the project. However, about the same percentage of the survey participants had no tacit opinion and observe neutrality on the question. But 44% of them were of the view that the government role in the process being extremely important that can't be undermined.

Now as to the role of citizen in the project realization 4% of them opined that citizen's role being insignificant while the same percentage remained neutral. However, 60% of them thought citizen's role as being extremely important, as against government role, in the realization of the project.

Again, the participants were sought to select one or more resources/factors in order of importance out of following options: 1. Finance 2. ICT infrastructure 3. Skilled Manpower

4. Energy 5. Management. The majority of them favored ICT infrastructure as most important and next in row were skilled manpower, finance, management and energy respectively.

Progress monitoring:
While rejecting the notion that progress should be visible only to govt. personnel, all participants believed the same should be monitored and shared with all registered citizens in close collaboration with the government. Majority suggested the progress may be monitored at least once a month also favored weekly and some suggested even on daily basis.

Project safeguards against failure:
Key to project's success is the transparency of processes having been agreed upon by participants. The participants unanimously agree that transparency could attribute to success of a project. Transparency operates in such a way that anyone can assess scale of the performance of project needed for success or failure. The transparency envisages carrying out the jobs relative to the project publically as such exercises contribute to better management and efficient accountability of defaulting workers as also for the auditing of the expenditure estimates. The concept of transparency has since accelerated the momentum in the formation of e-government as the ICTs have come up with efficiency and effectively. Other factors include i) Timely availability of resources ii) Thorough alternative plans as also iii) efficient government control.

How-so-ever, the action plan must envisage besides management support, finance and energy, the favorite factor to realize the idea is commonly considered is in the first place the availability of ICT infrastructure and secondly need for skillful manpower while sustained economy growth should go side by side. The participatory environment amongst the citizens is created by the use of ICTs impliedly in all aspects of life; in administration and also development of industrial growth, smart education, smarter healthcare, public safety, smarter mobility. The ICTs infrastructure in a smart city has generated skilled man power to sustain quality of life.

6.3   Structural and Behavioral comparison of the Model

> *"A central viewpoint is validity as correctness of representation of reality. In this viewpoint a model is seen as a partial representation of reality and validity as the degree of likeness or accuracy of representation of reality in the model." (Pala et al., 1999)* [22]

Consistency of the model needs its parameters and structure to correspond with the reality. In order to validate our model, we have used structural and behavioral comparison of our model with the reality i.e. existing system as shown in the table 5. Validation is a process supported by a number of tests at the structural and behavioral characteristics. The tests are grouped into two classes namely structural and behavioral [22].

The designed model of smart city discusses at length the citizens' and government role in development and growth process while highlighting the participation and involvement in the decision making processes. For the purpose, two surveys targeting groups of people globally dispersed and not known to each other were conducted to realize the concept of smart city. Overall the study is assessed as adequate and in line with our research aims as to how the citizen may coordinate, collaborate and communicate with the government. The interpretation of the responses validate purpose of the study in as much as their professional

linkage in one way or other is with Information Technology or Information Science and also some with social sciences backgrounds, eventually their opinions are taken as credible.

Both survey results though have limitations; point to one prime human needs i.e. development of public e-services within the context of smart city which seem probably the same all over the world.

The Design Culture

Therefore, the imperative is to cultivate the design culture that will enable the citizen to actively participate in the social arena (Gronlund 2006a, 2006b) [15]. This will consequently empower the citizens both individually and collectively. The concept so developed socially will make the individual participate willingly in decision making processes as also in design projects. Banathy (1996) claims that to be involved in design, the stakeholders of a system need to acquire knowledge about design, i.e. to develop what he calls, a design culture [16]. The basic therefore is the e-participation of citizen in the social arena, so as to remain connected and informed necessary for shaping the futuristic society. Banathy claims that design thinking and practice create competence in social systems design whereby people are empowered and create participative democracy. Design thinking creates the future and it begets design culture that encourages creation of culture collaboratively. Design culture is essentially borne out of collaboration on community level. "Collaboration is not only important but it's demanding."[16]

The result of surveys conducted speak of citizen-citizen, citizen-government and government-government engagement towards structuring public administration that ultimately benefits citizen for better services.

