Role of ICT in Developing Lahore as Smart Tourism Destination

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August 2020

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CERTIFICATE

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Date of Examination: April 22, 2020

Dedication

To my Parents

Acknowledgment

This research has been possible with the support of my supervisor Dr. Zulfiqar Ali, Head, Department of Development Studies, who always encouraged me to look at new perspectives independently. This led me to organize and reorganize my thoughts a million times.

The motivation of selecting my topic of research was not only due to my love for Lahore but because of the advances in ICT that were being brought by Khadim-e-Aala Punjab, Mian Muhammad Shahbaz Sharif, at the time, when I started my research. His fullest support to Dr. Umar Saif, VC ITU and Chairman PITB helped Lahore to become the first Smart City of South Asia. Therefore, I found it the best time, where Lahore is now able to use its ICT based infrastructure to increase Tourism in Lahore. Besides that, I am thankful to all my crazy respondents, who are giving their time for Lahore.

I am thankful to the Prime Minister of my heart Mian Muhammad Nawaz Sharif for the laptop that I got in the Phase-V of PM laptop scheme. Without this laptop, I could not be able to do my research. This laptop and its right hand – my mouse, proved super-friends of mine, the most empathetic machines on earth.

I am thankful to my hostel room #6, who[sic] provided me a chance to enjoy a lot more tastes of hell, than that of Dante Alighieri's Divine Comedy. This put all the paradisaical creatures away from him and let me enjoy my core – the solitude.

Muhammad Akif Tufail

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List of Acronyms

ICT	Information and Communication Technology
IoT	Internet of Things
STD	Smart Tourism Destination
NADRA	National Database and Registration Authority
PITB	Punjab Information Technology Board
PSCA	Punjab Safe City Authority
RFID	Radio Frequency Identification Device
PAC	Personnel Access Control
VAC	Vehicle Access Control
IVS	Intelligent Video Surveillance
WASA	Water and Sanitation Authority
GPS	Global Positioning System
VR	Virtual Reality
AR	Augmented Reality

Abstract

As Pakistan stepped into the 21st century, ICT slowly and gradually seeped through every public and private sector. In these two decades, a lot of avenues adapt themselves to the emerging needs and demands of society. In this short span of time, how these interventions started changing the landscape of Lahore, needs to be described so that the possible opportunities for new disruptors in the tourism sector could comprehensively be stated. My research comprises of mainly three sections, describing the past, present and future of ICT, which holds its place for the tourism industry in Pakistan. In the past, firstly, it is described that how did ICT placed its first steps in Pakistan to how it grew up till now, and secondly, it is explained in detail that how it impacted all those sectors related to the tourism industry in the result of the ICT diffusion. The present part of my research covers the implication of ICT on 57 indicators of an STD in detail. The future section of my research has given details of the opportunities that are available for the tourism sector while considering the current infrastructure and resource set up of Lahore. To accomplish this goal, a descriptive research design was adopted for this study. For the past and future sections, desk research was conducted extensively, while for the present section, semi-structured interviews were conducted with all tourism stakeholders of Lahore.

Keywords: Smart City, Smart Tourism, Information and Communication Technology (ICT), Internet of Things (IoT), Smart Tourism Destination (STD)

Chapter 1

Introduction

Lahore is the second-largest city of Pakistan with a total population of 11.3 million (PBS, 2017). From the last three decades, it has seen massive infrastructural development in addressing the basic needs of the citizens. Being the capital of Punjab for centuries, it does not only have an enriched Mughal heritage but also contains the cultural, academic and intellectual showcase. The glorious Mughal Era (1524-1752), was an era of art, culture and architecture that made Lahore the thriving cultural center of the great Mughal Empire in 1525 A.D. and was beautified with gardens, palaces, monuments and mosques. In the British regime, many monuments were destroyed, and some others were constructed in Lahore which blended the Mughal, Gothic and the Victorian styles of architecture (TDCP, 2019).

With the wave of terrorism entering Pakistan after 2001, tourism took a deep plunge and there was a sharp decline in the number of tourists visiting Pakistan (Samina, 2007). This decreased tourism demand throughout the country. Lahore was also severely affected by that wave of terrorism in the context of tourism. As the security situation in Pakistan has improved in the past few years, tourism in Pakistan is on the rise. According to Kay (2019), there is a 300 percent increase in the number of tourists visiting Pakistan since 2013. In 2016 alone, 1.75 million tourists visited Pakistan. But despite all these good indicators, tourism in Lahore is not enough to justify its rich cultural and historical background which is the core basis of its pride. The total number of foreign tourists visiting Lahore in 2015 is 2350, which is embarrassing low. By doing a lot of effort, Walled City of Lahore Authority (WCLA) has increased the number of tourists both local and foreign up to 51,647 (Dawn, 2016).

The tourism industry has always been at the forefront of using technology. Buhalis and Amaranggana (2013) describe that Smart Tourism Destinations (STD) take advantage of technology embedded environments, responsive processes, end-user devices and engaged stakeholders. With the presence of these structural elements in a city, there are a lot of new economic opportunities that can be generated in almost all areas of life. Buhalis (2000) describes that there are six characteristics of a tourism destination: attraction,

accessibility, amenities, available packages, activities and ancillary services. If a destination is provided with these 6As, it could become a Tourism Destination. Furthermore, if these 6A's are deployed with the smart infrastructure, then it would become an STD.

Pakistan has seen a lot of development in Information and Technology since 2000 at the federal and provincial levels. The recent project of Lahore Safe City has also applied some ICT interventions in the social context of the city which has improved the safety and security issues in Lahore and helped in better management of traffic and emergency systems. These interventions had a direct and indirect impact on the tourism industry in Lahore.

1.1 Statement of the Problem

Every city in the world has unique features and a certain context around which it is developed. Even smart cities around the world, are built while considering those elements of indigeneity. With the change in the features of cities with time, and the context around which the cities are built in the past, the new needs of the cities start emerging, that are realized when the emerging demands try to meet their requirements around old constraints. Therefore, it becomes crucial to come up with the solutions that must keep up with the pace of a city. Lahore, being the capital of the Punjab province, has been the center of interventions to cast and test a model, to be applied in other major cities of Punjab. Therefore, several projects based on ICT has been applied in Lahore with the emergence of issues in the city. This development of infrastructure in Lahore helped the city in gaining the status of the smart city in the world (Bhutta, 2019). Through these interventions, traditional practices of tourism consumption in Lahore get acquainted with the new practices of the city. There is no doubt that tourism takes highs and lows with the changing political scenarios of the country and demand and supply with almost all its traditional 6A's of tourism destination are present in Lahore, but with the advent of technology in all walks of life, the major technological interventions in Pakistan, their resultant impacts, what traditional components of tourism destination are being replaced with the smart components, and with the present capability of results of those

interventions, what tools and systems could be developed that could help in developing smartness for tourists in Lahore, need to be identified.

Based on the preceding text, the research problem has been operationalized by formulating research questions and objectives, as given below.

1. 2 Questions

This research has addressed three fundamental research questions:

1. Which major technological interventions and resultant transitions helped Lahore in becoming a smart city?
2. How the resultant smartness has been contributing to developing Lahore as an STD?
3. What smart tools can transform Lahore into an STD?

1.3 Objectives

1. *To describe the major technological interventions that took place and identifying key transitions that led Lahore to develop smartness*

The first objective gives a detailed description of the global and local trends that created the need to introduce some major IT interventions at federal, provincial and city level, which took Lahore to the road of becoming a smart city and to identify the resultant transitions that took place due to these IT interventions at all levels in Pakistan, in various areas of civic life, like health, education, economic activity, law and order, governance, and eventually led Lahore to develop smartness.

2. *To find out contributions of ICT infrastructure in developing Lahore as an STD*

The second objective will find out the components of STD that developed in Lahore with the introduction of these transitions and identifying the areas in which the government and private stakeholders have grown their capacity and can make further ICT interventions to work out on the remaining components, considering Lahore as an STD.

3. *To identify the tools and systems that are needed to develop Lahore into an STD*

The third and last objective will identify the smart tools and systems that would help in developing smart tourism in Lahore. It will detail the tools and the systems, and their capacity in taking the destination forward towards smartness.

1.4 Key Terms

To make it convenient and understandable for the reader, the key terms used in it are defined as follows:

1.4.1 Smart City

The term ‘smart city’ is not a concept for a city, that is considered to have the same meaning and characteristics everywhere and every time. Nam (2012) examines the connotation of the term ‘smart’ in the context of a smart city. According to him, ‘Smart’ is a more legible word that attends better than other words like the term intelligent, which can be considered to have a sense of being quick and responsive. This proposes to us that ‘smart’ is way more than ‘intelligent’, and smartness of a system is its capacity to adapt itself according to the needs of the users. Therefore, a smart city according to Giffinger et al. (2007) is an efficient and forward-looking in all the areas of human life like the city economics, its residents, governing infrastructure, commuting mechanisms, environmental sustainability, and modern living standards, that are built with the smart amalgamation of endowments and self-analyzed activities that are performed by well-aware citizens. I will use the definition of Harrison (2010), according to whom, “the smart city is a one connecting the physical infrastructure, the IT infrastructure, the social infrastructure, and the business infrastructure to leverage the collective intelligence of the city.”

1.4.2 Tourism Destination components

Buhalis (2000) structures tourism destinations consisting of 6As of tourism destinations that include attractions, accessibility, amenities, ancillary services, activities and available packages. Each of these 6 As of tourism destination can be further divided into various components, like Attractions such as mountain, amusement parks, music festivals; Accessibility that refers to the whole transportation system of the destination that is used in commuting; Amenities which include those services in the city that facilitate convenient stays, for example, accommodation, gastronomy and leisure

activities; Availability or mostly called Available Packages, referring to the available packages for the tourists in the respective destination, offered directly by intermediaries to the tourists, to catch their attention to specific exclusive features of a destination; Activities that include activities going on in the city at certain time in the destination that may motivate the tourist for the visit; and Ancillary Services that mean the daily use services, that are not primarily aimed for tourists, but are included as a basic necessity for the tourists such as banks, postal services and hospitals, etc. These sub-categories of 6As are the ones, I am calling as tourism components. In the case of STD components, see table 4.1.

1.4.3 Smartness

There are many concerns about these contentious development terms like smartness, which raises the problem related to equity, that whose purpose this smartness is serving etc. Hollands (2008) maintains that the issue of smart cities is that they try to take different aspects that could not always sit together, while ignoring other issues, therefore smartness is considered as a label that could help in the branding of a new development paradigm. But I will use the term 'Smartness' as referring to the smart and effective use and management and smart city resources, along with the care of social inclusion of isolated groups. (Bauman, 2013).

1.4.4 Transitions

Cities around the world, keep on evolving with the changing socio-economic phases through which they pass. Similarly, smart cities also evolve with the development of new technologies and innovations, more dynamically than ever. These swift changes to tackle old problems and new emerging issues of cities with various ICT interventions are changing the faces of the cities (Bibri, 2018). I used the transition concept from this research, where I mean the transitions take place in the cities with the advent of ICT.

1.4.5 Interventions

The word intervention is defined as the actions that are intentionally taken to change the prevailing situations to improve or prevent it from worsening. According to

Merriam-Webster, it is the act of interfering with the outcome or course, especially of a condition or process. But I will use the simplest definition of the Oxford Dictionary as ‘the action taken to improve or help a situation.’

Chapter 2

Review of Literature

This chapter discusses the literature reviewed. A conceptual framework has been developed by using various concepts from the reviewed works.

The purpose of the literature review is to survey and present the studies and academic works and literature done for a selected area of study. The literature review provides an in-depth analysis of the prior works and aids in creating a foundation, an academic connection and a discussion for further research being done. A literature review can be of various types differing due to their modes of collecting and displaying the literature reviewed.

This literature review was done in the form of a theoretical review. The main motive of this type of literature review, was to study the corpus of theories that have been accumulated related to the issues, concepts, theories, or phenomena. This type of review helps in establishing that what theories have been presented in this domain up till now, the relationship between these theories and to what level the theories were examined, and finally developing a hypothesis to be tested and gaps to be filled. This type of approach is needed when there is no certain theory or way to explain the new emerging issues in society.

A theoretical literature review helped in this qualitative research because it encompasses the various relevant concepts, theories and works which aid in the understanding of the basic key concepts involved in the research, and builds a theoretical and conceptual background for the research. I have arranged my literature in three broader sections. The first section will present the comprehension of different technologies used in a city. In the second section, understanding the tourism destination will be taken. In the third section and last section, the development of a smart city to STD will be described.

2.1 Technology and Its Usage

In the first section, the understanding of technologies will be elaborated. It will also explain the usage of these technologies and the difference in the purpose of using IoT and ICT in cities.

2.1.1 ICT

Information and communications technology (ICT) is a big umbrella term for communication technologies. In general, there is no universal agreed upon definition of ICT, but it normally includes all those devices, networking components, applications and systems that help in the communication with digital world. Often, it is being interchangeably used with IT. Though ICT is more inclusive and includes more entities related to the digital world technology. Components include data, Internet access, cloud computing, software, hardware, transactions, and communications technology. But more importantly, ICT encompasses combinations and applications of those components. It has revolutionized the thinking of the people and work places, their ways of communication with each other, their learning and living styles, and is continuously doing so in every part of human life, from mere desktop computers to the autonomous vehicles. ICT contributes greatly to our economic development. Some have labeled it the fourth industrial revolution. Within the ICT market, the usability of ICT among all the sectors has increased the capability of developing and delivering various technological products in cheaper prices to the market alongside providing market opportunities for businesses. Advances within ICT have brought a slew of cost savings opportunities and conveniences, ranging from highly automated cost cutting business processes, to the big data revolution that leads new insights products and services, to ICT driven transactions like online shopping, telemedicine and social media. However, ICT is not without its downsides. The digitization of data has led to new levels of crime, automation tools and robots that can displace workers, and many believe ICT has stifled human interaction (Panel, 2002).

With the growth of cities, various challenges start emerging with time. This includes increase in population, disasters, and other social issues, which creates hindrance in the functioning of a city. These issues can be decreased or minimized by using various applications related to the use of ICT while doing the practices of urban planning. These technological practices can be performed to produce urban design systems innovatively and sustainably. In this way, urban planning and decision making could communicate all

the information of the activities going on in the city with various sensors installed in the city.

ICT provides us a platform to digitally create the information systems through spread out networks. These systems provide the data to be analyzed and thus increases the insights about the city that could help in optimization of resources in the city (Patil, 2017).

2.1.2 IoT

In the era of globalization, IoT is getting rapid importance (Atzori, 2010). The term IoT was first used in 1999 by K. Ashton while working in MIT's AutoID Lab. IoT was defined as a network of things that connect anything at any time and any place to identify, locate, manage or monitor (Li, 2012). This system was able to produce real-time feedback interaction between objects which are connected to the network and help in reducing the distance between the real and digital worlds (Erb, 2011). The late advancement in mobile computing does support several apps like RFIDs and NFCs which are contributing towards the betterment of IoT (Borrego-Jaraba, 2011). IoT creates a certain platform that could transmit different ranges and different types of data, through a participatory sensing system (Gutiérrez, 2013). For example, in this industry, a tourist uses his/her cell phone to find out different aspects of their destined places and events he is interested in, with the collected data and its reports. Their activity creates a large size of traces that are gathered and managed in a multidimensional set of data called Big Data. Using Big Data, tourism institution uses a lot of information to infer new ways of assisting tourists and giving them a better experience, and it will also help in the better interaction with the customers (Pakistan Software Export Board (PSEB), 2019). This mastering of system helps in improving the competitiveness of a tourist place.

The number of things on earth, connected with each other through internet have exceeded the population of planet earth. It is estimated to increase up to 50 billion in the year 2020, which will extremely flourish the digital landscape of the earth (CISCO, 2019). IoT also helps in various sectors like health, education, vehicle industry, quick response to the accidents and natural disasters, that requires humans to intervene in vulnerable ways (Ahmad, 2016).

IoT sensors and actuators have the capability of translating different types of signals in to a unified system response. Therefore, IoT enhances the conventional quality of a thing by adding a ubiquitous and pervasive computing element in it. It is considered that soon the internet will move beyond just the network of connected computers (Shu, 2011).

2.1.3 Big Data

Big data refers to huge amount of data that is amorphous in nature. In a world full of sensors and actuators, this data is constantly being produced though our cell phones, laptops, and even humans. Due to the increase in economic activity, the amount of data has been increased . Online shopping websites collect their customers' data to predict their shopping behaviors and customize the availability of their products. Social networking sites similarly collect large amount of data that helps in generating analytics of users, which help in better niche marketing (Patil, 2017). Increase in social media images and videos has also increased the volume of data being shared online. In cities this big data could help in generating citizens' activities to generate analytics to increase the demand of sustainable infrastructure and improved governance, thus improving the quality of urban planning. This could also help us in generating better management system to mark an impact on the life of citizens. This is usually done by connecting the city with ICT or IoT infrastructure, which help in generating this valuable big data. To manage this data, cities establish their data centres that could gather data from various locations and feed them to the central station through integrated management systems (Patil, 2017).

2.1.4 ICT and Big Data

The installation of ICT infrastructure in cities can also help the cities to generate data through wired and wireless connections. Normally devices are not always smart but certain mobile and web applications produce huge amount of data from user devices. These devices could also be used through ICT in homes where the data is collected through user appliances and is fed to the residents for real-time analytics. The same data could also be fed to the manufacturing companies to give analytics for better performance devices and the issues that arises often at various times in the days and months of the year (Ahmad, 2015).

There is no doubt that currently, the data collection and processing facilities are very costly. But with the advent of new algorithms and application platforms this cost is reducing with time. This shows that the future of big data collection with its new techniques and procedures is going to revolutionize the whole policy making process (Rathore, 2015).

2.2 Understanding Tourism Destinations

This section will identify the characteristics of a touristic city and how a touristic city with its resources, develops the potential of a tourism destination.

2.2.1 Urban Tourism

Tourism is seen as a type of leisure activity that we can do in our leisure time (Holloway, 1994) and it includes the travelling of the masses out of their home destination to some outside areas to spend some quality time with family and friends (Witt, 1991), and spending some money there, that helps the destination's economy to grow.

When tourists leave their places to move towards urban destinations to find out the places for joy and pleasure, the cities become objects of urban tourism (Urry, 1990). In the 90's when the urbanization started, the cities start getting importance, and with this jump in competition with each other in terms of their unique characteristics to be recognized among the world. This started an era of urban tourism around the globe.

The dynamic life in the cities and the activities that take place, make the identity of the city. Therefore, tourism growing in the city also corresponds to those functioning elements related to that particular activities in the cities. When those activities change with time, so the culture of the city. This is why, that culture form the basis of urban tourism in the city (Howie, 2003). This is how tourism is marketed around the world by putting forth its tangible and intangible cultural dimensions.

2.2.2 Types of Touristic Cities

There are different types of activities like business, shopping, sports matches, cultural shows, and others going on in the cities. This generates various forms of diverse tourism in the cities. On the other hands, it tends difficult to understand that what

dimension of the city must be considered to put a label to market that city and which not (Gheorghilaş, 2004).

In the recent decades, tourism has emerged in both developing and developed world alike, and there are a lot of avenues to be capitalized by putting forth the cultural and heritage element before the tourists around the world in some convincing way (Ashworth, 1990). The tourism of the 50's and 70's has also changed in to niche type consumption plan, where tourists not just come to enjoy their leisure time but for special type of offers that would be available at their visited destination.

Figure 2.1: Multivalent/ Polyvalent/ Overlapping Touristic City (Source: (Bădiţă, 2013); Redesigned by Author[1])

In the era of economic depression, it was under discussion that the mono-functionality of a tourist city must be considered seriously. The reason being the cost of living and other consumption is so high that tourists do not want to stay or eat there. They just come to avail certain leisure, and to spend their money they go to the nearby

[1] This framework is taken from the *Approaches to the analysis and evaluation of urban tourism system within urban destinations by Bădiţă, (2013)*. It contained the element 'The functional links between the demand and supply in a touristic city', which was beyond the scope of this research. Therefore, framework was redesigned by Author.

communities, therefore putting themselves in the list of false tourists. This was becoming a serious threat to the urban tourism.

In the result of globalization, the whole world has also commoditized various standardized products, services and resources that are used throughout the world (Boniface, 1995; Pearce, 2001; Urry, 1990) since it is easy to apply those projects in your cities that are already tested somewhere else successfully. Van (1995) argues by contradicting that the imitating products result in the decrease in the image of any tourism destinations, because tourists strive for originality and come far away to these places, just to observe and involve in those aspects. Similarly, different forms of art can become the symbol of a destination (Turnbridge, 1990).

The tourist destination that is urban center or some city, could also have multifunctional characteristics. The cities could be termed as *Multivalent or Polyvalent Touristic City* (Figure 2.1). Bădiţă (2013) argues that these cities could have complex typologies of tourists because these cities employs a lot of different resources that are demanded by the visitors. These cities are also called *Overlapping Cities* because a lot of different characteristics of the city like, "historic city (with historical monuments, museums, art galleries, theatres and concert halls), the cultural city (with museums, theatres), the nightlife city (bars, clubs, cafes, restaurants), the shopping city (shops, cafes, restaurants) overlap each other (Burtenshaw, 1991).

2.2.3 Tourism Destinations

Tourism destinations can be defined in various ways. A tourism destination is considered to have every possible type of the amenity such as accommodations, restaurants and entertainment places (Bieger, 2005). But a tourism destination can be defined beyond any geography and it can depend upon the motivation of a tourist (Luft, 2007).

Buhalis (2000) describes a tourism destination as a mixture of accessories related to tourism and the services that are provided at the spots. This according to him provide a unique customer experience to the visitor. Buhalis (2000) also states that a tourism destination to be become a success must contain 6As in it.:

(1) Attractions which can be natural such as mountains; artificial such as amusement parks; or cultural such as music festival.

(2) Accessibility refers to the entire transportation system within destination that comprises of available routes, existing terminals and adequate public transportations.

(3) Amenities characterize all services facilitating a convenient stay, namely accommodation, gastronomy and leisure activities.

(4) Available Packages refer to the availability of service bundles by intermediaries to direct tourists' attention to certain unique features of respective destination.

(5) Activities refer to all available activities at the destination which mainly trigger tourists to visit the destination, and

(6) Ancillary Services are those daily use services which are not primarily aimed for tourists such as bank, postal service and hospital.