Structural components identify static part of the smart city [41] such as, government, citizen, technology, finance, economy etc whereas, behavioral components denote dynamic part of the same e.g., decisions, interaction, activities, messages etc. to give this study a more semantic value. The study demonstrates the improvement in the approaches between the structural alignment and behavioral alignment processes involved in a smart city with the introduction of the technology. The processes are gradual and was applied to influence among the set of options of smart city components. The basic notion of our approaches to discuss extension of this work to the analogical reasoning that makes city smarter and better e-government which requires behavioral and structural changes. The intersection of the alignments protrude the set of common features between each of the components of the smart city. The structural and behavioral processes help align both static and dynamic components of a city taking into account policy options through ICTs use as to transform them into smarter components, those of semantic values. The alignment process plays key role in conceiving the concept of e-government and how citizen collaborating with the government becomes key stakeholder change the city into integrated components making itself to a system to systems. Finally, the paper focuses on citizen and government and vice-versa that affect and plays key role in comparisons that how citizen represents information from one discipline of study to another and how government responds. Current approaches for component retrieval are largely limited only to specific components; it was therefore considered incumbent to make a breakthrough in the processes and take refined diagrammatical retrieval techniques to describe the components in a meaningful and efficient ways. To elaborate the statement structural and behavioral retrieval technique is applied so as to segregate semantic from heterogeneous components repository. This retrieval process is made possible when combining formal and semi-formal specification used to describe component that makes the retrieval process efficiently. An example can be quoted: some pairs are analogous like the digital camera and a scanner; these have different arguments and

pairs dissimilar. Both captures images and can be transferred to a computer and processed [29].

In the real world which exists today, the condition of a model remains un-matched with those that entitled themselves as smarter cities. This is due to factors both social and technological. To verify the validity of the proposed model whether beneficial? It has to be compared with that of real world model which exists and the proposed is that what is intended. Our model is Idealized model and we compare it with the real world system. The proposed model is essentially built on the opinions, ideas and suggestions of the respondents of the surveys conducted as detailed are consistent with the Delphi Methodology.

Key Components	Structural Comparison	Behavioral Comparison
Interaction between Citizens	The real world citizens have limited access for interaction with each other. The citizen will only integrate and communicate with only one knows and have relation to whom he chooses to interact. Whereas, in idealized smart city interaction takes place with each other by use of interactive devices they have i.e. mobile, laptop etc anywhere, anytime. Interaction portals are also made available for citizen convenience. It is to bridge the digital divide investment in ICT infrastructure is made as also to provide access to ICT at lower cost for lower income citizen and also enabling executive decision-making support. The portals provided a government web portal that is meant to provide information on city's laws, regulations, instructions and policies. Portals are also available for emergencies such as fires, natural disasters etc.	In the real world there is vast gap of digital divide within communities which offers grim situations in terms of health and education. Therefore, change is needed at the grass roots level. In a smart city there is vibrant human bond among people. The two key factors i.e. the ICT and education have brought about phenomenal changes in broadening opportunities for better life to the citizens. The situation has mainly a reason out of digital divide that needs to be effectively addressed at the grass root level i.e. the schools and those who cannot afford a computer may have the facility free of cost and given practical training. This way desired changes can be brought about for better living standards in the long run.
Interaction between Government	In reality, there is lack of information sharing amongst different governments departments, whereas, G-G interaction platform provides effective and efficient way to interact and function in accordance with rules, regulations and policies framed by consensus between them. The shared information through connected G-G portal should be read by concern department officials for effective and efficient planning in their areas.	Using G-G between the elected government and functionaries in the government departments reflect public confidence as the amicable relationship brings in quick benefits for the citizen. In the real world, however, the government functions are not so transparent thus the governance is autocratic.
Interaction between Citizens and	In the real world the interaction is limited. Over the years the citizens have won both direct and indirect	The citizens and government in smart city attain life in collaborative and participative

Government	democracy returning their representatives to national, provincial and municipal assemblies. Whereby they involve themselves meaningfully for sustainable living standards. Often seeking information and services is time-consuming and costly, and mostly the citizen's role is passive. In the smart city citizens and government are key stakeholders and each of them has the right to benefit from the e-services and contribute in the development process of the city actively or passively.	environment and endeavor for sustainable development of the city so as to raise the quality of life. They receive all types of services and information online. In real world the situation is rather adverse; citizens have to go through time consuming exercises to get information and services. Thanks to introduction of ICT tools, the situation is gradually changing. The people are becoming more and more conscientious about active participation in government affairs that perceives benefits in the shape of e-services.
Culture	The modern technology (ICTs) is up for deliverance to save time and revolutionize our life patterns and help create new opportunities and smarter services to build smarter community. Such is the culture in the offing. In the real world people are traditional and have limited access to ICTs.	The smart city has a community network for better services through technology to produce a smarter world, whereas the people in the real world are traditionally passive and know a little about use of modern technology.
Technology	ICTs have integrated the communities to build network for creating smarter world. Technology may be brought to at the door step of the people so that everyone can access the Internet which is of paramount importance to encourage private and public sectors offering the citizens in participation of political process. In order to save the project from failure transparency of processes is of basic importance. Whereas in the real world access to ICTs is limited due to deficiencies in economic and social factors such as digital divide and proficiency in lack of skilled workforce.	Online citizen-centric services culture having developed, the online businesses have also taken over the world by storm while companies operate efficiently and profitably, leaving far behind their contemporaries who mostly rely upon traditional businesses practices. There is phenomenal growth of internet banking.
System integration	According to John Post (2009), currently we have separate systems for managing different components of the city like water, energy, transportation, security, waste emissions and ICT, and these systems have separate data, infrastructure, responsibilities, tasks, projects, etc. In addition, we also miss a holistic view at city level; therefore, an integrated	Each idealized smart city is taken in its own right as an organic whole, as a network i.e. as a linked system. Our model brings out holistic approach of community integration discussing all at one time the urban issues like housing, transportation, health services, economy, culture and environmental conditions, as against in the real world different

	system is desirable, which brings together all data and infrastructure for different city to make it a system of systems [9].	systems of city that do not interact and treated as compartmentalized separate entities.
Services	Fundamentally, the smart city qualifies itself for economic reasons and accounts itself for technologies and social development as such builds its capacity to absorption of influx of immigrants to seek better their life styles perceiving better services. The real world, however, is incapable of keeping up with providing desired services.	The service provided today stimulate the citizen of smart city to strive for yet greater growth to have the potential to change the fundamentals of community, as their skillful endeavors are opening door to unlimited opportunities to prosperity.
Education	Education is prime factor that attributes the emergence of smart city. As in survey the respondents claim the importance of education in a way that education is the key to transforming the social systems which culminates into smart community. The importance of education is further emphasized as instrumental to public-private partnership. Lack of education in the real world is great barrier to the development into welfare communities.	The smarter places are getting smarter by leaps and bounds because the highly qualified individuals attract more skilled high-tech workers employ them in innovative enterprises to reap the most benefits by living in a smart city. The respondents are of the view that ICTs are indispensible while the skilled manpower those who use the ICTs are of crowning importance and as such their status can never be undermined as they play critical and smart role for the sustainable development of communities in a smart city. One has to be properly educated in learning how to use technology and learning into how to bridge the deficit of smartness which could only be measured by scale of dedication to the user. These educated individuals have now turned particularly conscious about their kids education as such they drives the local government heads to invest in primary to graduate level education through legislation and other means.
Safety	As a city starts to grow in size and development, priority for investment becomes imperative for keeping peace, reduction of crimes and protection of lives and property of citizens. The real world suffers at the hand of criminals who often create law and order situation in the community.	Today's smart city keeps vigilant its police and justice systems ensuring citizens protection of lives and property. This promotes confidence in the government. The life in real world is chaotic, state of injustice is rampant.
Housing	The smart interaction ways allow citizens and government to highlight the issues/opportunities	The city fathers have the vital responsibility which they do carry out with well laid out roads,

	they face to solve them in short time with low cost. Whereas, in real world the citizens enjoy no modern amenities and live in pollution filled environment.	markets, poly clinics, educational institutes and pollution free atmosphere in a smart city. Whereas, same amenities in real world remain a far cry even today.
Economy	A smart city must have the major criteria of sustained economic growth. This is achieved with the industrial and technological base. This, therefore, is of the key component that serves demands for employment opportunities, affordable housing, health-care etc. The respondents of the view that the use of ICTs do not make on their own a community smarter, but unless a city has the necessary potential for its sustainable economic growth, it would hardly possess the criteria to entitle itself for being smarter as also other respondents have also stressed to use resources appropriately. The real world of even today lacks such developments.	A city that qualifies to be smart stands on the edifice of its sustained economy with industrial and technological base that absorbs the immigrants' skilled workforce with better amenities of life including attractive employment condition and affordable housing etc. Lack of these amenities in the real world disqualifies the areas to become smart cities.