Figure 2.2. 6As of Tourism Destination (Buhalis, 2000) (Source: Smart Tourism Lab)

Therefore, destination must accomplish these 6As in them to become a successful tourism destination. Though a new factor of ICT that has been added in this new era has

brough some new challenges and opportunities for the stakeholders. To create tourism destination, stakeholders must be connected in a way to develop a well sustainable and efficient destination that may not benefit each stakeholder through co-creation but also benefit visitors through better tourism experience (Neuhofer, 2013).

2.3 Technology at Destinations

In this part, we will discuss the impact of information technology on cities. It will be discussed in detail that how cities adopt smart solutions to increase their efficiency, and how these solutions help in developing STDs.

2.3.1 Smart City

By looking at the situation of cities in the modern world, cities need to be looked upon with a new thinking. Now, cities should be developed with a smart outlook. In 2008, the CEO of IBM in a speech described his conception of Smart Planet that needs to be planned. It was endorsed later by the then president of the USA, Barack Hussain Obama. In the same year, CEO of IBM in China also described the same concept and wished to plan and implement in China by looking at the need of the Chinese cities. In the year 2009, Chinese Premier Wen-Jiabao stated at the Institute of IoT in Wuxi, that we should now work on the technology of sensors and actuators because it is the biggest need of China in this era of technology (Su, 2011). This will help in make the lives of the people more dynamic and productive and help in making an economy work with intelligence.

This concept of the smart planet was later reduced to smaller projects that were taken into consideration at the city level by the local governments at their capacity, and that is a smart city. These smart cities would become the part of a larger smarter planet that would be efficient and connected not only at the city level but at the global level where the information is mutually exchanged and this will help economies to mutually grow and work together for each others' benefit (Su, 2011). Smart Cities use ICT to improve the quality of life in a city, to produce efficiency in the mobility of a city through smart transport systems and smart economies and sustainable infrastructures (Ronay, 2013).

According to IBM, Smart City is a place that uses information technology to analyze the core information systems of the city and integrate all information to create a new knowledge system. With this, cities can produce better intelligent responses that help in generating new opportunities in society that are most demanded (Su, 2011). Interconnectedness means that the whole city is connected through wired and wireless connections to communicate with different elements of the city (Buhalis, 2000). A smart city normally consists of connectedness through the internet, with the smart buildings including smart homes and offices, the smart and intelligent transport systems and public transport facilities, the use of ICT in better social services, and a better surveillance system for urban management.

2.3.2 Smart Tourism

Most of the initiatives of smart tourism arise from smart city projects. Due to which the concept of smart cities around the world and concept of STD is increasingly getting importance. In Europe, the focus is given on creating innovating and competitive markets and in the development of smart end-user products which would help in improving tourist experience by formerly produced data in various ways (Boes, 2015; Lamsfus, 2015).

The truth is that the word smart has become quite loose concept that is normally used to achieve various socio-political agendas to increase the demand of new technology products. It is considered very serious, especially when it comes to smart tourism, because here it is seen that the talk about open data is normally done in the name of some benefits given to the public, for example to give a free Wi-Fi to the public places.

Alongside being related to a destination, smart tourism is also a sociological phenomenon that arise on meetup of ICT and tourist experiences (Hunter, 2015). The component of smart experience includes those experiences that are driven though technology in some way or the other. It can be enhanced by personalization, context awareness and real-time monitoring (Amarangana, 2015).

In smart tourism, a large amount of data is collected through intelligent systems which is then combined and analyzed to develop useful information that helps in making better inferences for innovation. The most important aspect of smart tourism is data

collection and its use. But then comes an issue of privacy that concerns the common citizens. Because private data is being collected from the citizens that are then processed to give them in the form of information. But this data can be used for some ill purposes, which is very crucial.

One important aspect is that the whole system of the tourism industry gets dependent on smart tourism systems. But along with the population that updates itself with the technology, there lies a large population that could not walk along with this class, which is then neglected, and this produces a digital divide within the citizens of the same city and country. Therefore, there is a lot of debate on the extreme dependence on technology and infostructures.

2.3.3 Smart Tourism Destination

To bring smart components in the tourism destinations, dynamic interconnected stakeholders are needed that are connected with some technology frameworks through which data related to the tourist activity can be exchanged at once. This integration of platforms has various touchpoints which can have access to different devices that would have some supporting framework to create and facilitate some real-time tourist experience. This also improves effective capability of managing the resources of tourism in all the tourist sites at all economic levels.

STDs take advantage of three things: (1) Technology embedded environments; (2) Responsive processes at micro and macro levels (3) End-user devices in multiple touch-points; and (4) Engaged stakeholders that use the platform dynamically as a neural system. Its major purpose is the utilization of the systems that could help in enhancing the tourist experiences at destinations. This would increase not only the competitive advantage of a tourist destination but also result in the customer satisfaction. Furthermore, this would also help in increasing the sustainable infrastructure over the next several years.

Public–Private Partnership (PPP) helps a lot when there is a plan to set up a STD at some places. The major benefit is the efficient systems that emerge in competitive environment. It also increases the creative environment because the experts from all sectors jump in to the field to help develop a tourism destination (Heeley, 2011). Private stakeholders not only take care of the innovation perspective but also implement their

project with better management of resources, skill set and better planning of risks that would arise in the future (Nisar, 2013). The better planning of the private investment could also bring Foreign Direct Investment (FDI) to the table. The good thing of these investors is that they tend to stay for decades, therefore these investments are stable and help in building sustainable infrastructure at the destinations. This method seems to have some difficulties but it is quite opposite to that because it is more beneficial in terms of cost of building those destinations (Reischl, 2013). Though one thing must be kept in time that to attract private investors can also bring some bad things in the process. Because if the private sector is given a chance to invest in those infrastructures that are directly linked to the customer's benefits then they could create a monopoly in their respective domains (Vanolo, 2013).

There is no doubt that STD are developed under some political influences, therefore it could benefit in some way but could also neglect few other factors of importance (Gretzel, 2011). They can build some of their parameters around which those destinations would be build and the indicators of the performance of those destination would be measured around those parameters. The worst thing is that those parameters would surely not be inclusive in any way, and other destinations that would be built while keeping the same parameters in mind, could be a complete disaster because the infrastructural elements could vary from destination to destination (Vanolo, 2013).

Destinations should also consider both the literate and the ill-literate of the population that might have differences in understanding the technology. The tourists are normally thought of as adapting to the culture and technological differences. They never feel hesitant about that, but destinations must consider their local population that resides in those places. Therefore, local population must be educated with the technologies being used in their destination through various engagement methods (Komninos, 2013).

2.4 Conceptual Framework

Lahore is taken as a Multivalent Touristic City and is divided into different dimensions, like Historic city, Cultural city, Shopping city, Entertainment city, Nightlife city (Fig 2.3 (a) and (b)). As a Tourist Destination, it must have all the six components of Tourism Destination (Fig 2.3 (c) and (d)). But among the 6As of tourism destination, it has some of the elements deployed in it while other elements are missing in it (Fig 2.3 (e) and (f)). The elements that are deployed in the city make it a Partial Tourism Destination (Fig 2.3 (g)). The ICT infrastructure employed in the form of major interventions (Fig 2.3 (h)), introduces Smart As and Smart Replacements (Fig 2.3 (i)), that makes it Partial STD (Fig 2.3 (j)). And the components that are missing in Lahore, as a tourism destination, can be smartly replaced with these 6 As (Fig 2.3 (k)). If both the missing and deployed elements are treated as described above, it can convert Lahore into an STD (Fig 2.3 (l)).

Figure 2.3: Conceptual Framework (Source: Author)

Figure 2.3 (a): Multivalent Touristic City (Slanted View)

Figure 2.3 (b): Multivalent Touristic City (Top View)

Figure 2.3 (c): A destination containing 6As of Tourism

Figure 2.3 (d): 6As of Tourism Destination

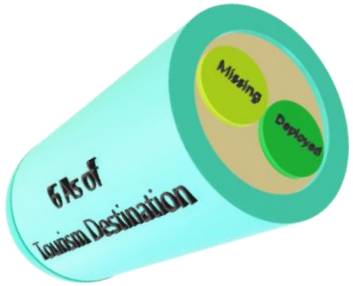


Figure 2.3 (e): Missing and Deployed elements in 6As of Tourism Destination (Slanted View)

Figure 2.3 (f): Missing and Deployed elements in 6As of Tourism Destination (Front View

Figure 2.3 (g): Partial Tourism Destination

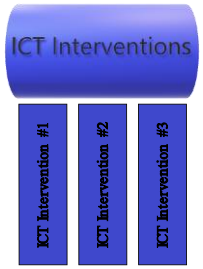


Figure 2.3 (h): ICT Interventions

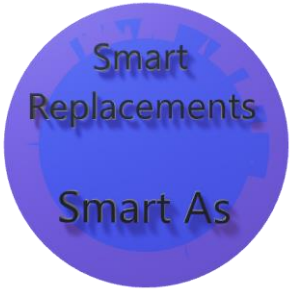


Figure 2.3 (i): Resultant Smart Replacements and Smart As

Figure 2.3 (j): Partial Smart Tourism Destination

Figure 2.3 (k): Deployment of 6As with Smartness in a Smart City

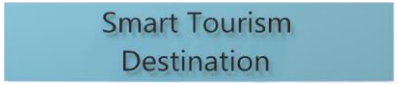


Figure 2.3 (l): Smart Tourism Destination

The chapter presented the literature review on the technological stuff that is required for smart cities and STDs. Later it was seen that how what makes the touristic cites act as tourism destinations. After that, a glance at the structure of STD was given, with the concluding stuff of how a smart city is converted into STD. From this literature review, a conceptual framework (Figure 2.3) was framed out. This framework will help in looking at Lahore from an angle of a touristic urban city, passing through various steps, and eventually converting itself into an STD.

Chapter 3

Research Methodology and Methods

The following chapter contains a research methodology and research design along with its justifications. Secondly, it describes the tools of data collection that were applied to collect data and the procedures that were used for them. It also describes the sampling techniques that were applied to collect the required data. Finally, it explained, how the collected data was analyzed, and the details of stages in which the framework was applied.

The research methodology is considered as a science of conducting research in some type of scientific logic. In this process, research problems are systematically solved (Kothari, 2004). Kothari (2004) further explains that when we talk about the research methodology, we do not only mean the research methods but also the logic of using that specific tools, which are necessary to conduct this study and why these tools or techniques are logical in this case than others, and how the tools being used are capable to produce the results that would be easy to be evaluated.

3.1 Research Design

Descriptive research design is a method that involves observing and describing the behavior of a subject without influencing it in any way. According to Earl Babbie (2013), many qualitative research studies aim at descriptive research design, because descriptive studies deal with questions like what, when and where. The research design used in the study is a descriptive research design because this research contains the description of the interventions that took place in Lahore and the transitions that help in making it easy to adopt those transitions and how it is helping and could help the tourists in Lahore.

3.2 Research Strategy

Sarantakos (1998) defined the research method as “the theory of methods”, or the way through which a researcher makes sense of the object of inquiry. Within research methodology, the research strategy assumes as the “general plan of how the researcher will go about answering the research questions” (Saunders et al., 2009). For this research, a qualitative research strategy is opted. The reason being the questions of inquiry which are based on experiences of my respondents through which they realized and implemented the ICT interventions; the changing scenarios they know and its impact on tourism.

3.3 Units of Data Collection

A unit is that segment of a certain phenomenon regarding which data has to be collected. These units can include individuals, households and organizations, etc. (Kerssemakers, 2012). The units of data collection for my research study were:

- UDC-1: TDCP officials, WCLA officials, PHA officials
- UDC-2: TDCP and WCLA tour guides, Private tour guides, Application developers
- UDC-3: Local and foreign tourists visiting Lahore
- UDC-4: Theoretical and Applied Research Work
- UDC-5: Websites, Newspaper & Magazines Articles and Blog Posts

My UDC-4 included the theoretical and applied research literature produced. Google Scholar was used to search out published articles. The UDC-4 was necessary to develop a framework of available and suitable technologies for Lahore. For this, purposive sampling was done. I searched out the relevant 10 papers on the technologies available in Lahore. Through those papers, necessary tools were sorted out, that could draw its relevance for Lahore. It is not necessary that this technique would list out precise tech apparatus for Lahore, but it could give a broad idea to all the stakeholders, that what can be done through the available systems.

UDC-5 includes the websites, newspapers, magazine articles and blog posts on the IT interventions and the resultant impacts of those interventions in Lahore. Convenient sampling was done in this regard. The major websites that were used for data analysis were of NADRA (www.nadra.gov.pk/), PITB (www.pitb.gov.pk), PSCA (www.psca.gop.pk) and Digital Rights Foundation (www.digitalrightsfoundation.pk). In the newspapers and magazines section, Pakistani Newspapers and magazine articles were searched online with the relevant keywords. Among magazines, a technology magazine, MIT Technology Review Pakistan (www.technologyreview.pk) helped me a lot in getting precise data. Regarding blog posts, convenient sampling along with snowball sampling technique were used. To build up links between the news and cross-check the information, the snowball sampling technique helped me a lot.

3.4 Sampling

A sample is defined as “a smaller collection of units from a large target population, such that the researcher can study a smaller group and generalize about the target population” (Neuman, 2007, p. 241). To select a sample from the population, sampling design is needed.

3.4.1 Sampling Design

There are different types of sample designs based on two factors viz., the representation basis and the element selection technique. On the representation basis, the sample may be selected through probability sampling, or it may be non-probability sampling. Probability sampling is based on the concept of random selection, whereas non-probability sampling is 'non-random' sampling. In this research, non-probability sampling was used. In non-probability sampling, there are four types, that is purposive/judgmental, convenience, quota and snowball. Among them, purposive and convenience sampling was used for this research. For UDC-1 and WCLA tour guides, private tour operators and application developers of UDC-2, purposive sampling was done. For tour guides of TDCP in UDC-2 and UDC-3, convenience sampling was done.

Purposive sampling enables you to use judgment to select cases that will best enable you to answer your research question/s and to meet your objective. This form of sampling is often used when working with a small sample and when you wish to select particularly informative cases (Neuman 2005). In qualitative research, convenient sampling is used in those cases where the target population is subject to easier availability, their will to participate and geographical proximities (Dornyei, 2007).

For UDC-1, that includes the officials of TDCP, WCLA and PHA, I used purposive sampling, to inquire about the past, present and the future projects going on, and the products and services being offered under their umbrella in Lahore.

In UDC-2, I conducted purposive sampling for WCLA tourist guides, because I decided to interview only the experienced ones among several of them. Though for TDCP tourist guides, I used convenient sampling as I was traveling on a bus, on which available guides could only be interviewed.

In UDC-2, for private tour operators, purposive sampling was done since few private tour guides are doing intensive and sincere work in Lahore.

In UDC-2, one important unit was application developers. Purposive sampling was done to select them since both application developers were involved in the development of a tourism app. For UDC-3, which is tourists, I used convenience sampling.

3.4.2 Sample Collection and Size Details

My total sample size was 52. No of TDCP officials is more than any other department, because I spent a lot of time, understanding how tourism is working in Punjab and Lahore. I also tried to differentiate the tasks on the concurrent list, so that I may focus on the ones being done by TDCP and PTDC. I also talk a lot of officials about other stakeholders that are working for the activities in Lahore. On their recommendations, I visited more departments and added them to my UDC. For example, PHA and City District Government Lahore (CDGL) was not on my list, but visiting their head offices, I found that PHA is one of the important stakeholders in conducting events in Lahore. On the other hand, I found that there were few annual activities, related to the national days, for which CDGL use to arrange some activities like seminars and rallies, etc. But visiting Town Hall, I found that CDGL is again converted into Metropolitan Corporation Lahore (MCL), and there is now no activity that is being arranged anymore by them. So, my total respondents from TDCP were 16, out of which, 4 were from Tourist Information Centre at temple road, 4 from TDCP Sightseeing Bus Terminal-1; out of which 2 were officials and 2 tourist guides, and 8 from TDCP head office at Garden Town. After that, I went to the WCLA office at Delhi Gate entrance. I interviewed 5 tourist guides. The rest of the 6 respondents were the officials of WCLA at the head office of WCLA at Majeed Nizami Road. After that, I went to the PHA office at Jillani Park (Old Race Course Park). I interviewed one official there and went to Greater Iqbal Park to visit the National History Museum. There, I interviewed two officials, while visiting through the whole museum.

I interviewed 4 private tour guides by arranging special meetings inviting them to Pak Tea House. The reason for the low number of private tour guides to be interviewed, depend upon the impact they are making in promoting tourism in Lahore. These 3 tour operators were working through the whole Ramazan this year, doing this work, almost for non-profit, sparing time from their office and business duties. Two application developers were from one software house. We did a group discussion, on the demand for tourism applications for the promotion of tourism in a city like Lahore. The interviews from tourists were taken at Greater Iqbal Park, Walled City of Lahore and while touring at Lahore Sight Seeing bus. The number of total interviews conducted was 11. The total number of local and foreign tourists interviewed was 14. Most of them were local. The reason being the summer season. Since the recommended season for tourists is September to April, every year, and I was conducting interviews in May, June and July.

Table 3.1: Sample Size

TDCP	WCLA	PHA	Private Tour Guide	App Developers	Tourists (Local and Foreign)	Total
16	11	5	4	2	14	52

3.4.3 Locale

This research was conducted at Lahore, which is the second-largest city of Pakistan with a population of 11.13 million and the traditional capital of Punjab for a thousand years, it had been the cultural center of Northern India extending from Peshawar to New Delhi. The origins of Lahore are shrouded in the myths of antiquity, but Lahore is undoubtedly ancient.

The Lahore of today can be divided into three regions: Walled City Lahore, Colonial Lahore and Modern Lahore. All three regions of Lahore were part of my Locale, as previously stated Lahore being a multivalent city. One can clearly differentiate the difference of architecture in the three regions, but these are still part of a whole.

Collage 3.1: TDCP Offices

The offices of my UDCs were at various locations. Even one UDC had its offices at two to three different locations. For example, TDCP had its three offices, head office at Garden Town, Tourist Information Center at Temple Road, and Lahore sightseeing Bus Terminal at Punjab Stadium. I had to visit all the three offices to interview different officials and tour guides (Collage 3.1)[2].

WCLA has its two offices, one at Delhi Gate, the other being at Majeed Nizami Road (Old Lawrence Road (Collage 3.2)[3]. PHA has its head office at Jilani Park (Old Race Course Park). The second office was actually at the National History Museum, Greater Iqbal Park (Figure 4.3)[4].

Collage 3.2: WCLA Offices

[2] For Images of TDCP Offices with detailed caption, See Appendix E – Picture 1, 2 & 3
[3] For Images of WCLA Offices with detailed caption, See Appendix E – Picture 4 & 5
[4] For Images of WCLA Offices with detailed caption, See Appendix E – Picture 6 & 7

The private tour operators and App developers find it better to meet at interviewed at Pak Tea House (Picture: 8)[5].

3.5 Methods of Data Collection

Methods used in the current research were qualitative. Strategically, I had to divide and diversify my tools to get extremely different types of data. At the initial stage, it seemed, I could search out the answers to my research questions through semi-structured and unstructured interviews from various stakeholders and actors that took their part in the whole ICT development process. But when stepped into the field, I found it nearly impossible to approach those key respondents in such a short span of time. So, multiple methods were employed to generate data for this research. The techniques that I used for data elicitation are explained below:

3.5.1 Sources of Data collection

Data collection may be of two types primary and secondary that are collected through techniques (Ghauri et al., 1995). Primary data is a piece of information that researchers collect with the help of questionnaires, interviews and tests while secondary data consist of documents, research papers, reports and other data collected by some other researcher (Bryman and Bell, 2015).

Collage 3.3: PHA Offices

My research work consists of both primary and secondary data. The secondary data has been collected through text documents and video documentations. On the other hand, primary data was collected through semi-structured interviews, and where necessary some unstructured interview techniques were used. At certain times, participant observation was used to just to cross-check the data, that was formerly collected by officials of TDCP and WCLA.

3.5.2 Tools of Data Collection

The tools, I used in my research were interviews and desk research. In interviews, semi-structured interviews were conducted from UDC-1, UDC-2 and UDC-3. I conducted

[5] Detailed Caption is given in the Appendix E – Picture 8

purposive sampling from UDC-1 that consists of officials of TDCP, WCLA and PHA. Along with that, I also conducted purposive sampling from WCLA tour guides, private tour guides and application developers, that belong to UDC-2. From TDCP officials of UDC-2, I conducted convenient sampling. Similarly, I also conducted convenient sampling from UDC-3 that consists of Local and Foreign tourists. In desk research, I used document analysis and Internet-based research methods to collect my data for UDC-4 and UDC-5.

3.5.3 Procedure of data collection

I started my data collection when I met one of my respondents Faizan Khooji coincidently in a marriage ceremony. Faizan is known as 'Lahore ka Khoji', running a private organization called 'Lahore Shanasai Foundation' that aims at informing the people of Lahore about their own city. I talked to him in detail about my topic of research. Then he called me to his home for a detailed discussion. I developed a customized interview guide for him to get as much data and some information about my other respondents. Khooji was aware of a lot of people who were the officials of public companies like TDCP and WCLA, and public and private tour operators that were working for the promotion of Lahore. There again, I reshuffled my list of respondents. I took all the contact numbers and the addresses of the offices, I had to visit.

On the other hand, When I tried to approach Punjab Safe City Authority (PSCA) and Arfa Software Technology Park (ASTP), both places were extremely difficult to approach. At PSCA it was told that until the permission of IG Punjab, you would not be allowed to meet any Punjab safe city official, and IG Punjab is on a foreign tour. At ASTP, I was asked to contact the officials by myself, when they will send an email to the security guard at the main gate, then I would be allowed to access them. I tried to access some of the officials, but I didn't get any reply because, in those days, there was a bit chaotic situation in PITB with the resignation of its Chairman, Dr. Umar Saif, along with the end of contracts of 80 key officials at PITB. Therefore, I had to move to secondary sources, which proved much helpful in the long run. I decided to perform a document analysis of all secondary data related to PITB. I found documents on the websites of both PSCA and PITB under the Right to Information (RTI) act. These documents helped me a lot to answers one major part of my research question. Along with that, some discussions helped me to reach other references related to the transitions that were happening in Pakistan and especially Lahore. These references gave half of my data related to my second question of research.

Secondly, a problem arose, when I tried to develop a questionnaire as developed in $(SA)^6$ framework of STDs (HM Tran et. al, 2017). The first difficulty was the institutions that I initially contacted like TDCP and WCLA, who were unaware of the framework constituents

in the context of tourism suppliers, and it was quite difficult to get that data directly through them. A similar attitude was expected in the case of PITB and PSCA. Therefore, I had to change my technique.

I put TDCP, WCLA and tourism stakeholders in one UDC and defined another UDC for document analysis. This worked perfectly. With the interviews of all stakeholders of tourism, I was able to identify, how tourism is working in Lahore, and what ICT interventions have been done up till now that has helped in taking the tourism to the current consumption techniques. Also, a very important aspect that I found was how much the current institutions i.e. PITB and PSCA are capable to alleviate the tourism from the current state to the ICT enabled efficient tourism in Lahore. That was a success.

After that, to get some important information on questions 2, how ICT is helping Lahore in developing it as STD, I redesign my interview guide for all of my UDCs. I took interviews from TDCP, WCLA, public and private tour guides, foreign and local tourists and application developers (that developed applications helping in the consumption of tourism).

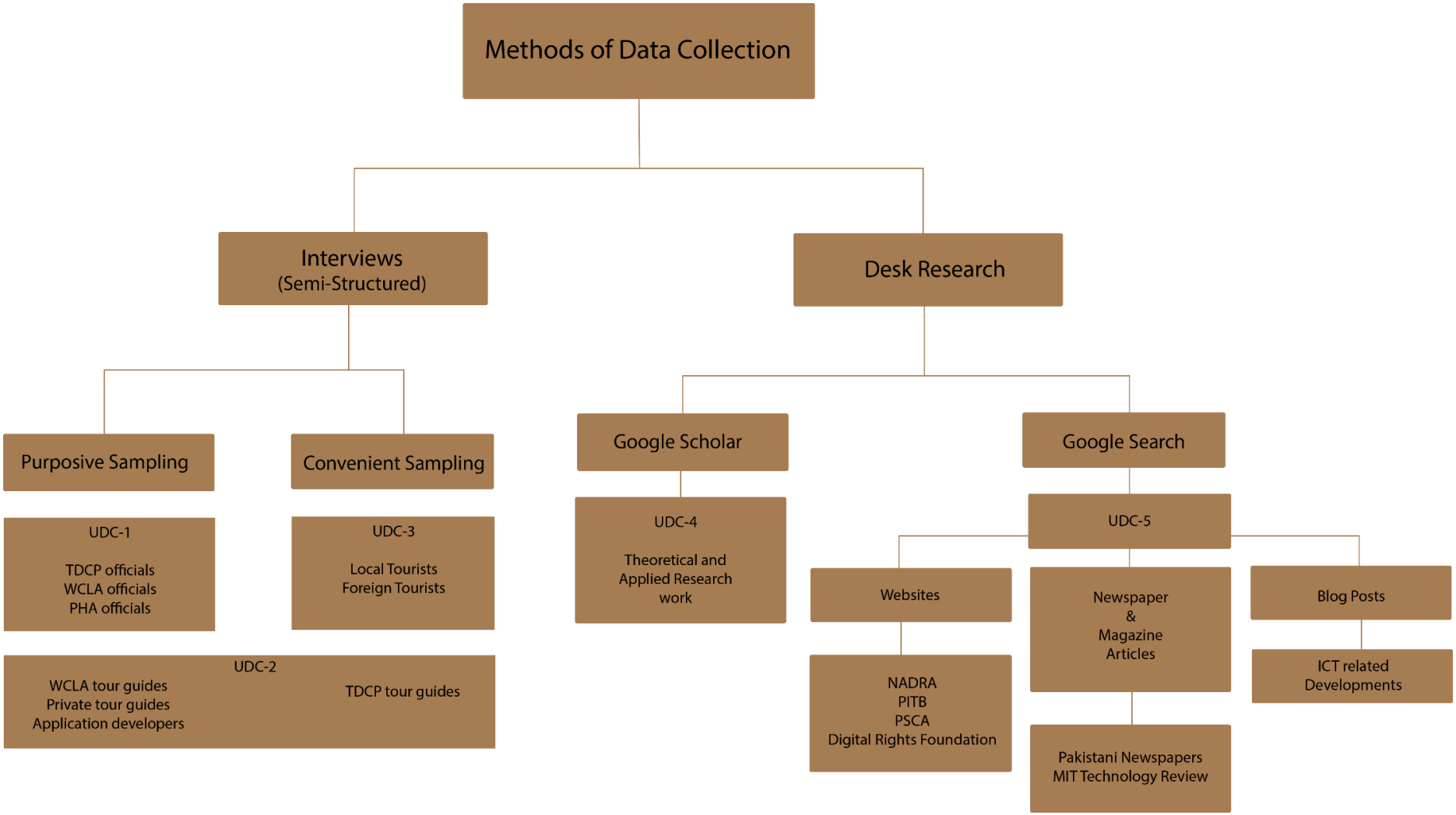
I conducted a total of 46 interviews, in which 15 interviews were taken from TDCP. It was quite complicated to know about the whole working of this public sector company. The reason was the rapport building issues at the beginning and the various contradicting perspectives that demanded some presence in the institute and spending some time with the employees that know the actual unofficial explanation of the working of TDCP. Then I started conducting interviews of WCLA. Here I took care of the issues I faced at TDCP. I took interviews of the tourist guides and other employees working there. I conducted detailed interviews of six tourist guides and find out about the projects of WCLA and the whole procedure through which tourists access them and consume tourism in Lahore. I also asked about the contribution of WCLA in the tourism of Lahore. Then I went to the office of WCLA and conducted interviews there. I prepared an updated interview guide there and asked about all the questions related to the ICT interventions in tourism at Lahore.

After that, I conducted interviews from the Parks and Horticulture Authority (PHA). This was done because PHA not only organizes activities twice every year, but it has developed the National History Museum at Greater Iqbal park along with Citizen Archive of Pakistan. This intervention is one of the best examples of ICT and the use of technology to develop smart attractions that give tourists, a real-time tourism experience.

After that, I conducted interviews of private tour operators few of which are working fabulously in Lahore. Along with that I also conducted interviews of the application developers that have contributed their little part in making things smart. In the last, I conducted

interviews of both local and foreign tourists to know-how and in what ways, they use ICT to consume tourism in Lahore.

Most of my interviews from the officials of TDCP, WCLA and PHA were semi-structured. Each interview spans from 35 to 50 minutes. Few interviews went up to 1 hour and 30 minutes, that were conducted in some office or a place where there was less interruption due to official works. Interviews from tourist guides and tourists were semi-structured, but they were encouraged to talk off-topic to give their interpretation of needs and demands that should be addressed. These interviews took 20 min to 35 minutes. While there were two interviews from application developers. One interview took almost 1 hour 30 minutes while others took 2 hours.


Methods of Data Collection
Interviews
(Semi-Structured)
Desk Research
Purposive Sampling
Convenient Sampling
Google Scholar
Google Search
UDC-1
TDCP officials
WCLA officials
PHA officials
UDC-3
Local Tourists
Foreign Tourists
UDC-4
Theoretical and
Applied Research
work
UDC-5
UDC-2
WCLA tour guides
Private tour guides
Application developers
TDCP tour guides
Websites
Newspaper
&
Magazine
Articles
Blog Posts
NADRA
PITB
PSCA
Digital Rights Foundation
ICT related
Developments
Pakistani Newspapers
MIT Technology Review

3.5.4 Rapport Building

In qualitative research, rapport building is an important constituent because it enables the researcher to become part of a given society. During the rapport building, the researcher informally communicates with the community members and tells them about the project on which he/she is working. For this researcher adopts the manners that suit with that of the community. The research makes sure that his behavior is not awkward to community members.

Though at first, I was thinking there would not be any need for rapport building and I was a bit true because I was getting the data as per my need. But when I started getting some contradictions in the present realities of the departments, then I started building rapport with the key people in the organization. It helped me in getting the actual issues that were existing and not being addressed properly, even by having a required setup.

3.5.5 Participant observation

Participant observation also aims at collecting the information that could be used later in research such as a collection of documents and doing some random discussions (Bryman, 2015). On the other hand, a slight difference with the participant observer there is a partially participating observer where the observation is not the main source to collect data. This method suited me much. Through this method, I got information about the documents that helped in further aligning my interview guide and interpreting the collected data in a more functional way.

3.6 Document Analysis

I used document analysis in the replacement of PITB and PSCA interviews that I wanted to take from the officials because there was difficulty in accessing both the places, due to some security concerns and the time availability of the officials.

3.7 Anonymity

The employees and officers of public sector institutions, that in my case were TDCP, WCLA and PHA gave a lot of contradicting statements. There were many reasons behind that. One of the main reasons was that the concerned departments were not working at their fullest capacity, so when asked about the concerned officer, it was told that everything is working perfectly fine and there is no problem with their sides. But when cross-checked by the customers or even the employees of the same institution, who were in the operational wing of the tourism sector, the actual situations were quite different. Therefore, I decided to keep the names of all

officials and employees altogether anonymous. So that the perspectives from all the stakeholders could be described easily.

Chapter 4

Analysis and Results

This takes us to the analysis and results section, where the answers to the three questions are analyzed in detail. Before this, it is important to note that to answers Q1 and Q2 I have done extensive desk study because it was based on the works done up till now. It was better to look at the authentic secondary sources to understand actual themes for these questions. To answer Q3 all these interviews were done. This was quite logical to listen to every stakeholder related to the tourism industry in Lahore at any level and find out the impacts of ICT on tourism. They were sources that could tell better which interventions are even not needed in the case of Lahore.

4.1 Important ICT Interventions

There were mainly four ICT interventions that took Lahore to the stage of a smart city: Two at the federal level, one at the provincial level in Punjab, and one at the city level in Lahore. At the federal level, the formation of IT Policy 2000 and establishment of National Database and Registration Authority (NADRA) took place, while at the provincial level, revitalization of PITB and at the city level, Lahore Safe City Project was initiated.

4.1.1 Pakistan IT Policy 2000

The first IT policy of Pakistan was made and implemented in the year 2000, under the leadership of Dr. Atta-ur-Rahman, the then Federal Minister of Science and Technology. This laid the foundations for the development of IT sector in Pakistan. In that policy, the ICT sector was assigned two roles, one as a production sector in the county and other as an enabler of socio-economic development.

ICT as a production sector was expected to give strength to the ICT related industry that includes Computer hardware and software, telecommunication sector, and ICT related services. It was considered essential because it involved commercial use of ICT related industries that could be able to contribute to the national economy. ICT as an enabler of socio-economic development was meant to the application of ICT to harness wider development objectives in different social sectors of society.

4.1.1.1 ICT as a Sector.

4.1.1.1 (a) National Capacity Building. To achieve this objective, the National policy of Pakistan takes a shift from protectionism to liberalization. In the earlier 1980s and 1990s, there was a focus on the development of the ICT sector domestically. But then the emphasis shifted to economic liberalization and building ICT based infrastructure projects.

The integrated policy announced by the government in the IT sector started the era of globalization and modernization. The main focus of policy was on:

(a) Human Resource Development

(b) Infrastructure Development

(c) Software Industry Development

(d) Hardware Industry Development

(e) Wider access and use of the Internet

(f) IT Promotion and awareness

4.1.1.1 (b) Export Market Focus. IT policy put its focus on the export potential of the IT sector. Due to the erosion of Pakistani Currency owing to the influx of an increasing number of imports, and an increase in foreign debt and low foreign reserves, the ICT sector contributed in decreasing the pressure.

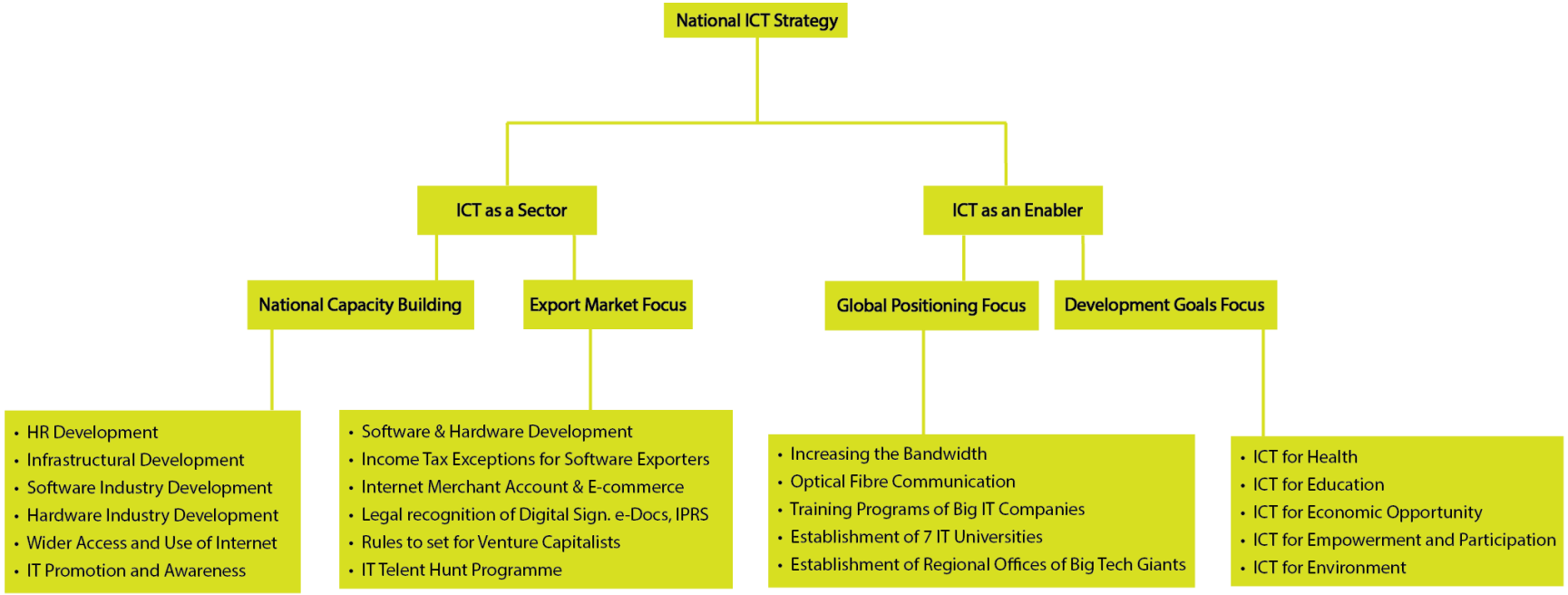


Figure 4.1: National IT Policy, 2000 (Source: National IT Policy 2000)

4.1.1.2 ICT as Enabler.

4.1.1.2 (a) Global Positioning Focus. To align the ICT sector with that of the world, several initiatives were taken. Internet penetration was planned to be increased by decreasing Internet bandwidth costs for software houses and educational institutes. Pakistan Internet Exchange is planned to be established soon and Digital Cross Connect is helping in the deployment of Internet Service Providers (ISP) and Voice over IP (VOIP). Internet Kiosks are planned to be built with a public-private partnership with PTCL where digital radio systems and international gateways at capital city Islamabad and Karachi.

4.1.1.2 (b) Development Goals Focus. In recent years, ICT has proved itself as an effective tool in service delivery and good governance. It helps to optimize the cost and realize the output with efficiency. Therefore, it acts as a tool for social development in society. Therefore, the necessities of life like education, health and environment can be improved with the help of ICT.

4.1.2 Establishment of NADRA

NADRA is an independent and autonomous agency that is working under the Ministry of Interior to regulate government databases and manages the sensitive registration database of the citizens of Pakistan. It not only keeps the largest government database but also claims to hold the record for maintaining the largest biometric database of citizens in the world.

It was established on 10th March 2000 by the merger of Directorate General of Registration Pakistan (a department created under 1973 constitution) and National Database Organization (NDO) (created for 1998 census). Due to its work and capability, it got so much recognition in the world and achieved numerous international awards.

In the beginning, there were many roadblocks due to the lack of ICT infrastructure and architectures that were difficult to develop at that time in Pakistan. So, for example in 2006, to expand the outreach to deliver its services to the citizens living in the far-flung areas of Pakistan, NADRA was facing a lot of serious challenges like limited and secure

availability of telecom infrastructure. Therefore, to cover up the absence of the infrastructure, NADRA acquired stat of the art DVR-RCS satellite communication system that enhanced its broadband capability. It enhanced the authority's capability to verify documents and application fields anywhere in the world for different purposes.

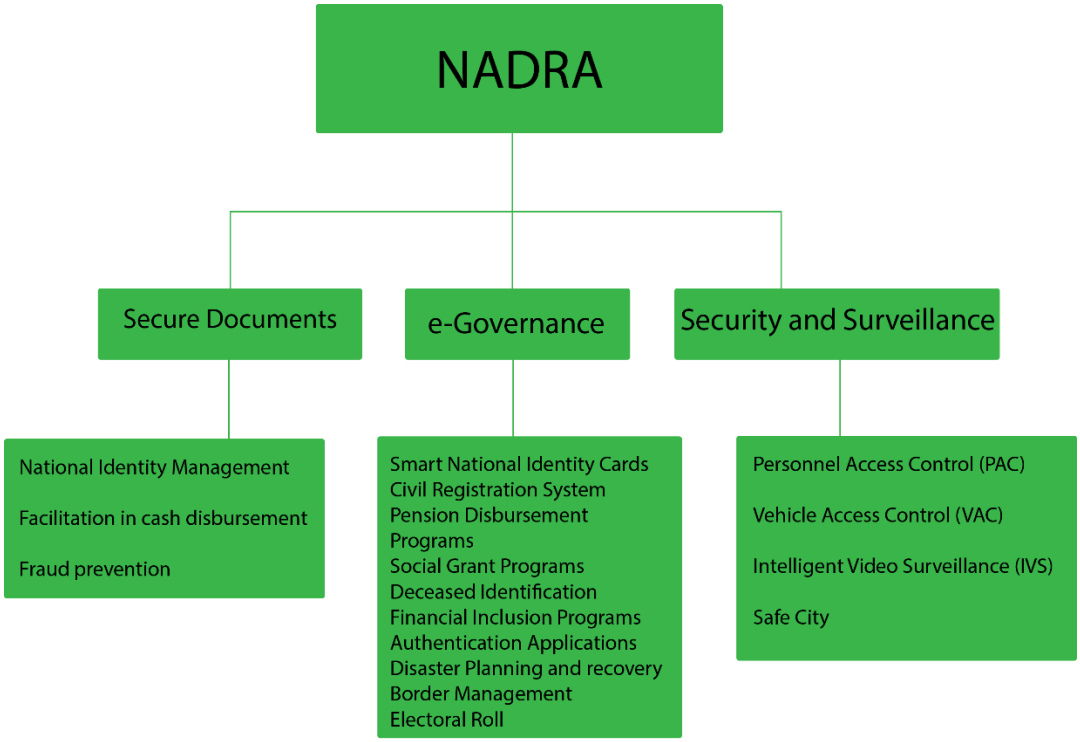


Figure 4.2: Contribution of NADRA

Over time, NADRA has proved itself a success story. The accomplishments of NADRA can be categorized into three themes:

- Secure Documents
- e-Governance
- Security and Surveillance

4.1.2.1 Secure Documents. NADRA has developed expertise in the Identity Management industry that issues secure documents. Its facilities can produce 65000 to 100000 cards per day, by using substrates like Teslin, Polycarbonate, PVC, Magnetic cards, papers and scratch cards. The system is equipped with auto-document feeder, digital printers, customized plain and holographic lamination machine, die cutting machine and automated mailing mechanism. Additionally, the security features also include security lines, micro-text, watermarks, guilloche patterns, UV duplex, rainbow printing, holograms with animated images, 2-D barcode and many more. These facilitate cash disbursement, fraud prevention and enabling the quest of 'Good Governance' in Pakistan.

4.1.2.2 e-Governance. When talking about the contribution in e-Governance, NADRA's National Identity Program is an exemplary case. It is based on the citizens' centric data management system. Its ubiquitous reach to millions of citizens has brought transparency and trust in the people of Pakistan. It helped the federal and provincial governments to manage a lot of governance and social security-related programs. It includes the issuance of Smart National Identity Cards, Civil Registration System, Pension Disbursement Programs, Social Grant Programs, Deceased Identification, Financial Inclusion Programs. Authentication Applications, Disaster Planning and recovery, Border Management and Electoral Roll.

For border management, NADRA uses Integrated Border Management System (IBMS), in which IBMS takes the information from NADRA Database and Passports Database, and this data is used to match with Visa details, Passenger Information, ASF surveillance Feeds and the Exit Control List data to validate every passenger.

One important shift that came after NADRA biometric databases of citizens is that NADRA could help in digitalizing the pooling system in the country. This system helps to decrease the fraudulent attempt in the electoral system.

4.1.2.3 Security and Surveillance. Being experienced in developing and implementing Multi-Biometric identification systems, NADRA developed the capability of real-time monitoring with security, scalability and transparency. Through its architecture, NADRA developed capability in four major systems: Personnel Access Control (PAC), Vehicle Access Control (VAC), Intelligent Video Surveillance (IVS) and Safe City.

In PAC systems, the system controls the entry and exit of people at earmarked areas like offices, shopping malls and airports. This mechanism detects the security breach by electronic scanning and immediately reports to the concerned department. A similar system is employed for another important purpose that is Biometric Attendance. This system is installed in public and corporate sector offices to ensure the punctuality of employees at the organization.

The VAC system of NADRA uses Radio Frequency Identification Device (RFID) technology to identify vehicles that pass through manned and unmanned check posts. This system can also be deployed for e-Toll collection at toll plazas. This real-time information and ensures the smooth flow of traffic on the highways.

The concept of the IVS system of NADRA is based on Behavioral Detection Systems (BDS), which are programmed at tracking the identified people and areas and alert about the movements of the subjects. This system is so designed that it can read the violations of the predefined rules which are fed to them. It analyses and assesses the videos in real-time and without human interaction. It holds the capability to develop complex behaviors of individuals, groups, crowds, and vehicles, and determine a certain matrix that could detect the abnormality that arises in any situation.