Table 5: Structural & behavioral comparison of the Idealized Design Model and Real World

7   CLOSING REMARKS

The smart city as research topic is still an emerging field of research. The smart city takes shape when using new technologies that promote to transform into intelligent entity. It is emerging field as social construction of technology is still in evolving and developing stages to take up systems of interconnections for greater efficiency bringing them into a web of city's core system. However, the field offers several areas for research one of which has transpired within the context, is the role of the citizen and government in the city's integrative and participative environment to build a community network for better services through technology media. The smart city project has practical and significant importance. Its evolvement is gradual and formidable that for the purpose ICTs has enormously enabled services and opportunities available to citizens to build an integrated collaborated and instrumented community. The citizen's participation for the explicit purposes is necessitated as a way to better understanding the future requirements. The study emphatically brings out that the development of cities is categorized on account of infrastructure that represents the technological base and social development. These two key factors are inherently dependant for sustenance on the ICTs and education that have the potential to change the fundamental nature of community. The ICT and education are instrumental in technological progress and social development importance of which can hardly be undermined. These factors go a long way attributing to sustainable development of a smart city. With these attributes in place, the smarter cities have transformed communities into network society as an organic whole. The smart communities that inhabit the smart cities have smart integrated information system aimed for e-services perceived by smart citizens. In the real world where there is rapidly increasing population, faces alarming situation with regard to resources that can hardly provide for industrial and technological base for adequate social development, besides meeting demands for employment opportunities, affordable housing and other basic amenities for the citizens.

The study does not fully comprehend the exact method to achieve the need for e-services to citizens, the assumption has to have test of times, and the study has to be repeated time and again. The most important factor involved in the development of e-services is the user participation which will augment citizen empowerment to devise design and development of e-services perceived by the citizens. Banathy (1996) explained how competence in social systems design empowers people to direct their progress and create a truly participative democracy [16].The decisions taken at the civil servants level have to be in line with the policies of the political parties in power which impact local public e-services systems of the city being managed by the local government.

ICT is key factor that has proven to bring about phenomenal changes in the fundamental nature of community. Today's technology is a universal phenomenon that serves the humanity without being biased to communities, it is for everyone without discrimination and is available who have the ability to acquire and retain skills, knowledge and creativity [10].The result is generally applicable to considerable extent, all weather and sure. Thanks to modern technology. ICT tools are such management tools which have organized the communities into network societies. The phrase "ICT for smart cities" is appropriately applicable for city executive offices, agencies and managers, ICT connectivity can be a prime source of urban economic growth and social cohesion [23]. The technology has helped create new opportunities by producing smarter services in virtually entire trading and industrial business models as well as improving our social and cultural conditions. The ICT provides endless possibilities from communicating with friends to collaborating with business associates thus helping in attaining quality of life.

Increasing access to technology, developing useful Internet content and software solutions and providing training are aptly indispensible, so that people can learn how to use the ICTs as this would open doors to unlimited opportunities to prosperity. The result of the research indicates through interactive ways the individual plays significant role by dynamics of C-C, G-G and C-G interaction portals.

The citizens in smart city are mostly active participants to its sustained development. Sustenance is the life blood of a smarter city. Enhanced C-C, G-G and C-G engagement and participation can be attained by which the interactive ways found the concepts of social system design that consequently evolve development of citizen-centric e-services. However, though all citizens may not be willing to participate, as such it is difficult to have the ideas of social system design realized, but by and large the interactive modes of engagement can achieve positive results by way of citizen empowerment. The surveys conducted have been highly supportive as a research process. The opinions, suggestions, comments on the delivered questionnaires evinced from the participants of varied backgrounds have indeed been very helpful in designing our model. Majority was unanimous in citizen-centric e-services and opined that citizens are real "owners of Government". They also favored the design of centralized system by social network. As is argued under section 2.1, the direct democracy suggests citizens' involvement in the decisions of the state by deliberative models of collaboration. The theorists who favor direct democracy opine that the people may assume a role whereby thrust their decisions upon the government in improving e-services and always keep holding government accountable, as their duty.