The security and surveillance infrastructure of NADRA had its true implication in developing Safe City Project Islamabad. It holds the capacity to secure a specific region through its formidable technology. The safe city project employed different technologies, for example, Smart ID cards, RFID tags, Smart Registration Cards for vehicles and Centralized databases for authentication of individuals and their vehicles. This system is assisted by the whole security structure that is supported by a myriad of cameras and CCTVs.

4.1.3 Revitalizing PITB

Keeping in mind the growing demand of *digitalization,* the Government of the Punjab realized the need to choose the path of ICT in different departments of Province. To achieve those objectives, PITB was established in 1999, which was an autonomous organization but was put under the Department of Industries. Later in 2001, PITB went under the Information Technology Department. But in 2011, the government decided to dissolve the Information Technology Department, putting it under the Planning and Development Department of Punjab. Since then PITB is working on the modernization of the government departments. It includes both sectoral and cross-sectoral projects. The first one involves a lot of sector-specific interventions that were done in Education, Public Health and Law and Order - the three sectors that are considered very crucial to Sustainable Development Goals (SDGs), the latter being at the core of citizen-government interface. In these projects, e-governance initiatives were taken in Punjab to automate the whole system of governance. Furthermore, flagship projects like Citizens Feedback Monitoring Programme (***CFMP***) were also done to reduce the gap between citizens and government and improve transparency and efficiency in the system. In short, the main aim of the government was:

- To increase the role of IT in Governance
- To improve the Transparency and Information Accessibility
- Performance Monitoring, Evaluation and Feedback
- Deploying Management Systems
- Human Resource Development
- Provincial ICT Policy and Plan for short, medium and long term

Figure 4.3: PITB - Areas of Intervention (Source: PITB Digital Punjab Report 2012)

4.1.4 Setting-up of PSCA

In 2015, the government of the Punjab launched the PSCA project, promulgating an ordinance - Punjab Safe Cities Ordinance 2015, to put all concerned stakeholders under one umbrella, that could keep the requirements of the different departments of the city such as police, emergency service-1122, fire brigade, civil defense, municipality, water and sanitation authority (WASA), traffic engineering and others. This ensured the establishment, development, and maintenance of a Punjab Police Integrated command, control, and communications system (PPIC3) under PSCA in major towns of the province that includes, Rawalpindi, Faisalabad, Multan, Gujranwala, Sargodha and Bahawalpur. The obvious purpose was to return the security, safety, and quality of life to today's complex cities using technology, infrastructure, personnel, and processes.

4.1.4.3 Terrorism. After 9/11 attacks, terrorism that was phenomena that were restricted to certain regions, spread around the world and no country or city is now out of reach of this danger. This has resulted in the business shifting to those parts of the world that have better security infrastructure. It also resulted in the brain drain, where a lot of business families altogether shifted from Pakistan. In the years 2013 and 2014, there was a 54% increase in the terrorist attacks in Pakistan and Pakistan ranked third in the Global Terrorism Index in 2014 (Institute for Economics and Peace (IEP), 2014). At least 60,000 people have been killed in Pakistan due to terror attacks since the beginning of the war on terror, while the economic losses have been measured at $120 billion (Dilawar, 2017). This urged the need to revisit the approach to tackle the safety and security situation of cities and a plan for the Integrated Security management system was conceived.

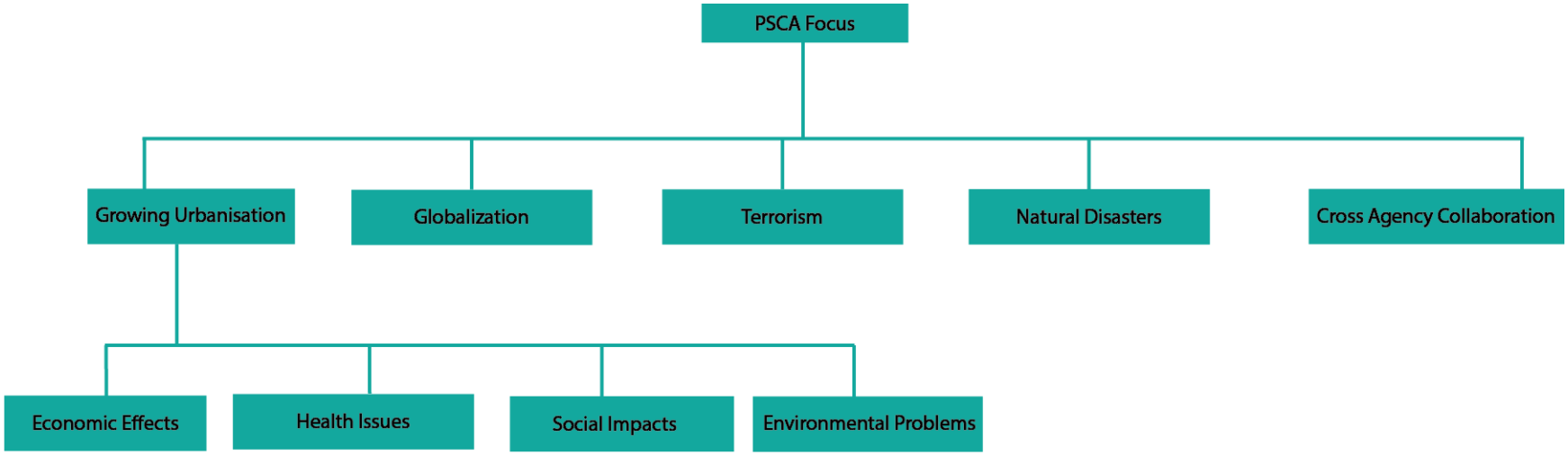


Figure 4.4: Focus of PSCA on the Emerging Challenges (Source: Concept-Paper PSCA)

4.1.4.5 Cross-Agency Collaboration. In big cities, a lot of city problems, need combined responses due to the interconnectedness of problems. An incident relating to bomb blast could not only include fire brigade, but also security institutions and bomb disposal squad. But these departments work independently, and it becomes difficult for them in information collaboration. Therefore, the different emergency department needs an integrated system for collaboration to respond in a critical situation. Also, there could be some city management problems that need a common information bank that could guide all the departments with updated data. Therefore, PPIC3 was thought to be developed for the solutions of Lahore.

4.2 Transitions that drove Lahore towards Smartness

Transitions that happened in the IT industry in Pakistan, can be divided into two phases. In the first phase, the IT policy was rolled out in 2000 by the government of Pakistan. Along with that NADRA was also established. IT policy helped in determining the future path of IT in Pakistan, while NADRA engaged itself in developing the National Biometric Database Management System, along with other wonderful technology initiatives. The second phase of IT transitioning was the restructuring of PITB which gave a new life to almost all the public sector institutions through the IT blood flowing through the veins of the government systems. The second important part of the second phase was the Lahore Safe City Project, which provided the city with the whole set of an urban surveillance system, along with a modern Integrated traffic Management System that helped in curbing traffic jams and also indirectly helped in decreasing air pollution in the city.

4.2.1 Transitions happened in result of IT Policy 2000

There were two important results achieved in the implementation of IT Policy 2000, Human Resource Development and IT Infrastructure Development.

4.2.1.1 New IT Universities and Strengthening the existing. As a result of that policy, 7 new IT universities were built. And to increase the capacity of the IT graduates, existing public sector universities were given grants to induct 100-200 students per year in BS/MS programs. The students were given generous scholarships on merit to be prepared as IT professionals. With the more budget-focused, 51 new universities and awarding institutions during 2002-2008 were established, which tripled the enrolment rate in universities. As a result of which, according to HEC, since 2010, Pakistan is producing 10,000 IT graduates annually (Haq, 2015).

4.2.1.2 Virtual Learning. The first-ever Virtual University of Pakistan was established, which started a new era of virtual education in the country. Later it encouraged the culture of virtually learning or in other words the online learning through the thousands of online free courses and millions of lectures among students, graduates and professionals. The Virtual University of Pakistan helped the working professionals to continue their education along with their work.

4.2.1.3 IT Education and Training. To promote the effective use of technology in classrooms, the Intel Teach Program was launched in March 2002. It included various programs and different courses, that focus on the use of technology in the teaching methodology. These courses trained more than 220,000 teachers around the country in 70 districts targeting remote cities and villages to the developed areas alike (ICTEC, 2010).

Furthermore, in the initial phases, 20,000 government employees were trained in IT, 1400 Networking engineers were trained by Cisco, 1000 JAVA developers were trained under the same program in one year. These programs continued time after time and when there were enough graduates and professionals, this training work was also later populated by private giants.

4.2.1.4 Fiber Optic Connectivity. It was decided that the fiber communication system will be developed throughout the country. In two years, 200 cities of Pakistan were connected through fiber optic. In 2013, China and Pakistan agreed on an 820-kilometer-long optical fiber Project that would be laid between Khunjerab Pass to Rawalpindi. This project will connect the older laid fiber optic that comes from Karachi.

The project was started a bit late when it came under the project of CPEC. It gave 3G and 4G connectivity to the Northern Areas of Pakistan, where there were very slow internet connections up till now. This project was completed in July 2018 and provided Pakistan an alternative safe route for the internet that comes through China.

Recently, Pakistan has successfully tested 5G that will be soon launched in Pakistan with the speed 100 times than the current available. The resulting network will be 10 times faster than the existing broadband connections available in Pakistan. The 5G home router's speed would be four gigabytes per second which means that it could be able to download a 50gb file in just two minutes (Dunya, 2019).

4.2.1.5 Internet Growth. The Internet came in Pakistan in the early 1990s. Internet Services Providers (ISPs) started operating in the country in 1996. By June 2000 the country had 1 lack Internet Subscribers and the coverage to only 29 cities. In 2001 just 1.3% of the total population was using the Internet. By 2006, this figure grew to 6.5% and in 2012 up to 10.0%. As of April 2019, 33.14% of Pakistanis are among the broadband internet users, which means that now approximately 70 million Pakistanis have access to broadband internet.

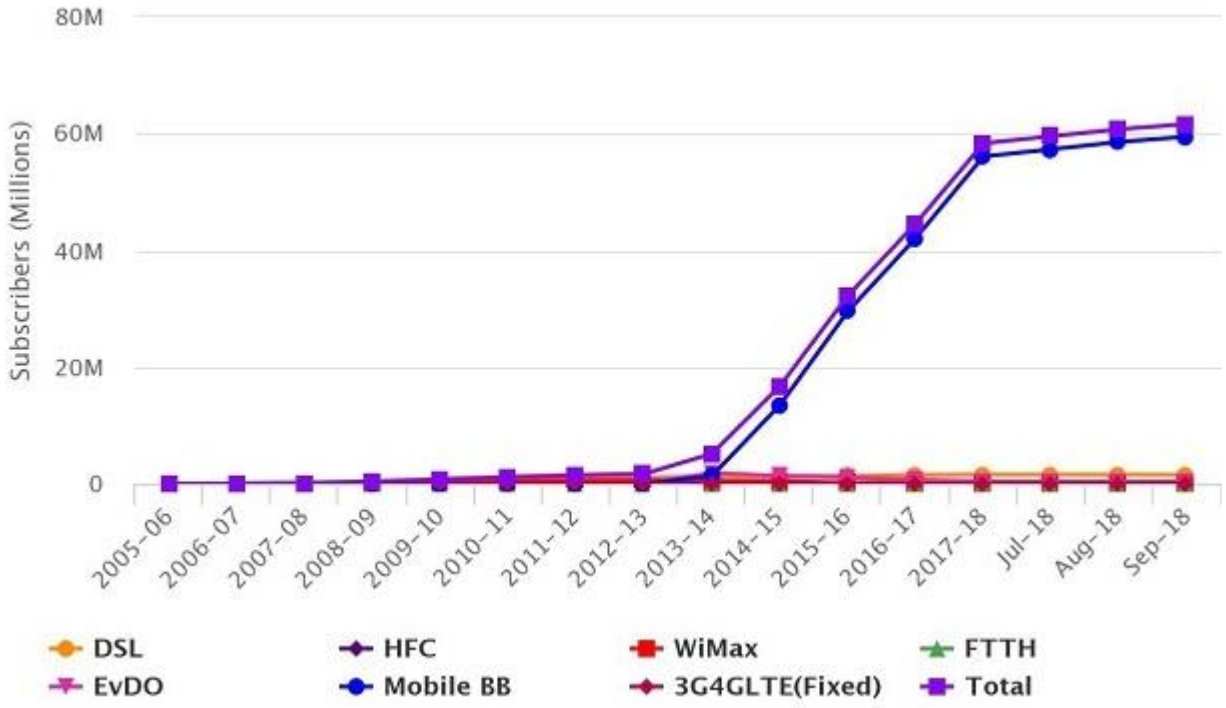


Figure 4.5: Broadband Subscribers by Technology (Source: PTA)

4.2.1.6 Information Technology Parks. To promote information technology and software development, IT parks were put into the policy. In its pursuance, initially, 2 ITPs were planned for Islamabad, 1 for Lahore and 1 for Peshawar. 6 ITPs were planned to be set up in a public-private sector partnership (PPP), where the Government was responsible to provide optical fiber infrastructure up to the park's buildings, and private sector operator will manage the ITP.

Up till now, 8 ITPs or Software Technology Parks are located in Lahore, 5 in Islamabad/ Rawalpindi and 1 in Karachi (Pakistan Software Export Board (PSEB), 2019).

4.2.1.7 Incentives for Investment in the IT industry. To increase the Foreign Direct Investment (FDI) in Pakistan, the Government of Pakistan took various initiatives. The bandwidth was drastically reduced from US$ 43,500/month per Mb/s to US$ 3000/month per Mb/s which was the lowest among the developing countries in the world. IT professionals were given a 50% rebate on income tax while IT companies were given a 15-year income tax holiday.

As a result of these types of incentives, the IT industry has grown 100 times, $30 million to $3 billion from 2001 to 2019. In the year 2019, Pakistan is expecting IT exports to cross $ 1 billion (Atta-ur-Rehman, 2017).

4.2.2 NADRA as a Centre for National Database Accessibility

NADRA started Civil Registration in Pakistan, in March 2000. In a short period, the team at NADRA created a state of the art centralized Data Warehouse with Network Infrastructure and Interactive Data Acquisition System. This started the issuance of National Identity Cards (NIC) to the citizens all over Pakistan. With the help of this fool-proof, comprehensive and sophisticated system, NADRA became successful in reducing the identity theft problems to a bare minimum.

With time, NADRA upgraded their systems to include more features and data acquisition instruments to their system, that enable them in developing Multi Biometric Identity Management System. Under this system, NADRA holds the record of 128 Million Facial Images and 800 Million Fingerprints data on its servers. This data is being used throughout the country in different public sector institutions, telecos, banks and security institutions in Pakistan.

With its database, NADRA is helping in the following national projects:

National Identity System, Benazir Income Support Program, Arms License (Punjab, Sindh, Federal), Machine Readable Passports and Visa, Punjab Kissan and Imdadi Package, ERRA Livelihood and Housing project, FIA Integrated Border Management System, Kiosk and e-Sahulat, Vehicle Registration Card (ETO-Islamabad), MOI Safe City Islamabad, Watan Card Phase I and II, E-Toll Collection System, Prime Minister Health Program, UNCHR Afghan National Registration, ECP Data Entry and Production of Electoral Rolls, Pakistan Card, Biometric Verification Services, Pakistan Engineering Council, INGO Registration, Civil Registration Management System, Pension and Zakat

Disbursement System, Sindh Employee Card, National Action Plan, Tax Payers ID, National Alien Registration System, Frontier Corps Cards Production, SMS Services (7000, 8400, 8300, 8500).

NADRA has given its database access to the Punjab Information Technology Board (PITB), to digitalize the citizen's data by linking their NICs to various public departments (ArabNews, 2018).

A lot of PITB projects involved the use of the NADRA database to be fully realized. A project named "Hotel Eye" is a web application to log the details of check-ins/check-outs at hotels. It asks for personal and Computerized National Identity Cards (CNICs) details of the visitor. This system is connected with NADRA, CRO and PSRMS. If a person with criminal record checks in, a notification is sent to the police department and appropriate action is taken.

Similarly, to develop Citizen Biometric Verification System for the Punjab Police, NADRA biometric database has made the system so easy that now there is no need to identify a person from its CNIC or matching the person's face with the picture on the ID card. Now, the enforcement agencies of Punjab just need to use their M3 biometric devices, where they scan the thumbs of the suspects and it searches out complete details of that person from the NADRA database and Criminal Record Management System (CRMS) from the server.

There are a lot more cases where PITB has to use the biometric database to set the records clear. Whether using School Information System for public schools where Parents CNIC numbers are used to identify their children's record or on the other hand it may be the Job Portal where CNIC data of candidates is used to verify them or sometimes determine their eligibilities based on quotas.

Similarly, in many instances, PSCA had to take help from NADRA biometric database system. For example, when there comes a case where the authorities issue e-challans to the violators, but they are not submitted by the violators. And if that vehicle is transferred to some other person then the new person had to pay for that violation that he didn't do. To remove this flaw from the system, Excise changed the system in a way, that now both the seller and the buyer had to give the record of their fingerprints that are then

matched with NADRA's biometric database and the record of violations is thus maintained in a systematic way (Hanif, 2018).

The cameras installed by Lahore Safe City project has the capacity to zoom in to the vehicles very closely, reding their number plates and detecting faces. The facial recognition feature of the software takes the help of NADRA's facial database to search out the identity of that particular person (Zafar, 2016).

Being an autonomous corporate body, NADRA does a lot of projects for the public and private sectors. For the Ministry of Interior, the Islamabad Safe City project is one of the examples that it carried out with Chinese company Huawei. Recently Sindh is considering a project of Karachi Safe City, where NADRA is ready to bid (Zameendar, 2019).

4.2.3 Punjab Information Technology Board

In 2011 from an organization of 100 people, PITB has become 10 times bigger employing more than 1000 employees. In the last 5-6 years, PITB completed around 240 IT projects around Punjab. PITB also helps other provincial governments as well as foreign governments in different IT-based projects. It has done partnerships with various departments in Punjab and convinces them to implement IT-driven reforms. These projects were not easy and entailed a significant amount of time and hard work since it involves re-working of all old processes, that needed a lot of patience and resolve from all levels of the government (Describe as the source is describing it). In the past 8 years, there is hardly any major IT initiative in the province that was not enabled by PITB. After these reforms, it is now seen government departments are now doing more reforms as per their requirement by themselves. Since PITB is structured to work as a management consultancy, therefore the processes do not take similar paths to be realized. Therefore, there is a need to look at how the projects in Punjab were conceptualized, developed and implemented. Below are the case studies of a few projects. These case studies are made by conducting different interviews, video documentation on PITB social media sites, and press conferences.

The contributions of PITB brought about revolutionary transitions in society. If we try to categorize all the components of the system that were used to bring the transformation, then they can be divided into four tools: (i) Database Management (ii)

Facilitation Centre (iii) Tracking and surveillance systems and (iv) Monitoring Evaluation and Feedback Systems (MEF). These four tools are ubiquitously connected, constantly feeding and updating data through Integrated Database Management (IDM). This IDM if studied carefully, is providing two important supplies to the public; one is facilitation centers and the other is smartphone applications.

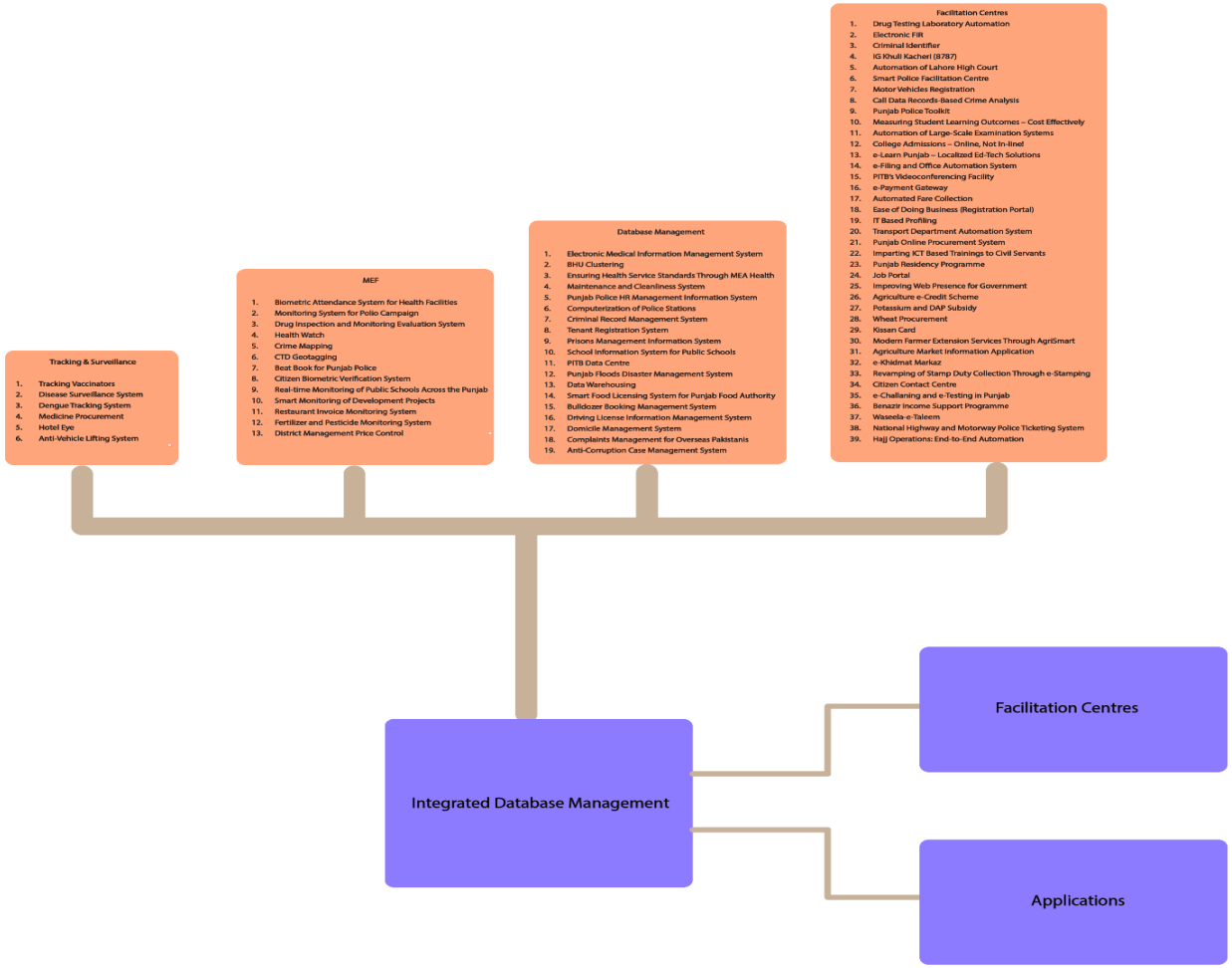


Figure 4.6: PITB Systems Developed - Making a Sense (Source: Author)

4.3 Role of ICT in developing STDs

The following are the results according to Tran et al. (2017) framework of 57 indicators for STD.

Table 4.1: Smart Tourism Framework (Source: Tran et al., 2017)

Cr.	Sub-criteria	Attributes	Explanation	Findings
1. Smart attraction	Artificial attractions	Building	E.g. visitor center, modern building personalized with geolocation, video and audio guides.	National History Museum Arfa Software Technology Park
		Park	Artificial parks-oceanography, botanical garden	Nil
		Amusement	Quick-witted experience center, sport complex	An amusement park was planned but was not realized
		Entertainment	Cinemas, live theatres, casinos, shopping malls applying ICTs in their operation and promotion.	Some malls contain few ICT applications but no fully automated mall
	Heritage attractions	Heritage attractions	Historical immersion is offered through smart devices	Nil
	Special events	Special events	Use local sensors and crowd control at large events.	PSCA only covers crowd gatherings through cameras
	Attraction management	Attraction management	Manage the attractions in a participative and collaborative way: public-private organizations, with citizens of the destination and tourists.	TDCP's Punjab Destination Software-Once done effort; not regularly updated
2. Smart accessibility	Physical mobility	Public transport (1)	The adequate connection between airports, ports, train stations, bus stations and the city center.	The whole Lahore is fully connected
		Public transport (2)	Adequate public transport between attractions.	Attractions are not considered, though public transport is available
		Public transport (3)	Good connections with the nearby tourism destinations.	Completely connects with other tourism destination
		Geolocation system	Provide basic help to visitors, displaying all places of interest.	RASTA App by PITB is quite good, but no tourist-centric

				application showing places of interest is available
		Disabled and elder tourists	Adequate public transport support for disabled and elderly tourists.	Public transport is custom built to accommodate disabled and elderly
		Traffic management (1)	Real-time traffic management system updated with optimal routes (Arup 2010)	Intelligent Traffic Management System& Application
		Traffic management (2)	Efficient management of intermodal transport.	The whole city is connected through the transport system
		Traffic management (3)	Efficient management of the parking area by using up-to-date mobile applications.	No, but the Safe parking project recently launched that is aimed at safe parking places through ICT, and its scope can be increased.
		Traffic management (4)	Efficient management of the traffic with a high flow of tourists.	No need in Lahore
		Public safety	Video monitoring in tunnels, metros and unsafe areas.	Lahore is completely monitored
	Digital mobility	Access to the internet	Free wi-fi connection at public spots	Yes, public places have free wi-fi spots
		Websites	Local tourism official website that follows the Web Content Accessibility Guidelines 2.0 (WCAG 2.0) and contains useful tourism information.	Nil
		Mobile applications	Provide mobile application that takes into account the Mobile Web Best Practices (MWBP) and the W3C (World Wide Web Consortium) recommendations.	Nil
		Social media	Establish and update frequently local tourism fan pages in social media.	Cursory practices are seen
		Promotion	Provide on-line some promotional materials.	Cursory practices are seen

		NFC tags and	Applied in points of interest through mobile	Metro Bus Cards and tokens, e-stamp papers and other projects of PITB have many examples of its use

		QR codes	devices (GSMA 2012).	
		Information services	Travel information is provided in road panels, local web pages and mobile applications, considering visual impairments.	Road panels information display, Safe Cities RASTA FM 88.6, Rasta app
		Internet of Things	Use sensors/actuators in tourist attractions or tourist areas to obtain information about the visitors and to provide information to them.	Nil
		Recommendation systems	Provide real-time information for tourists about cultural activities or events that fit with their personal preferences.	Nil
	Accessibility management		Create assessment and management protocols to maintain and develop the accessibility of the attractions of the destination.	Nil
3. Smart amenities	Natural amenities	Natural amenities	Apply EMS (*Environmental Management Systems*) to the management of the natural amenities at two levels: local government and small and medium-sized companies (Lee, 2011).	No smart mechanism available
	Built amenities	Hotel and restaurant	Use *Customer Relationship Management* systems (CRM) for efficient management of hotels and restaurants.	Nil
		Control system	Use marketing systems (B2B, B2C) and *Central Reservation Systems* (CRS).	Nil

		Content management	Use perceptive *Content Management Systems* (CMS) integrated with social networks and geo-positioning.	Nil
		Innovative public-private network	Implement supportive PPP (public-private partnerships) between the local government and tourism enterprises to foster efficiency, creativity and innovation (Heeley, 2011).	P&D Punjab has PPP opportunities, but it is not effectively utilized
		Hospitality network	Define an ICT-based innovative entrepreneurial hospitality network.	Nil
	Amenities management		Natural amenities: eco-regulation and sustainable management. Built amenities: sustainable management, participative public-private management in accommodation and gastronomy.	Nil
4. Smart ancillary	Bank	Smart banking	Provide smart banking and mobile banking services.	Available
		Payment system	Use payment systems specific for tourists.	Nil
	Postal service	Postal service	Provide postal service support for tourists through tourism websites or mobile applications.	Nil
	Medical service	Medication geolocation	Provide geolocation of nearby 24h chemists, hospitals and medication services.	Information is available online, but not through some certain tourist app
		Medical history and treatments apps	Provide smart multi-lingual applications that allow visitors to access their medical history and treatments.	Not for tourists, but PITB has developed a system for the local tourists
		Medical tourism information	Provide information on medical tourism. Advice on the dangers of high levels of sun exposure and make a risk profile of each visitor.	Nil

	Local Communities	Smart community	Innovative and friendly communities	Nil

		Cultural exchange and mutual enrichment	Creation and promotion of new spaces for travelers to meet locals, towards cultural exchange and mutual enrichment.	Nil
	Citizen journalism	Citizen journalism	Citizen journalism is used to enhance collaboration among users, information sharing and creativity via the Web (Johnson & Wiedenbeck, 2009). Citizen journalism programs allow tourists to participate in destination communication through ICT resources.	Nil
	e-culture		Creation of strategies which enable a visitor's respectful immersion in local history and traditions.	Nil
	Feedback		Deploy complaints management applications that allow tourists to easily register their complaints and directly route them to the appropriate city officials that should handle them.	Nil
	Ancillary	Management	Incorporate an international view in the management of the ancillary services.	Nil
5. Smart activities	Business-MICE	Business-MICE (Meetings, incentives, conferences, exhibitions)	Host MICE-tourism activities (meetings, incentives, conferences, exhibitions), organize gatherings on areas like education, religion or health, organize retreats in the destination (Buhalis, 2000b) (Buhalis & Spada, 2000).	Nil
	Leisure	Quick access to third-party leisure source	Provide quick access to third-party sources, such as activities timetable, travel planning or event ticket reservations.	Nil

		Open data	Management of the open data of the activities.	Nil
		Nature and adventure management	Apply DMS (*Destination Management Systems*) to manage efficiently nature and adventure activities in the destination.	Nil
	Activities	Management	Manage the activities in a participative and collaborative way (public-private organizations) with citizens and tourists.	Nil
6. Smart available packages	Transport package	Mode of transport	Efficient management of transport services in the packages: saving energy, improving sustainability, avoiding traffic jams, respecting parking areas.	Nil
	Accommodation package	Type of accommodation	Implement up-to-date mobile applications which offer available accommodation packages with on-line reservation.	Nil
	Service package	Services included	Offer multilingual application that gives an easy overview of the available packages for tourists (Jordan, B., 2011).	Nil
	Co-creation package	Chip-based Smart Tourist Card	Successful tourism experiences can be achieved through co-creation with a high level of technological support (Tussyadiah &Fesenmaier, 2009)	Nil
			Design and implement chip-based *Smart Tourist Cards* which give access to a wide range of cultural and leisure activities, as well as to public transport, and various discounts in shops.	Nil
		End-user Internet service systems management	Make smart management of the end-user Internet service systems (e.g. sharing services and virtual pockets) to strengthen the interactions between tourists and the DMO.	Nil

	Package management	Creation and management of packages in a collaborative way: public-private organizations.	Nil

4.3.1 Smart Attractions

Lahore is full of touristic sites, which meets its Attraction component of 6As which is the presence of places of attraction. The detailed list of attractions is given in *Appendix A.* With the development of ICT in the city, few efforts have been done by government and private stakeholders. The details are given below:

4.3.1.1 Artificial Attractions. Artificial attractions include buildings, parks, amusement parks and entertainments. The situation of artificial attractions in Lahore is as under:

4.3.1.1 (a) Smart Buildings. One public sector project of Parks and Horticulture Authority (PHA) is the National History Museum that was dedicated by Citizen Archive of Pakistan (CAP). It is located at Greater Iqbal Park.

Other than that, few buildings that are considered as the smart buildings and attractions of Lahore, are among them, which includes the tallest building of Lahore, Arfa Software Technology Park, but it is not open for public or tourists. Similarly, there are few other innovative attractions built privately by citizens that do not come under tourist places, but it holds the future potential of ICT innovation in Lahore.

4.3.1.1 (b) Amusement. In 2017, a Greek investment group, LEEAD Consulting, agreed to make an investment of $621 million in a Disneyland-esque amusement park for Lahore. It was planned to include water aquarium, state-of-the-art rides and a thrilling rollercoaster. The park site was to be built on an area spanning 600 acres between Sagian and Kot Abdul Malik areas, near River Ravi, while the Parks and Horticulture Authority (PHA) would have been the local executing agency of the project. This project could not be realized with the change of the federal and provincial governments.

4.3.1.2 Heritage Attractions. There is no historic immersion project considered up till now, though WCLA has developed Virtual 3D tours of Royal Trail, Shahi Hamam,

Masjid Wazir Khan, Hazoori Bagh, and Haveli Soorjan Singh for their websites to attract the tourists. Its links are also shared online to develop an interest of tourists to visit these places.

4.3.1.3 Special Events. In Lahore city, there is not an immense flow of tourists or other gatherings that may need some crowd control sensors, but PSCA usually controls all the gathering, rallies, protests and some important special events through the cameras installed in the city. Furthermore, PSCA uses Unmanned Aerial Vehicle (UAV) to provide support to the PPIC3 Centre when the installed resources e.g. CCTV cameras do not have the coverage of the area where an incident is ongoing or when surveillance is required of a covert nature.

4.3.1.4 Attraction Management. In 2016, TDCP, with the help of a private consultant, identified 480 potential tourism sites across the province. Among those sites, 41 are categorized as potential/explored, 132 historical, 27 cultural, 119 religious, 188 recreational and 18 unexplored tourism sites. Among them, 58 tourist sites are in Lahore which makes provincial capital the best tourism destination of Pakistan. All 58 touristic sites are organized on a web application software named as "Punjab Destination Software." Each site contains the google map attached with its precise geographical coordinates and its pictures taken at that time. In addition to that, all the sites have complete details about the distances from the big cities, the mode of transport to access those places and if there are all the important ancillaries including banks, shops, hospitals, postal services, etc. available within the 2 Km radius of the site. This software is not regularly updated.

4.3.2 Smart Accessibility

Smart accessibility is divided into two types namely, physical and digital mobility.

4.3.2.1 Physical Mobility. Physical Mobility includes different aspects of public transport, geo-location, elements for elderly and disabled, different aspects related to traffic management and public safety. The details about each of the elements are given below:

4.3.2.1 (a) Public Transport. The whole city of Lahore is connected through the Speedo Bus service. This bus service was introduced after the Lahore Metro Bus Service project in Lahore. These buses are also called feeder busses because they feed the whole Lahore city with buses to and from Metro Bus service that runs from Gajju Matta to Shahdara. The next transport project is Orange Line Metro Train, which would run from Ali Town with the second stop being Thokar Niaz Baig to Dera Gujran. In the next phase, feeder buses will feed the buses from both the Metro services to all parts of Lahore, connecting almost all the parts of the city. (Attaching the route maps of Both METRO projects)

Nazim a bus attendant told that we have wheelchair lifts in all metro busses and speedos. When a disabled passenger comes, the bus is stopped aside, we establish the system properly to pedestal his chair on the bus. It may take 2-5 minutes to do that. But the bus had to take that passenger on the bus. He told that this type of passenger comes once in a day or sometimes in a week. But we always accommodate such passengers on our buses.

In Lahore, though tourists do not usually use public transport to access tourist places, and on the other hand, public transport was never considered as a supply element of tourism. But still, there is enough transport at all the tourist spots in Lahore that can be accessed through Metro bus or Speedo bus service.

4.3.2.2 (b) Geo-Location System. PITB developed Rasta App, that provides real-time geolocation information. It is customized and built for Lahore. It contains many other features like important places of Lahore, traffic advisory, route planning, traffic complaints, emergency calls and others. Basically, this application was not built for the tourists but the common citizens of Lahore. Because it also addresses other agendas of government like e-challan payment and its record check, information about the driving license, information about driving school, and driving test center.

4.3.2.3 (c) Disabled and Elderly. In all the public transports of Lahore, there are always few seats reserved for the disabled and elderly. Furthermore, there is an indigenous culture of leaving seats for the elderly and disabled, pregnant women, and the people carrying small children. But there is a difficulty for the disabled using wheelchairs to

access Metro and Feeder busses, due to unavailability of elevators at Metro bus stations and Wheelchair carriers at Feeder buses for boarding on and off for people.

4.3.2.4 (d) Traffic management. PSCA Intelligent Traffic Management System, through which real-time data is collected and changed into useful information that is communicated through the apps and radios and road screens. The traffic management system is smart enough to divert the traffic towards other roads or manage it intelligently by communicating the burdened roads situation with the traffic wardens who then communicate with each other to control the traffic in a better way. But it has been discussed earlier that Lahore does not have much flow of tourists that needs certain planning about the traffic routes and certain roads that lead towards the tourist sites. Though when such a need would arise in the future, the system has the capacity to perform the same function on the tourist routes according to the need.

Lahore Parking Company (Le Park) launched a pilot project of e-ticketing at the liberty market in Lahore. This was done with the collaboration of PSCA. The purpose of this project is to ensure, safety and security of parked vehicles and keeping track of the vehicles being parked at the parking lots in the city. But there is no certain real-time parking information providing project in pipeline for the city.

4.3.2.5 (e) Public Safety. After the completion of the PSCA project in Lahore, the whole city is being monitored with the help of 10,000 cameras installed at all the entrances and exits of Lahore, at VVIP routes, public places, crime hot spots and key infrastructure sites, public institutions and markets. Therefore, almost every activity happening in the main areas of Lahore is being monitored on the big screens in the PSCA centers, which has a quick coordination mechanism with the Quick Response Forces, that can respond within minutes. Therefore, in terms of security and safety, Lahore is completely safe for the coming tourists.

4.3.2.2 Digital Mobility.

4.3.2.2 (a) Free Wi-Fi Connection at public spots. The PITB has set up free Wi-Fi hotspots at educational and government buildings, public parks, marketplaces, hospitals, railway stations, airports and bus stations throughout the city, that gives (The PITB has set up 200 free Wi-Fi hotspots in Lahore, Rawalpindi, Faisalabad, Multan, Bahawalpur and Murree districts.).

The aim was to empower the citizens through technology and bridging the digital divide across the city by providing free internet access. This wi-fi facility easily connects the tourists to the internet, with which they can access the required necessary information.

4.3.2.2 (b) Promotion through Social Media and Websites. When it comes to the promotion of Lahore through websites and local fan pages, both public and private stakeholders operate their websites run their social media pages to promote Lahore and its tourism through the advertisement of their packages and put their post-tour pictures in website galleries or post them at their online forums. But all of this is done in an individual capacity by each stakeholder involved.

4.3.2.2 (c) Mobile Applications. There is no dynamic tourism application for Lahore. Though an application was developed in 2014 namely Locally Lahore. But this app is static and is not updated anymore.

Locally Lahore App covers up following key things:

- The largest database of local places and point of interests
- Explore, what's around you within specific proximity area
- Knows what’s happening in your city with updated events listings; of exhibitions, conferences and in-cinemas
- Check listings based on your category that you are looking for
- You can subscribe, check-in, mark as visited or rate and review to any place
- See POI details, location, photos, ratings, reviews and directions as yellow pages or a business directory

- Mark your liked places as favorite places
- See Featured Listings
- See Promotional Businesses and Products
- Categorized business and points of interest listings with contact information
- Quick action sheet to check-in, call or favorite that place

4.3.2.2 (d) NFC Tags and QR Codes. PITB started using smart cards containing NFC tags. The first instance in line was the introduction of smart cards for the metro bus service in Lahore. Those smart cards were then also extended to the Speedo bus service. The second instance was the introduction of smart cards for the registration of vehicles. This contains the complete information of the vehicle and its owner. It makes it easy for the traffic wardens to verify the details of the vehicle and check the expiry date of the token tax. This also helped the citizens in easily carrying an identity of their vehicle that can be presented to the law enforcement agencies on demand.

Though the QR Codes are being used for different purposes, an important example of which is the specific QR Code assigned to each e-Stamp paper. But there is no instance in which tourism is making use of it.

4.3.2.2 (e) Information Services. With the installation of safe city infrastructure, one of the components was the installation of road panels to display updated information about the traffic and other safety guidelines. The Lahore traffic police RASTA FM 88.6 is also used for this purpose.

4.3.2.2 (f) IoT. No such sensors and actuators have been installed at any tourist place.

4.3.2.2 (g) Recommendation Systems. No such recommendation systems are available.

4.3.3 Smart Amenities

Smart amenities mainly include natural and built amenities and their management. In Lahore, no work has been done on smart aspects of amenities.4.3.3.1 Natural Amenities.

Natural amenities that include EMS, has not been considered by PSCA. Still, the data is being collected through the Pakistan Meteorological Department (PMD) sensors, radars and satellites.

4.3.3.2 Built Amenities. Built amenities that include hotels and restaurants, their bookings, its promotions and feedback system, proactive hospitality network and public-private partnerships.

4.3.3.2 (a) Hotel and restaurant. In hotels and restaurants, the systems are manually working, and there is no CRM, being used. Mostly, tourists have to book hotels on calls. But there are few cases, where for example the Pearl Continental hotel has a facility of online booking system on its website. It is being operated through a third party i.e. Booking.com

4.3.3.2 (b) Control system. There is absolutely no CRS.

4.3.3.2 (c) Content management. No integrated CMS system is available.

4.3.3.2 (d) Innovative public-private network. The government of Punjab passed "The Public-Private Partnership Act 2014" that also included the tourism sector to be explored through the public-private partnership. This mode of tourism development in Punjab didn't yield any good for the tourism industry. But this mood is available for private investors to put investments into the tourism industry. One of my respondents Muhammad Raza, Manager Youth Tourism Wing, TDCP is investing in the projects in which private investors feel shy. Our projects will surely give them the courage to invest their money through PPP. One of the respondents from TDCP also told that there came some cases of PPP where the private investors were found in mischiefs and their main purpose was to get government facilities like land or rest houses and TDCP has filed cases against them. Other respondents told that now all the partnerships are done carefully, and the projects are completely monitored in different phases by P&D. Add the PITB Development Projects monitoring System??? (To cater the word Innovative)

4.3.3.2 (e) Hospitality network. No ICT based hospitality network is available.

4.3.3.3 Amenities Management. No Amenities management mechanism is available.

4.3.4 Smart Ancillary

4.3.4.1 Bank. In smart ancillary, banking services include smart banking and payment systems specific to tourists.

4.3.4.1 (a) Smart Banking. Mobile banking is the most common example of this banking that is developing very fast in Pakistan. The almost 72% of the population of Pakistan that is a mobile phone user, has the potential to trigger smart banking in the near future.

According to the State Bank of Pakistan, smart cards and mobile phones have increased up to nearly 1.4 million which indicates the transition in the financial sector of Pakistan due to the latest technology solutions. The number of mobile wallet accounts of Easypaisa and Omni has increased to 1.60 million which has the potential to increase from 2% to 35% by 2020 (PAS, 2019).

Typically, one of the main ancillaries, on which other consumption of tourism depends is the financial transaction of tourists that should be accessible and convenient to them. The mobile phone banking, especially through wallet accounts, has been increased due to the increase in the point-of-sale (POS) terminals that opened in each nook and corner of every Muhalla in the city. Also, with the presence of free wi-fi across the city, smart banking has now become relatively easy in Lahore city.

4.3.4.1 (b) Payment system. As described above, there are payment systems available in the market, but there is no specific system that could make transactions easy for tourists.

4.3.4.2 Postal Service. No such support is available.

4.3.4.3 Medical Service. This includes the geolocation of the available medical facilities in the area, smart management of medical history of visitors, and developing specific information and guidelines, with the risk profiles of these visitors.

4.3.4.3 (a) Medical geolocation. Not tourists centered, but formerly discussed RASTA app can be used.

4.3.4.3 (b) Medical history and treatments apps. No such system is there, to collect the medical history of visitors and tourists.

4.3.4.3 (c) Medical tourism information. No such information is provided to the tourists.

4.3.4.4 Local Communities. Like many cities, Lahore also consists of population, mainly from the middle class. Most of the population carry smartphones, among whom young generations are quite smart in using these technological gadgets. So overall, the citizens of Lahore are mostly smart.

4.3.4.5 Citizen Journalism. With the advent of ICT in the lives of the people, citizen journalism is also increasing, disseminating the news of the activities in the city. People are doing this job by themselves, but there is no collective collaboration among the citizens and tourists in Lahore.

4.3.4.6 e-Culture. No such intervention has been done.

4.3.4.7 Feedback. There is no electronic complaint system for tourism available.

4.3.4.8 Ancillary Management. Ancillaries are not being centrally managed.

4.3.5 Smart Activities

Smart Activities include the MICE tourism activities, dynamic access to the leisure opportunities and activities management.