7.1   Further Research

The subject of smarter city is yet an emerging field of study, needs more and more up-to-date studies with a view to further scaling up the services. However, the work performed in this study has provided a guideline model for designing smart city system, which allows both citizen and government to play their role in the development of the city actively/passively. The valuable guidelines for designing smart city provided by the respondents of the surveys are feasible and practical those support the study objectives while amply translate into patterns of idealized smart city. Significantly though, the surveys perceived both modes of interaction that is direct and indirect in critical decision-making for services. There are number of problems that must be solved to allow true development of such designing model. These problems suggest a variety of research directions that need to be pursued to make such a model feasible. One such direction would be to do empirically investigation and further development of the model, while another would be imperative to create a designing culture that can motivate and as well as educate the citizen in the design and development of local public e-services and increase citizens' willingness to be involved in the desired development of a design culture.

Finally, in terms of application the proposed model can be applied with help of research results which we can be obtained by using future research directions as mentioned above.

8 APPENDIX A: ABBREVIATIONS

SC	*Smarter City*
ICTs	*Information and Communication Technologies*
ICT	*Information and Communication Technology*
IoT	*Internet of Things*
C-C	*Citizen to Citizen Interaction*
G-G	*Government to Government Interaction*
C-G	*Interaction between Citizen and Government*
CDNP	*City Development Network Portal Architecture*
UK	*United Kingdom*
NIST	*National Institute of Standards and Technology*
IT	*Information Technology*
SaaS	*Software as a Service*
PaaS	*Platform as a Service*
IaaS	*Infrastructure as a Service*
E-Services	*Electronic Services*
E- Government	*Electronic Government*
IS	*Information System*
R&D	*Research and development*

9   APPENDIX B: SURVEY 1 QUESTIONNAIRE AND RESPONSES

Survey 1: Government and Citizen Engagement

Survey focus: "Proposing more effective and efficient ways for citizens and government to collaborate, coordinate, and communicate via social media and other ICT-means in order to make the city smarter." The idea is not be concerned about what currently exists, rather try to design such ways which would replace the existing ways of interaction system. Remember the idea is to create something entirely new, not add or subtract to what currently exists. In fact, a good way to begin is to imagine that the current system was completely destroyed and your job is to replace it with anything you would like right now. However, there are three limitations i.e. i) the proposed ways are technological feasible ii) they are operationally viable and iii) there is learning and adaptation quality There are 10 mandatory questions to be answered in this survey, however, survey focus question would be followed by first nine questions. There will be two rounds of surveys; the second survey would be based on the summary of survey-1 focus question and one open-ended question.
* Required

Q 1: Gender of Respondents
Responses

Gender	No.	Percentage
Male	20	80
Female	5	20
Total	**25**	**100**

Q 2: Age of Respondents

Responses

Age	No.	Percentage
Less than 18	--	--
18 – 29	8	32
30 – 39	11	44
40 – 49	4	16
More than 50	2	8
Total	**25**	100

Q3: Do you have any link with the government sector?

Responses Table

Government sector	No.	Percentage
Yes	8	32
No	17	68
Total	**25**	**100**

Q4: Country of Residence?

Responses Table

Country	No.	Percentage
Pakistan	16	64
France	1	4
Kuwait	2	8
UK	6	24
Total	**25**	**100**

Q5: Which of the followings represents your education/professional background? (Select more than one option if required)

Responses Table

Professional Background	No.	Percentage
IT/IS	13	48
Business/Economics	2	7
Social Sciences	5	19
Other	7	26
Total	**27**	**100**

Q6: How important is the existing "One-way interaction level"?

Responses Table

Response	No.	Percentage
Not very important	0	0
Moderately important	2	8
Important	10	40
Very important	9	36
Extremely important	4	16
Total	**25**	**100**

Q7: How important is the existing "Two-way interaction level Interaction"?