4.3.5.1 Business-MICE. The business MICE model is being used on a small scale. Embassies and consulate staff, delegations and others use to visit as a tourist. But that involves much of diplomatic efforts. A proper MICE opportunity needs to be explored.

4.3.5.2 Leisure. Leisure includes access to the information related to activities, that are openly available to all, and the management of the available local activities.

4.3.5.2 (a) Quick Access to third-party leisure source. There are many websites that give details of the activities going on in the city. Among them in https://allevents.in is efficiently doing the job. It is being operated from Gujarat, India. They hire locals from each city, called ambassadors, who collect events information from them. The company offers Event Ticketing Solution, to the event organizers.

Similar to that, there is a local Pakistani company http://bookkaro.pk/ that book the tickets of a night tour offered by WCLA with the name 'History By Night'.

4.3.5.2 (b) Open data. Data about the events is open on the internet. But there is no collaboration among different stakeholders, organizing, managing and attending the events.

4.3.5.2 (c) Nature and adventure management. No DMS is developed until now.

4.3.5.3 Activities Management. As discussed above, managing the activities going in the city could help in presenting customized alerts as per the interests of the attendees. For that centralized activities management system is missing.

4.3.6 Smart Available Packages

In smart tourism, packages include transport, accommodation and services packages and their co-creation.

4.3.6.1 Transport package. No such package is in demand for Lahore.

4.3.6.2 Accommodation package. No such packages are available due to less influx of tourists.

4.3.6.3 Service package. Both government and private companies offer their packages through their social media platforms. But the tourists contact them manually through phone calls to book their tours.

4.3.6.4 Co-creation package.

4.3.6.4 (a) Chip-based Smart Tourist Card. High-level technological support is needed for that, which is not needed in Lahore.

4.3.6.4 (b) End-user Internet service systems management. There is not much need for that.

4.3.6.5 Package Management. No systematic way of package management is available in Lahore.

4.4 Tools Needed for Smart Tourism in Lahore

4.4.1 Management Systems

As described above, Lahore has developed a lot of management systems in different areas of life. Regarding tourism, these six management systems must be considered.

4.4.1.1 Attraction Management System. Attraction management includes the information management of the tourist sites, and up to date feedback on the issues that are reported by tourists and other stakeholders.

As described in 4.2.1, TDCP destination management software, that could be made more dynamic so that it could manage the attractions in a participative and collaborative way through public-private organizations, citizens of the destination and tourists.to enhance management capacities.

4.4.1.2 Accessibility Management System. To enhance and facilitate the accessibility of the sites, management protocols must be designed. The systems could retrieve the data of traffic from the roads and the tourist sites and provide real-time information for tourists through recommendation systems. This management system could also help the tourists and the commuters to take the optimal routes to reach certain spots. There must also be an efficient management system for parking spaces in the city. This information must be accessible using up-to-date mobile applications.

4.4.1.3 Amenities Management System. To facilitate the tourists with amenities, management of different aspects must be considered. To care for the natural amenities, the site environment data could be gathered through local administrations or through a management system as slightly applied in the case of Lahore Waste Management Company (LWMC) (Lee, 2011). To facilitate the tourist and analyzing their demands and choices, Customer Relationship Management systems (CRM) must be developed that could gather and analyze the data of hotels and restaurants. This could be accompanied by Central Reservation Systems (CRS) and be promoted through B2B & B2C marketing system.

4.4.1.4 Ancillaries Management System. To manage the ancillaries in the city, the information must be sensibly organized and presented to the tourists to help them in urgent need. Regarding the health of tourists visiting Lahore, the dangers of pollution and especially smog in the city in the winter season must be communicated so that they may not face serious risks. If the tourists' personal health profiles are incorporated into the systems, the personal health recommendation system can also be developed. Furthermore, there must be a complaint and feedback system for the tourists that could register and forward their complaints immediately to the concerned department to be addressed on an urgent basis.

4.4.1.5 Activities Management System. To keep the profile of each activity in the city, efficient activities management system must be developed. This must also be done with the public and private organizations that organize activities in the city.

The data must be open and accessible for various other stakeholders that play their role considering their economic endeavors and contribute to those activities through their professional services. Furthermore, third-party sources could be used to manage such activities timetable, travel planning and event ticket reservations.

4.4.1.6 Available Packages Management System. To give all the tourists all the customized tourism packages for Lahore, a centralized system must be available. This system could be categorized based on all the demands factors that vary from tourist to tourist. The data of such packages would not only give different choices to the tourists but build competition among the stakeholders to strive for better services for their customers. This system should be accessible and managed with the collaboration of public and private organizations and must be accessible at various platforms to the tourists, whether on mobiles or websites. The packages like transport services would also help save time and money for the tourists and decreasing the consumption of energy in the city by avoiding traffic jams.

4.4.2 Web and Mobile Applications for Tourism

In her paper Gretzel (2012) looked at various applications relating tourism. She divided them in to seven different categories: Navigation, Social, Mobile Marketing, Security/Emergency, Transactional, Entertainment, and Information (Figure 4.6). In the navigation, the apps that fall under that category was in some way helping the visitors to find the ways in the areas of their visit. In its sub-categories, there were Global Positioning System (GPS), Augmented Reality (AR) and other methods to find ways. The mobile apps that come under the social category includes the apps that include the sharing, collaborations and communications part, with some other social ingredient in them. Its most obvious part is the social media outlet, where visitors share their experiences through various media like pictures and videos, and recommend others to visit this site. This tool also helps in the indirect marketing of the destinations. This category also involves other ways of communication like texting and audio and video calling.

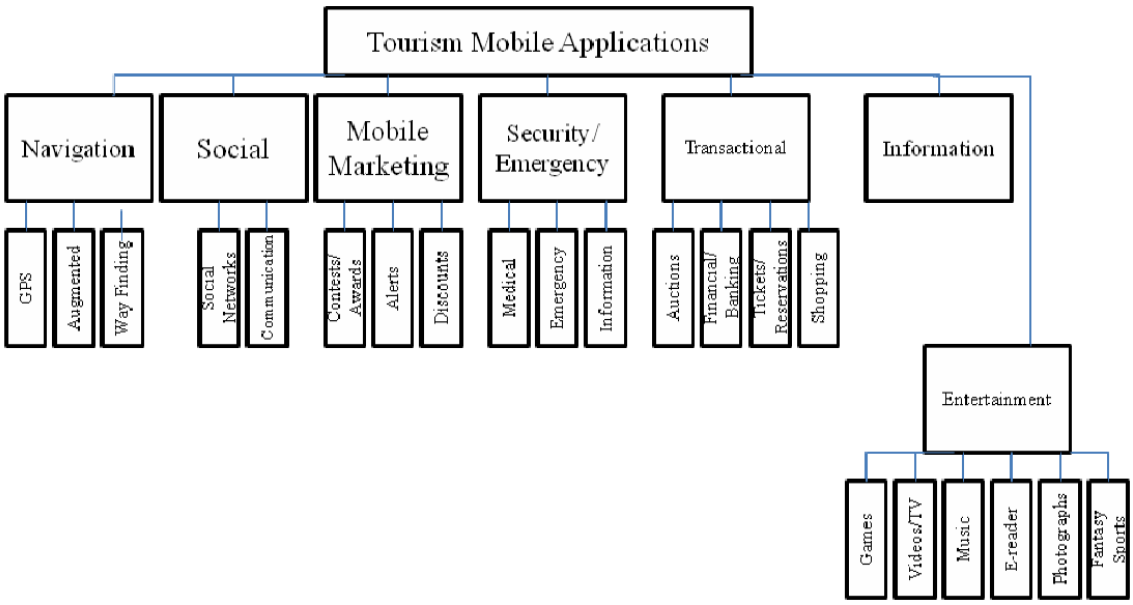


Figure 4. 7: Tourism Mobile Applications (Source: Kennedy-Eden, 2012)

There are also some apps related to mobile marketing, that help the visitors to receive free coupons for contests and other marketing advertisements for better tour packages. Security and emergency apps help the visitors to get in contact with all the necessary tools in the form of geo-locations of important places and updates and alerts in cases of bad weather and situations at the tour destinations. In its sub-category, medical reporting, emergency services and emergency information are included. In the transactional apps' category, there are apps that help in some type of transaction of money between a visitor and market, and it subdues the role played by the money exchanges. The different kinds of transactional apps are auctions, financial/banking, tickets/reservations, and shopping. Entertainment apps provide entertainment options like games, movies, e-readers, etc. Some of the apps stated above seems to have no role in tourism activities, but they help a tourist while he is on vacation at that tourism destination. Entertainment is separated into categories of games, videos/television, music, e-reader, photographs/editing, and fantasy sports. The information classification contains apps that give guests a variety of information related to tourism. This category contains a vast array of information sources, from a general information search to self-guided tours without GPS, event schedules, translator/conversion apps, etc.

4.4.3 Enabling Smart Environment

4.4.3.1 Wi-Fi. The key usage of wi-fi that a smart destination needs is connecting the destination with the internet around the city. It enables the e-governance and help in automation of the public and private institutions. The high-speed internet hotspots established around the destination helps citizens and visitors to engage themselves in various activities. This internet connectivity is promised at all major points in the city. Open Wi-Fi has economic, social, environmental, educational, and safety benefits. Free Wi-Fi is a beneficial economic development tool that can be used by tourists and travelers. Free Wi-Fi also makes it appealing to residents to be outside in public places, which in return stimulates the economy; furthermore, it benefits emergency services as Wi-Fi networks are used to aid rescue workers. Open Wi-Fi is simply a win-win solution, as it supports the growth of new businesses, virtual learning, and mobile entertainment; in addition, the city can make a use of its wide wireless infrastructure to build the IoT.

4.4.3.2 Ambient Intelligence (AmI) for STDs. Ambient Intelligence paradigm means creating an environment of electronic sensors and actuators, that could sensitize the and respond to speech and gestures, thus talking to its surroundings. The main purpose of generating intelligence in the ambiance is to build a level of abstraction by manipulating the technology. This conceals the actual technology from the common public and provides them to interact with the user-friendly environment, that could automate and enhance their experiences. AmI builds upon advances in sensors and actuators, their networks, pervasive computing, and artificial intelligence.

There are three of these tools that could create ambient intelligence, QR codes, RFIDs and NFCs. Each of these tools has different characteristics and can be employed in various dimensions to achieve an intelligent environment.

4.4.3.2 (a) QR Codes. Quick Response (QR) Code is a two-dimensional matrix, first designed in 1994 for the automotive industry in Japan. It can save more data than a normal barcode, which can only save products' certain information. A QR code can be scanned through any smartphone that has a camera on it, a QR code reader/decoder and a network connection. The QR codes are widely used in video streaming, online menus, advertising campaigns, linking to websites, and signing up to pages. QR Codes have a well-constructed error correction scheme that allows recovery of damaged codes up to 30% of the damage. The QR code orientation is usually managed and adjusted automatically by the QR code reader. The only limitation on reading the code is the reading distance.

In the tourism sector, QR code can be used in establishing virtual stores in and outside a destination, where anyone can purchase a product by scanning a code that is linked with that picture, and the product would be delivered to its physical address.

QR codes have been used to establish "virtual stores", where a gallery of product information and QR codes is presented to the customer, e.g. on a train station wall. The customers scan the QR codes, and the products are delivered to their homes. This use started in South Korea, and Argentina, but is currently expanding globally. Walmart, Procter & Gamble and Woolworths have already adopted the Virtual Store concept. Similarly, in other ways, QR codes can also help in storing bank account information that could ease specific transactions and in loyalty programs in stores.

4.4.3.2 (b) RFIDs. Radio-frequency identification (RFID) uses electromagnetic fields to automatically identify and track tags attached to objects. There are two types. Passive tags are powered by energy from the RFID reader's interrogating radio waves. Active tags are powered by a battery and thus can be read at a greater range from the RFID reader, up to hundreds of meters. Unlike a barcode, RFID tag doesn't need to be within the line of sight of the reader, so it may be embedded in the tracked object. The RFID tag can be affixed to an object and used to track and manage inventory, assets, people, etc.

Several studies have been proposed for the development of smart environments applied to the tourism sector. Combining RFID and Bluetooth technologies is used for

user navigation in indoor scenarios like Museums, real traffic, transportation services, tourism guides, commerce, etc. Other proposals use GPS technology supporting the user navigation in the city or other outdoors scenarios, or augmented paper map with RFID Tags. Facebook is using RFID cards at most of their live events to allow guests to automatically capture and post photos.

Similarly, RFIDs are also used in transportation systems to monitor and manage and tax traffic through RFID-based toll collection, vehicles at highways. Contactless

Group name	Example
Human tracking and control systems	E-passport (UK Home Office, 2006) Customer loyalty management (Capizzi and Ferguson, 2005) Tracking children or people with special needs (Konkel et al., 2004) Airport security (Feder, 2004; Cerino and Walsh, 2000) Amusement park (Kelly, 2006)
Assets and valuables tracking systems	Luggage tracking (Fung et al., 2007) RFID-tagged casino chips (Gellatly, 2005) Food and beverage management (Swedberg, 2006; Roberti, 2007)
Contactless payment systems	Toll collection system (Blythe, 1999) RFID-tagged public transport cards (Hassan and Chatterjee, 2006) Payment in hotel (O'Connor, 2006) Keyless room entry (O'Connor, 2006)
RFID-based information	Museum (Raptis et al., 2005; Fuschi et al., 2005) Shopping street (Foroohar et al., 2004)

Figure 4. 8: RFID Application and Examples in the Tourism Sector (Source: Öztayşi, 2009)

payment systems, including contactless billing and paying, are also one of the main applications of RFID in tourism. Similarly, libraries can replace barcodes with RFIDs, so that a member could access the database with its passcodes.

4.4.3.2 (c) NFCs. NFC is a standards-based, short-range wireless connectivity technology that lets different devices communicate when they are in close proximity. It is

based on RFID (Radio Frequency Identification). NFC enables simple and safe two-way interactions among electronic devices, allowing users to perform contactless transactions, access digital content and connect devices with a single "touch". In other words, NFC is a mobile device with RFID technology. NFC has also the ability to write information onto the RFID-chip. This opens up for features like door authentication, transit authentication, payment or even getting downloaded trailers or information from a Smart Poster.

NFC offers a simple solution based on the "touching paradigm" where users touch with their NFC device to everyday life objects augmented with visual marks and RFID Tags with the aim of trigger the intelligent services offered by those objects.

Figure 4. 9: An example of a Smart Poster in the touristic area (Source: Borrego-Jaraba, 2010)

Several studies and prototypes have been proposed for the development of smart environments applied to the tourism sector. Combining RFID and Bluetooth technologies are used for user navigation in indoor scenarios like Museums, real traffic, transportation services, tourism guides, commerce, etc. Other proposals use GPS technology supporting the user navigation in the city or other outdoors scenarios, or augmented paper map with RFID Tags. A user could design its own routes making use of a set of intelligent objects (Smart Posters) augmented by RFID Tags with information about localizations where the tourist could visit. The touristic information is shown to the user with different shapes and details, localization and navigation through different points of the scenario are provided through maps real-time downloaded. Answers to "what is this?", "where am I?", "where

it is?", "What is there nearby me?" etc., are given to the user in an intuitive, quick way and without any previous manipulation of the mobile device by the user. The proposed solution is based on the user of Smart Posters with text and visual information corresponding to the places where they are located. The Smart Posters spread up in touristic areas are formed by a set of Tags associated with each visual element of the Smart Poster, which offers the user different touristic services and information.

Chapter 5

Discussion

5.1 Synthesizing the Frameworks

The impact of ICT is evident in the tourism industry of Lahore. The ICT infrastructure that developed in the last two decades brought a lot of transformations in Lahore. At all levels from Pakistan IT Policy 2000, to the establishment of NADRA in the same year, revitalization of PITB and development of Safe City Lahore took Lahore to the level of Smart City. In this chapter, the findings of the previous chapter are categorized into three sections, and three new frameworks have been developed. These frameworks will act as the constituents of the new updated conceptual framework (Figure 5.1).

The first decade of 21st century, helped in promoting IT in Pakistan which includes the formation of IT Policy and implementation plan, and the establishment of NADRA to digitalize the National Database of Citizens. Both parts of this phase were Federal level projects and their impact came throughout Pakistan. It leaves no doubt that this induction of IT in important areas of life in Pakistan lead to the growth of ICT and prepared the ground for the expansion of IT in later years. In the next phase, the solutions to social issues were sought out by applying ICT solutions. On one hand, PITB developed solutions for e-Governance and deployed hardware and software infrastructures to digitalize and automate the systems of the public sector institutions. On the other hand, PSCA looked at the safety and security issues at priority list and connected different agencies of the emergency institutions under one umbrella of PPIC3 and started controlling traffic through ITMS. The private sector played a vital role in the spread of ICT based services. To get itself updated with the emerging trends of market, a lot of new entrepreneurs came forward and done amazing works. For example, Vanilla Arcade, that build advances in Virtual reality made it possible to realize the dream of building the first digital museum of Pakistan. Similarly, a lot of entrepreneurs came forward as a result of incubation centers of PITB and other private venture capitalists.

The part of the conceptual framework (Fig 2.3), can be updated with the new framework, which shows the ICT development in different phases. The addition to the

framework is made in the part of the framework where ICT interventions were discussed in Fig 2.3 (j). So, it started from the National IT Policy and NADRA in 2000 at the country level, PITB at the provincial level and Lahore Safe City Authority at the City level (Figure 5.2). ICT interventions done at the all levels developed Lahore into a smart city that has digitalized its governance systems altogether, whether in education, health, law and order, automating the government facilities for the public and fuelling disruptive innovation (that is a lot more crucial in the advancement of technology), and making it accessible for every segment of society (Figure 5.3).

The tools and infrastructure that have developed along the process can be divided into two sets of layers one is Database Systems (DBS) and the other is Application Layer. In the DBS layer, DBMSs were developed and in the Application layer, Facilitation centers and mobile Applications were developed (Central two rings

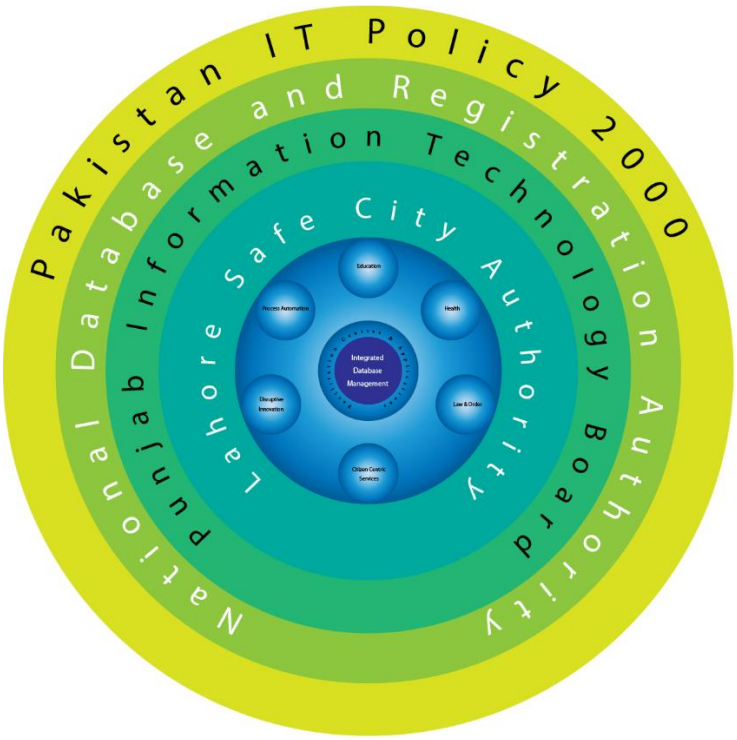


Figure 5.1: Conceptual Framework New Part (Figure 2.3 (j)) - ICT Interventions driving Lahore towards Smart City

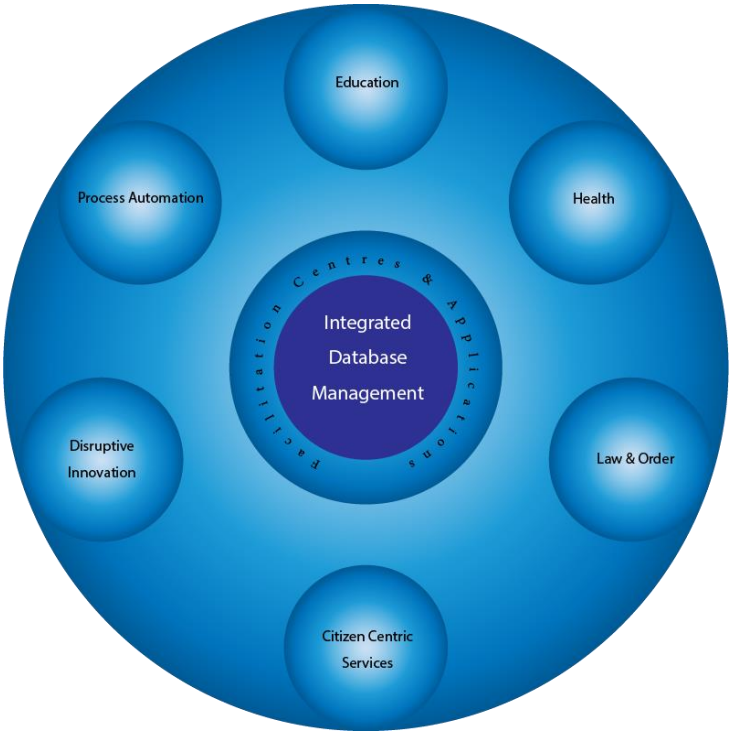


Figure 5.2: Tools for Smart City Lahore and Its Application for Better Governance

of Figure 5.2). These both layers hold the actual capacity that can serve for the smart tourism development in Lahore.

The representation of the second framework is done in the form of a simple table (Figure 5.3). In this table, we could look at the situation of tourism in Lahore, after the IT interventions, that were made up till now. Since this research is qualitative, this seems illogical to quantify the availability of IT infrastructure availability for tourism in Lahore, but its actual purpose is to give a rough insight that about how much Smart 6As are available in Lahore.