Responses Table

Response	No.	Percentage
Not very important	0	0
Moderately important	2	8
Important	0	0
Very important	8	32
Extremely important	15	64
Total	**25**	**100**

Q8: How important is the existing "Cooperation level Interaction"?
Responses Table

Response	No.	Percentage
Not very important	0	0
Moderately important	0	0
Important	5	20
Very important	8	32
Extremely important	12	48
Total	**25**	**100**

Q9: Select one or more from the following, which you think are critical for brining change in the existing system?

Responses Table

Interactive Modes	No.	Percentage
Government Centric E-services	8	40
Citizen-Centric E-Services	12	60
Total	**20**	**100**
G-G collaboration	6	24
G-C Collaboration	23	92
C-C Collaboration	12	48
Total	**53**	**100**

Q10: Now, imagine you are given a task to design a system, where citizens and government are using effective and efficient ways to collaborate, coordinate, and communicate via social media and other ICT-means. What best ways would you suggest for engaging citizens and government?

Answer 1:- i. Forums for knowledge about procedures, especially legal
        ii. Collaboration on experience based blogs

Answer 2:- I would design a system where a citizen can go online and communicate with each other on important government issues. Can utilize the means of online payment to pay the utility bills, pay fines (traffic and others).Government can inform the citizen about what is going on, any policy updates, etc.

Answer 3:- A design should be created with collaboration at governmental administrative level to citizen so it would be better to communicate on social media network.

Answer 4:- I will prefer that complete website system is allocated in which issues , problems etc are mentioned and responsible persons of these departments monitor and reply questions, comments and different options of interaction. Means a complete online application is best way for this.

Answer 5:- A website where government lays out information and advice for citizens. The system would include any application to be filed from the citizen side while he and government would process the application be it for anything like visas, passports, advice, government-related services, and the citizen would be able to view the status of completed application which could be downloaded. All this would save the government having to actually build a physical office and employ other people to work on it. On the other hand it would be easier for citizens to avail services by the touch of a button at home in their free time without having to take a day off from work.

Answer 6:- Blogging and interaction via mobile phone.

Answer 7:- Through an interactive web portal, more like social networking website.

Answer 8:- Social Media pages for every Govt. department
        - Regular updates to social media pages
        - Live Support Representatives
        - Self-learning articles

Answer 9:- Publication of financial budgets in detail and should be open for comments for masses. Governments must consider comments of masses before finalization of budgets.

Answer 10:- Governments must publish financial budgets online prior to the implementation and budgets must be open for the public comments and Governments must consider these comments before finalizing the budgets.

Answer 11:- Good feedback to citizens participating. Incentivisation to citizens to use such a system e.g. prizes, discounts, on goods/services etc. cost reductions to government without compromising of services.

Answer 12:- Use of social media by government to give information to citizens.

Answer 13:- There should be a system where the government should open their own internet website. Where the people can give their opinion and tell their ideas of how they make the country better .They should be able to complain about the problem and openly tell the government how they feel about the laws and administration of the society.

Answer 14:- There could be many ways, what I would suggest is the use of tools which most people have today in their hands like mobile, computer, television etc from one-way to collaborative participation.

Answer 15:- Town level political-free social society meetings with high officials

Answer 16:- Educational institutes must be a public-private partnership.

Answer 17:- An internal country's network

Answer 18:- The government (I am taking local government like Municipal Corporations as an example) should establish a social media portal where customers have access to all kind**s** of services including paying bills like water bill, local taxes, all kind of forms, complaints for uncleanliness in the area etc. In addition to that the portal must provide a forum for users to discuss various issues related with corporation functions they can comment on various services, they can discuss various government related problems in their area and they can discuss solutions. These discussions should be read by the government officers to address the concerns of people and to pick suggestions for improvement. This would reduce corporation workload as many users will get good advice from other users. Further all kind of city maps, city cleanliness schedule, all kind of services should be there with an opportunity to talk to the officers and other users online. You should also have citizen profile on the this portal with your interests like interested in developing football in the city so that other interested people can form online groups and offer voluntary help to the local government in implementing sports related plans. There should be rating of different government services so that all users and the government officials can see where they are performing well and where they are weak.