The Figure 5.3 shows that the out of the total of 9 indicators of Smart Attractions, 7 are available. Out of total 21 indicators of Smart Accessibilities, 15 are present. Out of 8 indicators of Smart Ancillary Services, only 3 are available. Out of 12 indicators of Smart Amenities, just 3 are present, and out of 7 indicators of Smart Available Packages, only two are present in Lahore. So, combining the numbers, out of total 57 indicators, 30 are currently available in Lahore. While others are partially available or totally absent. This table are the abstract form of Smart As Availability framework in Lahore, is made the part of STDs framework. This table is attached to the STD framework (Figure 5.1 (d)) on the left side of it. It must be considered as present situation of STD infrastructure in Lahore.

Smart As	No. of Indicators	Availability
Smart Attractions	9	7
Smart Accessibility	21	15
Smart Ancillaries	8	3
Smart Amenities	12	3
Smart Available Packages	7	2
All As	57	30

Figure 5.3: Smart As Availability in Lahore (Screen Shot)

The second framework, that would be attached to the right of the STD Framework part is the Smart Tourism Tools framework for Lahore (Figure 5.4). This framework

shows that three types of tools must be deployed in Lahore, Management Systems, Smart Applications for Tourism and Smart Environment. Under Management Systems, all six management systems for the management of Attractions, Accessibility, Ancillaries, Amenities, Activities and Available Packages must be developed for Lahore. Secondly, mobile and web applications related to navigation, social media, mobile marketing, security and emergency, transaction, information, and entertainment should be developed. Last but not the least, Lahore must develop its Smart Environment that could support the whole set of infrastructures of all stakeholders of the tourism industry. For this to happen, free Wi-Fi hotspots must be maintained at all key areas of Lahore. Furthermore, the use of QR Codes, RFIDs and NFC Tags must be inculcated in various areas of life, to ease and automate the systems throughout the city.

If this framework (Figure 5.4) is smartly applied in the Lahore, there is no doubt that Lahore could carve its way to be the first successful Smart Tourism Destination of South Asia.

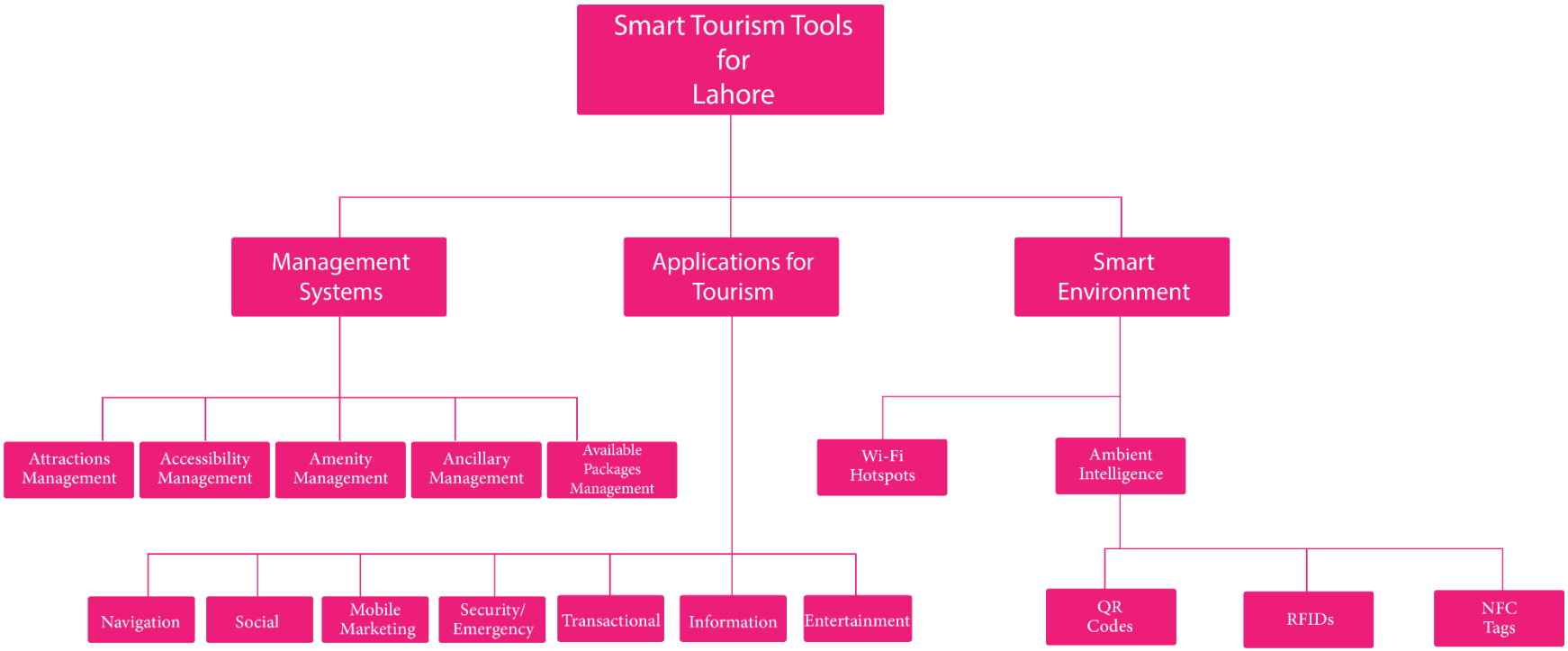


Figure 5.4: Smart Tourism Tools for Lahore

5.2 Updated Conceptual Framework

The conceptual framework (Figure 2.3) is presented in an updated form (Figure 5.5). Information and Communication Technologies block is added with one framework (Figure 5.5 (a)) and STD Framework 57 Indicators is added with two frameworks (Figure 5.5 (e)) on the left side and (Figure 5.5 (g)) on right side of the block.

Figure 5.5: Updated Conceptual Framework (Source: Author)

Figure 5.5 (a): ICT Block (Slanted View)

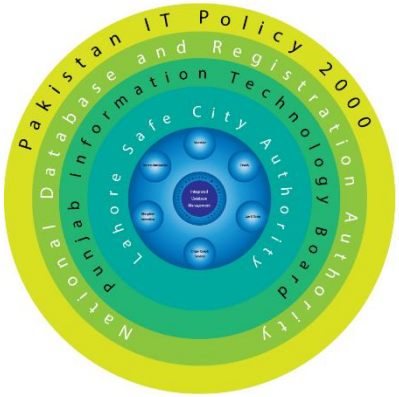


Figure 5.5 (b): ICT Interventions (Right Side View)

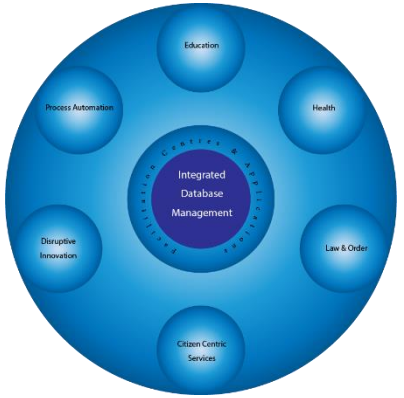


Figure 5.5 (c): Impact of ICT Interventions on Lahore

Figure 5.5 (d): STD Framework (Slightly left Slanted View)

Smart As	No. of Indicators	Availability
Smart Attractions	9	7
Smart Accessibility	21	15
Smart Ancillaries	8	3
Smart Amenities	12	3
Smart Available Packages	7	2
All As	57	30

Figure 5.5 (e): Availability of Smart As in Lahore

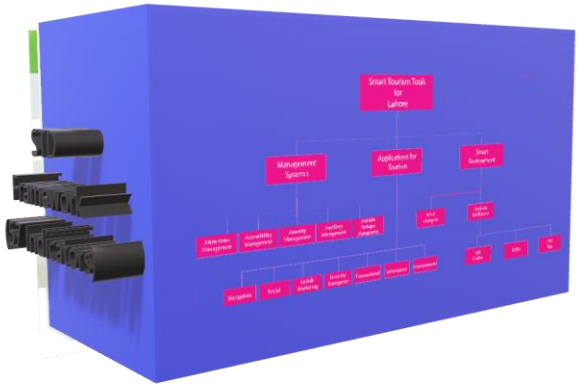


Figure 5.5 (f): STD Framework (Right Slanted View)

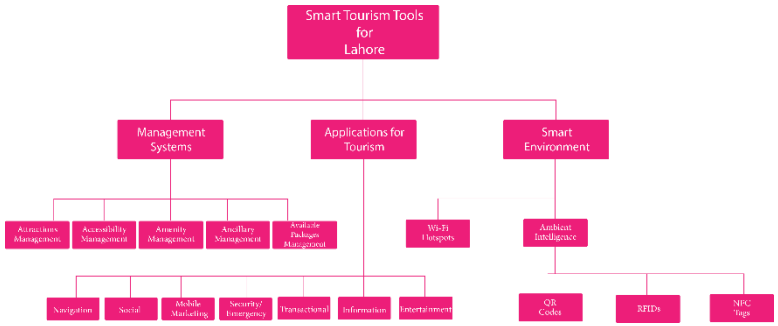


Figure 5.5 (g): Smart Tourism Tools for Lahore

5.3 Conclusion

The impact of the technological evolution on tourism in forthcoming years configure a new management scenario for tourism destinations that could favor the development of true smart destinations. The ICT infrastructures developed in Lahore can help in developing smart solutions for tourism demand and supply. This requires better knowledge of the technological evolution and its impact on tourism in order to adapt the new solutions and management of the destinations. This research has made clear connections that how technological push has not only helped in developing the solutions for the tourism industry but can go a lot further if both stakeholders, government and private sector focus on the potential industry of tourism waiting to intervene in Lahore.

5.4 Significance of the Research

There is no doubt, that every ICT based project initiated in Lahore was based on some necessity that arose at that time. But what were the general needs and demands of the society that are asking for ICT based interventions as a supply, here in our case, the tourism supply based on ICT infrastructure; there was a need to be identified.

5.5 Limitations of the study & Recommendations for Future Research

One of the major limitations of the study is that It is not inclusive for the poor and the ones who do not know, how to use smart devices. Secondly, the officials who were the actual interventionist, who were on my list of key informants, were out of their official government positions now, or they were not easily accessible (though their documentations including their articles, discussions, presentations and important interviews were analyzed). The third limitation was that of the time given to the research. Though it tried to cover many areas of interventions but detailed study interviewing the interventionist and disruptors could serve in listing out the applications and information centers that could be needed in Lahore. I recommend following, the 57 indicators framework of Tran et al. (2017) while doing the detailed work on smart tourism interventions that are needed.

5.6 Future Areas of Study

Two areas must be considered for doing further studies in this area:

- Technology adoption and acceptance model to Push & Pull people towards Technologies
- Estimating the economic cost of the projects and its returns in the long term.

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Appendices

Appendix A: Availability of Traditional 6As of Tourism Destination

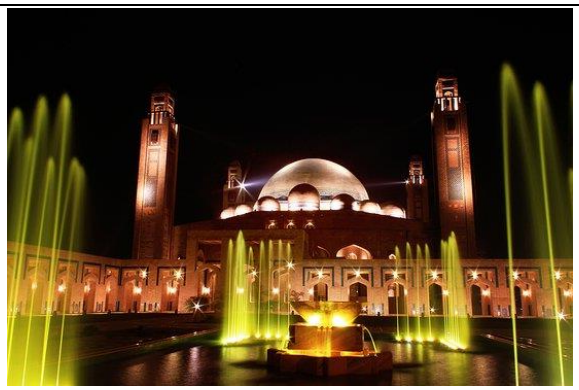
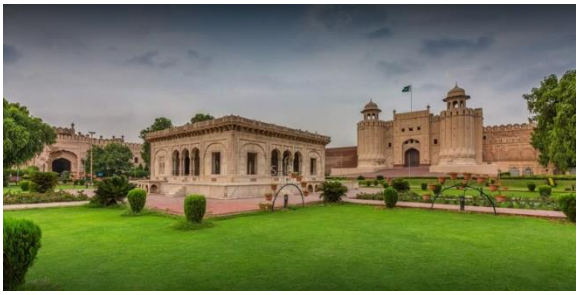
The following 6As of tourism destination that I am calling as traditional were as discussed earlier, taken from Buhalis (2000), that are considered fundamentals for any tourism destination. Since Lahore is an old thriving city, it has amenities and ancillaries in it. In the following, I am detailing about traditional attractions, traditional accessibility services, traditional tourism packages and traditional activities that are present in Lahore.

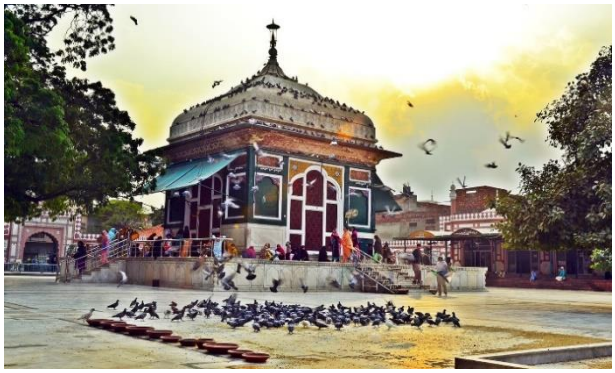
Attractions

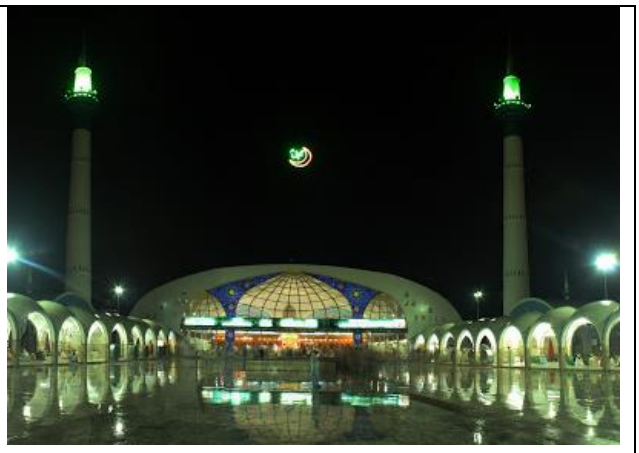
There are 58 tourist places in Lahore, that ranges from historic to cultural, religious, entertainment shopping, gastronomic and nightlife.

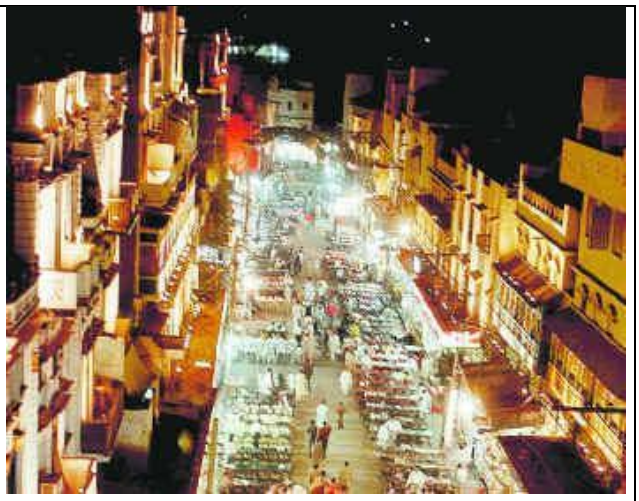
1	Abdur Rehman Chughtai Museum	
2	Allama Iqbal Museum Lahore	

3	Anarkali Bazar	
4	Bab-e-Pakistan	
5	Badshahi Mosque	

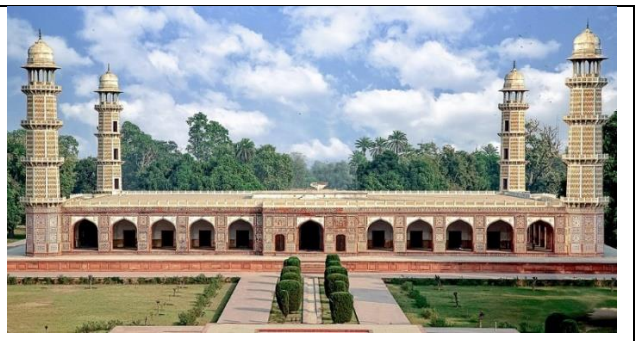
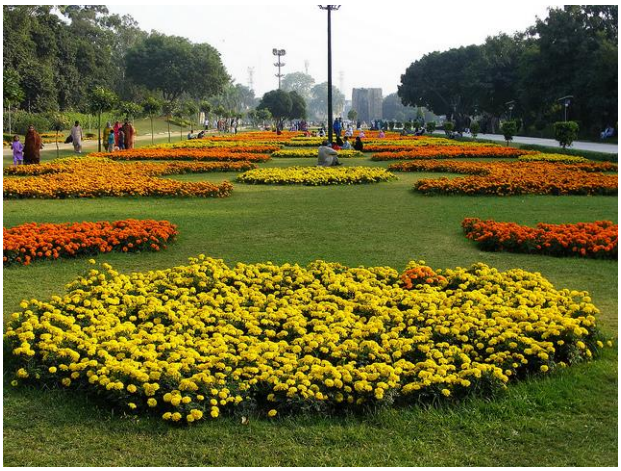
6	Bagh e Jinnah Lahore	
7	Bahria Town Masjid Lahore	
8	Bara Dari and Hazuri Bagh	
9	Cathedral Church	

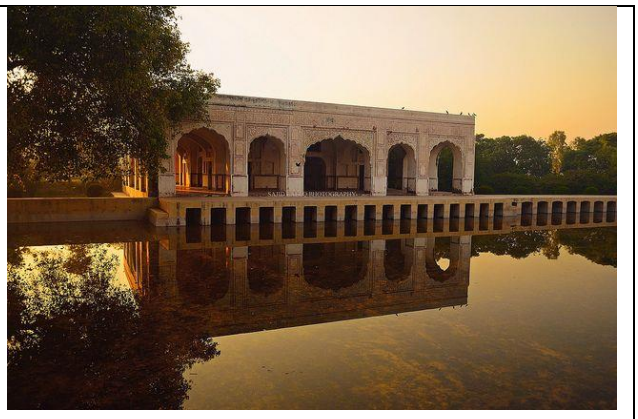
10	Chauburji	
11	Dai Anga Mosque	
12	Darbar Mian Mir	

13	Data Darbar	
14	Eiffel Tower Lahore	
15	Faqir Khana Museum	

16	Food Street Lahore	
17	Fortress Stadium	
18	Gaddafi Stadium	
19	Gates of Lahore & Walled City	

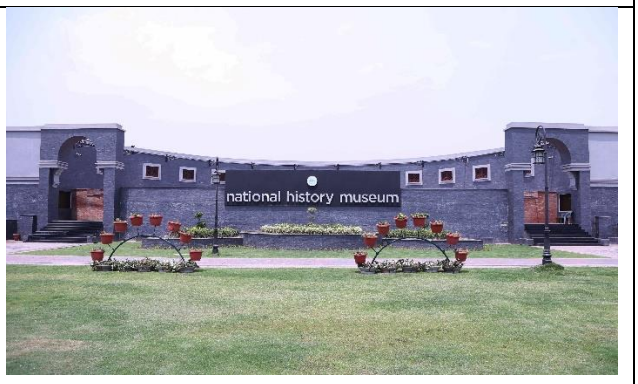
20	Ghazi Ilmuddin Shaheed Mazar	
21	Gurdwara Dera Sahib	
22	Iqbal Tomb	
23	Islamic Summit Minar	

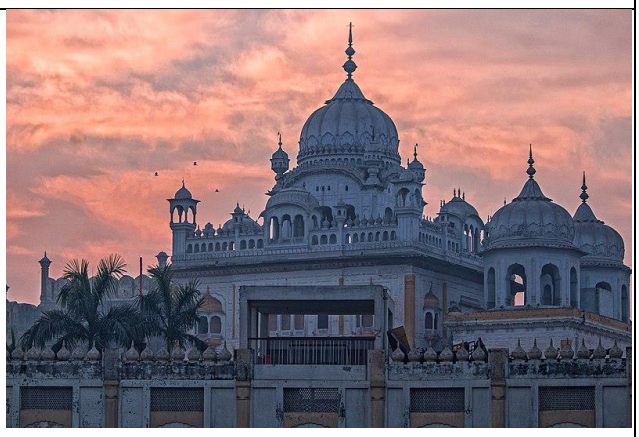
24	Jahangir Tomb	
25	Jallo Forest Park	
26	Jam e Shrin Park	
27	Jellani Park	

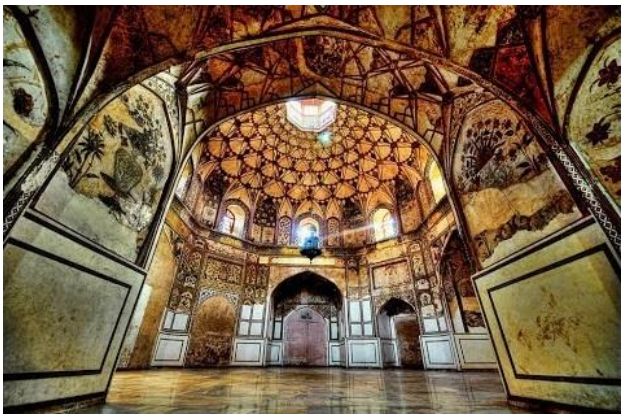
28	Kamran's Baradari	
29	Kims Gun - Zamzama	
30	Lahore Buddu Tomb	
31	Lahore Country Club	