Answer 19:- Private -public partnership, representatives from citizens in decision making

Answer 20:- By using the internet with the help of the interactive schemes launched by different Companies recently. Helpful websites can be used and its hyperlinks must be provided in different sites which have a high number of visits and is occasionally used by many of the citizens. For Government Informative situations should be put in front of them by the use of articles and facts about the countries problems and other issues. These must be made in accordance with some professionals and some authorized person of the Government must also be included for this task so as to successfully interact with the High Government Officials who can then later take the task at hand and try to solve it according to the general public suggestion.

Answer 21:- Video Conferencing, online lectures, using skype and supplementary material to understand the objectives and goal to design a system.

Answer 22:- Schooling and university education should include courses like citizen participation in every field of education and it should not be limited to social sciences subjects. Further, using mass media platforms and encouraging people with competitions and rewards.

Answer 23:- Not through social media and ICT means. Meaningful, embodied, face-to-face interactions between people are key.

Answer 24:- Economical revolution, decrease in poverty, National Interest, Social activity must be integrated in a unity.

Q11: Kindly write down you email address, so that, a summary of the above question (Q10) is sent to you directly.
Answer:- (As per University required email addresses of the participants can be provided)

Q12: Any other comments?

Answer:- There should be other means of social interaction such as forum, where other citizens can discuss their issues and information provided by government on bulletins, social media such as facebook etc.

Answer. I feel the above questions are not very clear for example, q.8 , how important is the current interaction level , we dont know whether it already exist online or not . I suppose it does not exist in Pakistani government departs, so the question that "how important is this current level " may be irrelevant because there is no current level.
Secondly as a respondent of the survey, the some description are not clear to me for example .8 "Cooperation level Interaction: An electronic system of service provision via Internet, available 24 hours" I think you need to highlight it with an example.
If people dont get very clear idea about the questions, they will tend to click on option 3 (the middle one).
You may also consider making this case more specific to one level of government. For me the importance of two way interaction at Federal government level is not very important , for example at the level of ministry of finance or ministry of Defence. However i feel it is more important at local government level or provincial government level (like in case of police department), you may consider to narrow it down to have more targeted responses.
Finally I wish you very good luck for your study and developing a new idea of online governance :) , please feel free to contact me for any later part of this survey Ahmad Qammar

Answer:-According to my experience and professional learning, the top most important point of the subject survey is how government and citizen can communicate, understand and deliver according to the set goals and objects of any task. It also depends upon the attitude of both sides as how much both sides are sincere, trust worthy and loyal with their mission. All efforts done by Government or Citizen will prove to be fruitless if both of these partners ignore the above mentioned attributes.

Answer:-Q9 answer is none ideally - I don't think electronic media are any kind of 'silver bullet'

10 APPENDIX C: SURVEY 2 QUESTIONNAIRE AND RESPONSES

Survey 2: Government and Citizen Engagement

Survey 2 Focus: "Realization of the best-ways identified together by all participants for citizens and government to collaborate, coordinate, and communicate via social media and other ICT-means in order to make the city smarter." In short, the idea is to implement the survey-1 solution, which is already shared with you through email. Kindly help us to fill all six questions of the survey, including one open-ended question.
* Required

Q1: How important is the role of government in the realization of the project?

Answer Responses

Response	No.	Percentage
Not very important	--	--
Moderately important	7	28
Important	--	--
Very important	7	28
Extremely important	11	44
Total	**25**	**100**

Q2: How important is the role of citizen in the realization of the project?

Answer Responses

Response	No.	Percentage
Not very important	5	20
Moderately important	5	20
Important	0	0
Very important	0	0
Extremely important	15	60
Total	**25**	**100**

Q3: Which of the following resources/factors are important for the project?
Select one or more options:-

Answer Responses

Resources/Factors	No.	Percentage
Finance	11	22
ICT infrastructure	18	35
Skilled Manpower	13	25
Energy	3	6
Management Support	6	12
Total	**51**	**100**

Q4: When/How the progress of the project should be monitored?
Select one or more options:-

Answer Responses

Response	No.	Percentage
Progress should only be visible to government personnel	--	--
Progress should be shared with all registered citizen along with government	23	74
On daily basis	3	10
On weekly basis	2	6
On monthly basis	3	10
Total	**31**	**100**

Q5: How project can be saved from failure?
Select one or more options:-

Answer Responses

Response	No.	Percentage
Through alternative sub-plans	5	15
Monitoring timely availability of resources	9	26
Transparency of processes,	18	53
Government control	2	6
Total	**34**	**100**

Q6: What plan / action would you suggest to design & implement this idea?

Answer1:-   1. Planning for entire project
         2. divide them into different modules
         3. make the timeline for them
         4. skilled persons should use for completing these modules

Answer 2:- The project should be well planned and the risks should have been noted in advance. Ant there should be plans for risk mitigation.

Answer 3:- project should be in compliance with UN rules for E-govt project. Sites should be interactive on which exchange of information between the govt and citizen is possible. Implementing sites just for the sake of collecting information is not enough. Use of digital stamps for approval of forms and procedures. Finally, project should not be limited to one ministry of function, inter departmental and ministry communication procedures should be entertained if needed.

Answer 4:- Through public private coordination with equal level of responsibility can be implemented.

Answer 5:- Have teams dedicated to coordinating flow of information between citizens and government organizations.

Answer 6:- 1. Implementation of ICT is the foremost imperative first to remove the digital divide and again to improve upon the performance of governance in terms of keeping the citizens satisfied.
2. Internet connection has to be made affordable for low income groups to provide them basic amenities like health, education and income opportunities by inculcating skills online.

Answer 7:- The whole community needs to have affordable internet access is of paramount importance to encourage private sector offering the citizens with participation in political process.

Answer 8:- Services should be more citizen-centric rather than government focused. Every one can access Internet.

Answer 9:- The plan may however, be so devised to achieve excellence in e-governance enabling to develop the relationship with each community member to realize the idea to make the city smarter.

Answer 10:- what is essential are e-government services to reach citizens by integrating them in political processes.
Internet connection must be accessed by citizens.
Proper planning must be devised by the government and should be implemented intelligibly to achievement concrete results.

Answer 11:- it is of utmost importance to motivate and engage citizens in the planning and designing of Smart city which envisages e-participation, e-government, e-services when all community citizens will participate in the design of e-democracy.

Answer 12:- i) Technology must be at the door step of people.
ii) It is for certain that in case the citizens are engaged in development process, promising results are realized.

Answer 13:- i think The citizen should play an imperative role .. The citizens remains to be nucleus within the social system and as such his involvement in the decision making process of government cannot be undermined. The citizens actually want themselves to engage in municipality issues and need to be encouraged to participate in development processes of the government in planning and development of projects.

Answer 14:- The quality, efficiency and effectiveness of the use of ICT are factors that impact e-government services to the citizen.

Answer 15:- Education is key to transforming social systems.

Answer 16:- Personal computers, telephones, emails and other internet accesses stimulate productivity improved planning and decision making which eventually improve administrative procedures, directed towards citizen's benefit.

Answer 17:- Smart phones or other ICTs do not make you smart unless you are already smart user of technology. The logic is that one has to be properly educated into learning how to use it and learning into how to bridge the deficit of smartness which could only be measured by scale of dedication to the user.

Answer 18:- The use of ICTs do not make on their own a community smarter, but unless a city has the necessary potential for its sustainable economic growth, it would hardly possess the criteria to entitle itself for being smarter.

Answer 19:- Using resources appropriately

Answer 20:- Cannot think of any action plan

Answer 21:- In all projects of social development Government and Public should be equally involved with sense of ownership and responsibility. All developments of these projects should be available for public comments at regular intervals so that the execution of the project may be examined by public.

Answer 22:- Citizens of all groups should participate in planning and designing of future e-society.
Citizens must be given training to use technology.
technology should also be accessible and affordable to every one.

Answer 23:- Proper planning and management approach is needed for sustainable growth of a smart city. It should also be energy effective and environment should be agreeable to human living as it is imperative for workable peaceful environment. All citizens should also strive for and work together for better facilities and to get knowledge and skills to turn

problems into opportunities. But to achieve all this sustained economy is imperative so that all citizens should have access to the Government functionaries to get improved services. Development of city is based in economic reasons.

Answer 24:- Work breakdown structure, Team management, Time Factor, Dead line, small mile stone.
These need to be done for successful project.

Answer 25:- Educate citizens about the project.

Q7: Any Other Comments?

Answer1:- We need a skillful workforce in order to make the city smarter and people must be trained enough to use the technology.

Answer2:- Development of a community depends on Economic growth, They will go side by side.

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