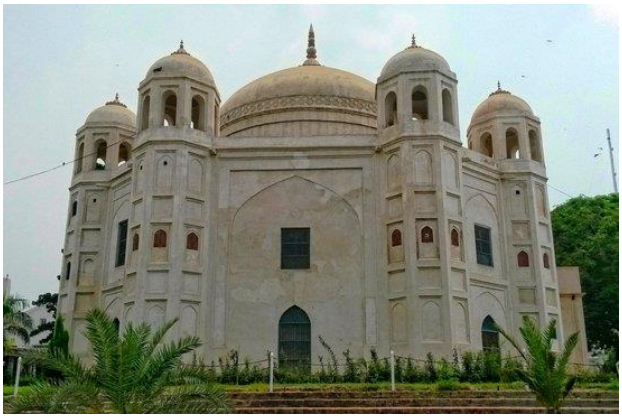
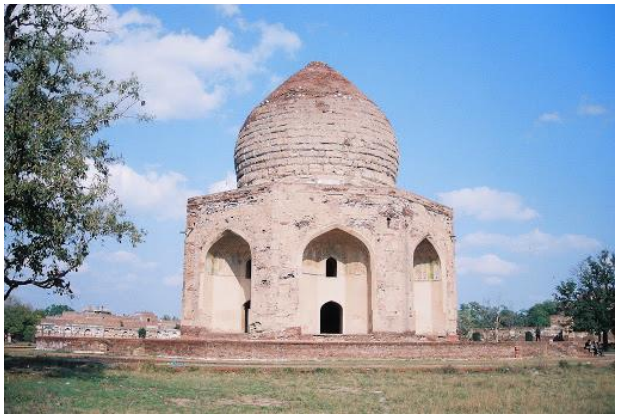
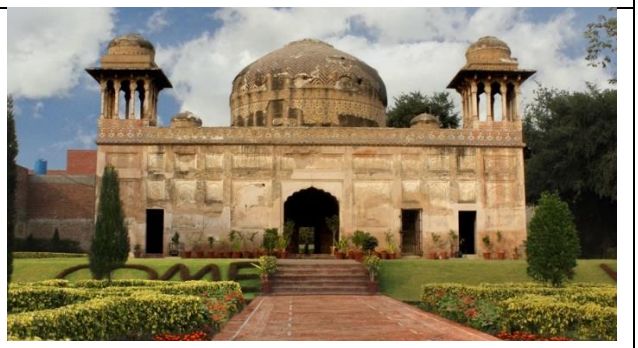
32	Lahore Fort	
33	Lahore Heritage Museum, Tollinton	
34	Lahore Museum	
35	Lahore Railway Station	

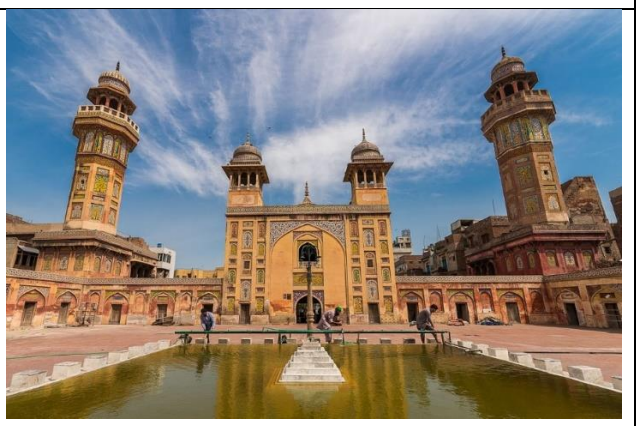
36	Lahore Zoo	
37	Lahore Safari Park	
38	Major Shabir Sharif Shaheed	
39	Masjid e Shuhada	

40	Minar e Pakistan	
41	National History Museum	
42	National Museum of Sci & Tech.	
43	PIA Planetarium	

44	Punjab Public Library	
45	Quaid e Azam Library, Lahore	
46	Samadhi Ranjit Singh	

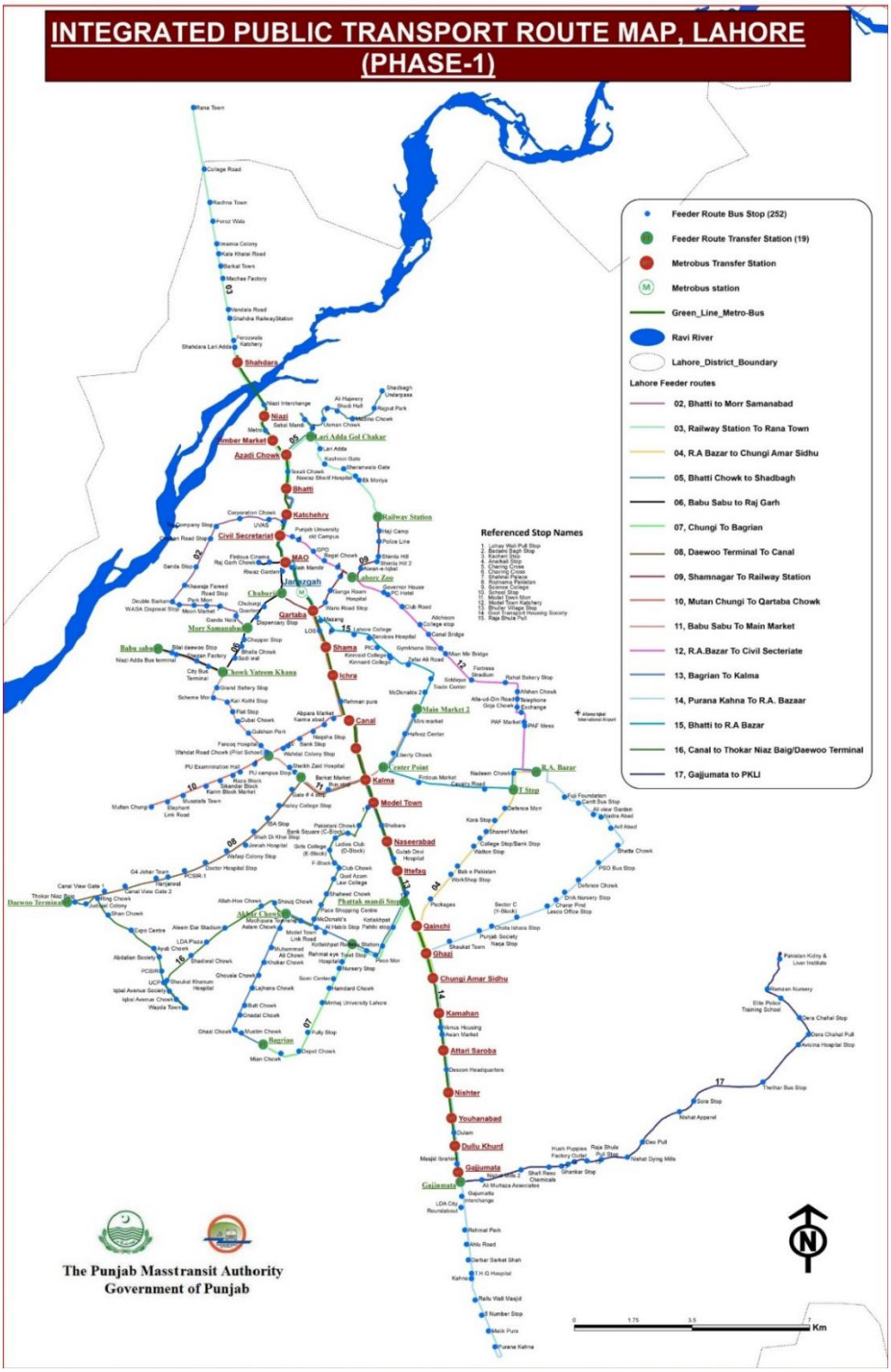
47	Shahi Hamam	
48	Shalimar Bagh	
49	Sozo Water Park	
50	Sunehri Masjid Lahore	

51	Tomb of Anarkali	
52	Tomb of Asif Khan	
53	Tomb of Dai Anga	
54	Tomb of Noor Jahan	

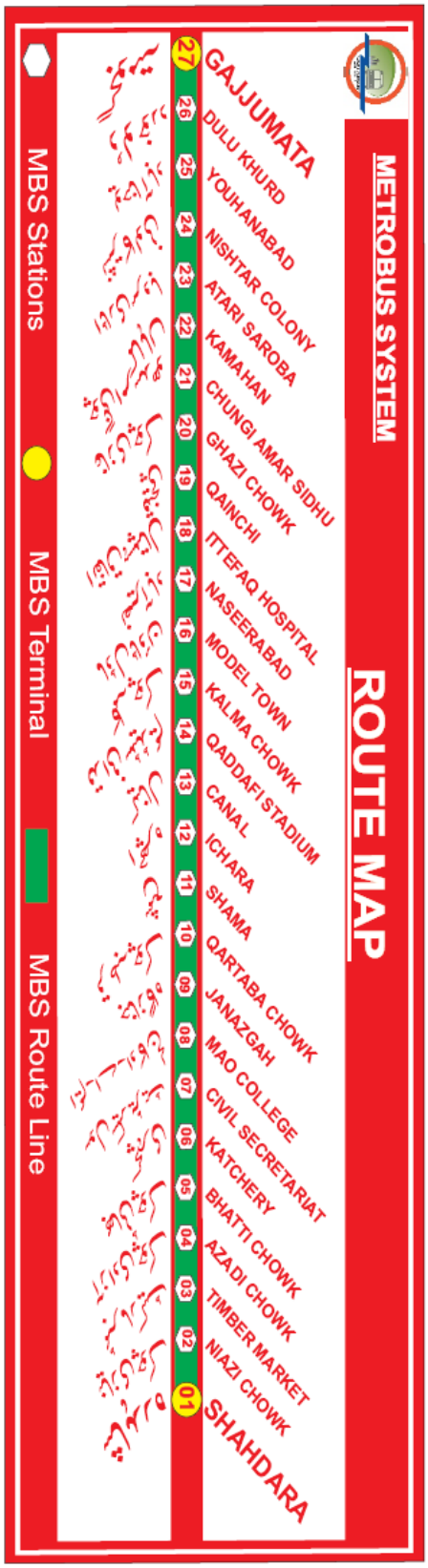
55	Tomb of Qutb-ud-Din Aibak	
56	Wagah Border	
57	Wazir Khan Mosque	
58	3rd Battalion 1965 War Monument	

Traditional Accessibility

There is a Metro Bus Service (MBS) in Lahore. An Orange Line Train is almost ready. Both connects Lahore with the help of feeder bus services. Maps of the routes are given below.



Route 1: Integrated Public Transport Route Map, Lahore (Phase-I)



Route 2: Metro Bus Service (MBS) Route Map

Route 3: Metro Bus and Orange Line Track Routes

Traditional Available Packages & Activities

TDCP Packages

TDCP is conducting two regular activities. One is the tour of Historical Monuments, which is done by picking up the tourists from the big hotels. The other is Lahore Sightseeing Bus.

Packages 1: TDCP Lahore City Tour

Packages 2: TDCP Sightseeing Lahore Bus Service

WCLA Packages

Walled City has its office at Delhi Gate entrance. It provides free guided tours with some paid guided tours facility. One key program that WCLA conducts every Friday is History by Night. The broachers are attached below.

Androon Lahore, a mystic Walled City confined within thirteen gates and thirty feet high wall, originated more than a thousand years ago. The city we see today remained a stage of Hindu Barahman Civilization, Ghaznavid Empire, Mongols, Khiljis, Tughlaqs, Lodhis rule. The city witnessed seasons of turbulence, peace, tranquility, cultural festivity, conquests, devastations and destructions during 1500 to 1900 AD. The Mughals gave it splendor; Sikhs occupied Lahore till the British took it over in 1849.

The partition of 1947 brought huge demographic changes. The culture, traditional architecture depleted and memories of the ancestors faded. The glorious heritage transformed into a sprawling commercial hub. Encroachments, commercialization, conversion of traditional architecture into new brick and mortar, traffic congestion, noise and environment pollution, issues of parking and dilapidated infrastructure took away the ancient relic.

In such conditions, the Government of Punjab, Pakistan, established the Walled City of Lahore Authority (WCLA) in 2012 - an autonomous body with its laws for the preservation and rehabilitation of the Walled City.

The Guided Tours is one of the initiatives by the WCLA to revive the lost glory of the Walled City and showcase our glorious heritage and culture,especially the "Royal Route Shahi Guzar Gah from Dehli Gate to Kotwali, where a major rehabilitation work has been conducted i.e infrastructure of the streets and facades of the shops and houses. Come and experience the traditional architecture and pulsating life of Walled City.

Texali Gate

DURATION OF TOUR

Delhi Gate to Wazir Khan Chowk – 1.5 hrs
(Distance 383 meters)

Delhi Gate to Fort Road – 3 hrs
(Distance 1.6km)

Walled City of Lahore Authority
Now Offers

FREE

Guided Tours of Royal Trail

MAKE YOUR OWN PACKAGE

AVAIL OUR TOUR ADD - ONS (EXTRA CHARGES PER HEAD)

Buggy Rides – Rs. 2500
Breakfast – Rs. 650 (per person)
Lunch – Rs. 875 (per person)
Dinner – Rs. 1000 (per person)
Cultural performances – Rs.225 (per person)

FOR YOUR INFORMATION:

- Parking facility available outside Delhi Gate.
- The guided tour is a walking route; vehicles will be parked at designated parking area.
- Duration of the tour maybe increased if you wish to shop during the tour.
- Prefer wearing walking shoes during the tour and bring your water bottle.
- You can design your own menu for meal/s.
- We facilitate in Tours By Choice
- Photographers are available

BOOK YOUR TOUR NOW!!!

54 - LAWRENCE ROAD, 2ND FLOOR,
IMDAD BILQUEES BUILDING, LAHORE

TOURS@WALLEDCITYLAHORE.GOP.PK
FACEBOOK.COM/WALLEDCITYLAHOREAUTHORITY

CONTACTS:
042 99204239 042 99204196 0300 4350693

Walk through the Royal Trail!

FREE

Guided Tour inside the Walled City of Lahore

Dehli Gate to Lahore Fort

Packages 3: WCLA Guided Tours

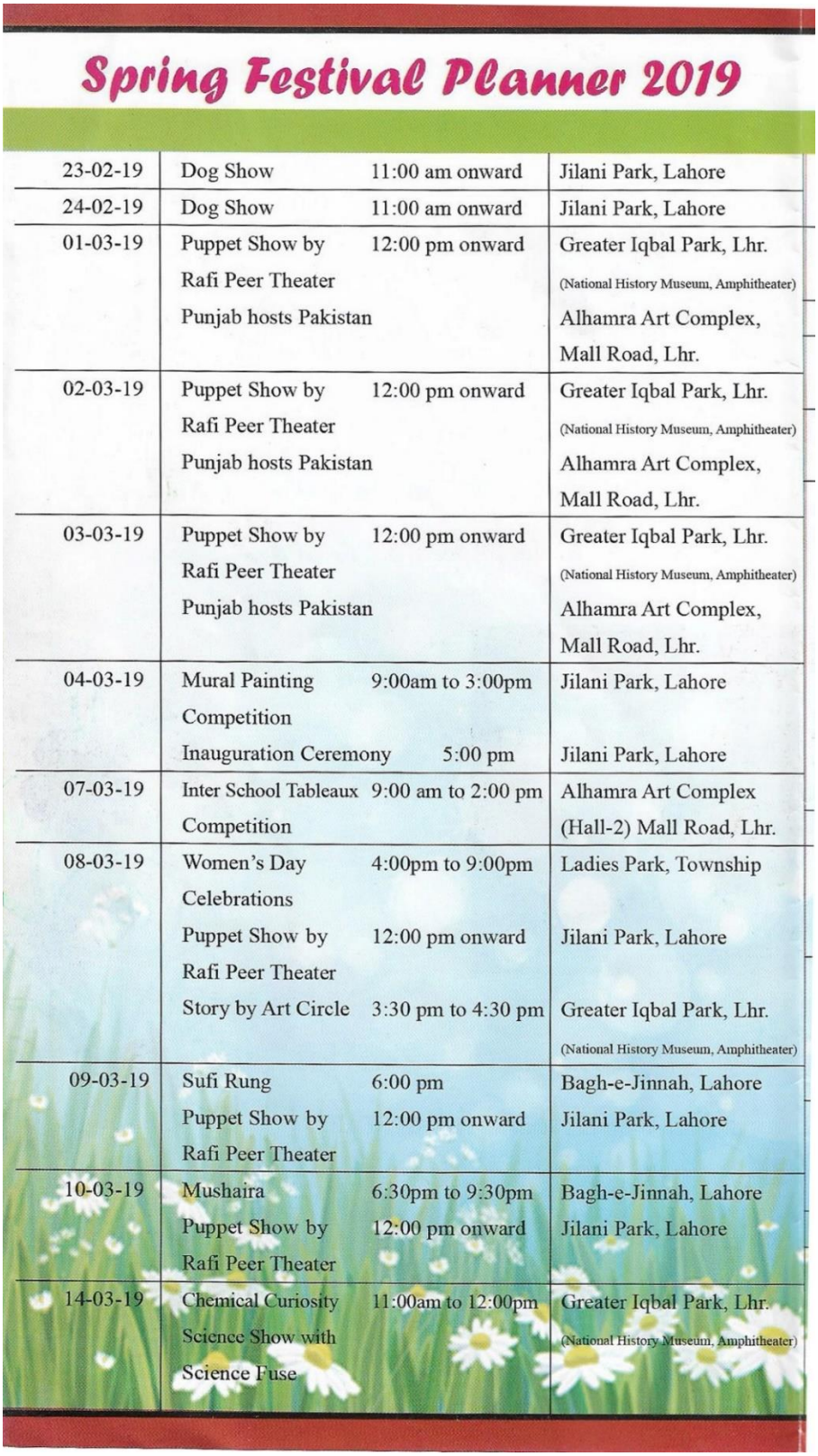
Packages 4: TDCP History by Night

Private Tour Operators Packages

Packages 5: Adil Lahorei Cultural Club

PHA Activities in Lahore

Packages 6, 7, 8: PHA Annual Events Schedule (A)



Spring Festival Planner 2019

23-02-19	Dog Show	11:00 am onward	Jilani Park, Lahore
24-02-19	Dog Show	11:00 am onward	Jilani Park, Lahore
01-03-19	Puppet Show by Rafi Peer Theater Punjab hosts Pakistan	12:00 pm onward	Greater Iqbal Park, Lhr. (National History Museum, Amphitheater) Alhamra Art Complex, Mall Road, Lhr.
02-03-19	Puppet Show by Rafi Peer Theater Punjab hosts Pakistan	12:00 pm onward	Greater Iqbal Park, Lhr. (National History Museum, Amphitheater) Alhamra Art Complex, Mall Road, Lhr.
03-03-19	Puppet Show by Rafi Peer Theater Punjab hosts Pakistan	12:00 pm onward	Greater Iqbal Park, Lhr. (National History Museum, Amphitheater) Alhamra Art Complex, Mall Road, Lhr.
04-03-19	Mural Painting Competition	9:00am to 3:00pm	Jilani Park, Lahore
	Inauguration Ceremony	5:00 pm	Jilani Park, Lahore
07-03-19	Inter School Tableaux Competition	9:00 am to 2:00 pm	Alhamra Art Complex (Hall-2) Mall Road, Lhr.
08-03-19	Women's Day Celebrations	4:00pm to 9:00pm	Ladies Park, Township
	Puppet Show by Rafi Peer Theater	12:00 pm onward	Jilani Park, Lahore
	Story by Art Circle	3:30 pm to 4:30 pm	Greater Iqbal Park, Lhr. (National History Museum, Amphitheater)
09-03-19	Sufi Rung	6:00 pm	Bagh-e-Jinnah, Lahore
	Puppet Show by Rafi Peer Theater	12:00 pm onward	Jilani Park, Lahore
10-03-19	Mushaira	6:30pm to 9:30pm	Bagh-e-Jinnah, Lahore
	Puppet Show by Rafi Peer Theater	12:00 pm onward	Jilani Park, Lahore
14-03-19	Chemical Curiosity Science Show with Science Fuse	11:00am to 12:00pm	Greater Iqbal Park, Lhr. (National History Museum, Amphitheater)

Packages 6, 7, 8: PHA Annual Events Schedule (B)

Have Fun!

15-03-19	Stage Drama	7:30 pm to 9:30 pm	Greater Iqbal Park, Lhr. (National History Museum, Amphitheater)
16-03-19	Stage Drama	7:30 pm to 9:30 pm	Greater Iqbal Park, Lhr. (National History Museum, Amphitheater)
17-03-19	Bird's Show	12:00 pm onward	Jilani Park, Lahore
19-03-19	Cut Flower Competition	10:00 am onward	Jilani Park, Lahore
22-03-19	Fire Works & Lantern Show	11:55 pm onward	Greater Iqbal Park, Lhr.
23-03-19	23rd March Ceremony	3:00 pm	Greater Iqbal Park, Lhr. (National History Museum, Amphitheater)
	National Song Competition	3:00 pm onward	Greater Iqbal Park, Lhr. (National History Museum, Amphitheater)
	Band Parade	4:00pm to 6:00pm	Greater Iqbal Park, Lhr. (National History Museum, Amphitheater)
	Suno Kahani Meri Zubani	3:30pm to 4:30 pm	Greater Iqbal Park, Lhr. (In National History Museum)
	Vintage Car Show	12:00 pm onward	Liberty Parking, Lahore
24-03-19	Cat Show	11:00 am onward	Jilani Park, Lahore
28-03-19	Spring Flower Show with Instrumental Performance	10:00 am onward	Jilani Park, Lahore
29-03-19	Mughal-e-Funk Concert (A Collaboration with Rearts)	6:00 pm to 9:00 pm	Greater Iqbal Park, Lhr. (National History Museum, Amphitheater)
	Mela Shaher Lahore Andar		Royal Trail inside Dehli Gate
30-03-19	Ikhtelaaf-e-Raaye (Young v/s Old Debate)	5:00 pm to 7:00 pm	Greater Iqbal Park, Lhr. (National History Museum, Amphitheater)
	Mela Shaher Lahore Andar		Royal Trail inside Dehli Gate
31-03-19	Mela Shaher Lahore Andar		Royal Trail inside Dehli Gate

Exclusive Mela:

Mela Chiraghan (One Week Festival)

Nov. Every Year Crescent Flowers Gul-e-Dawoodi

Packages 6, 7, 8: PHA Annual Events Schedule (C)

Appendix B: List of Applications developed by PITB

Application Developed by PITB
Management
Crop Reporting System
Centralized Barber & Salon License
BHU LHV
PESSI-SSO
NPRP (National Patient Referral Program)
Traffic Status
Customs Anti Smuggling
Franchising Application PWD
NAVTTC
PHF Loaning
Evaluation System
FDE School Monitoring
Anti Dengue Third Party Validation
FDE School Monitoring
PEC Examination Monitoring
KPIs Assessment
PWD Monitoring Application
MEA SAAF PUNJAB
Monitoring of Polio Campaign
Smart Evaluation
AEO Classroom Observation
MEA Secondary Health
Synergy Evaluation System
LND Official
LND Public
School Security
Rescue 1122 Monitoring System
PSSP School Monitoring
MEA Health
PMIU School Monitoring
SAAF PUNJAB IRIS APPLICATION

Services
Lahore Biennale
Nigeria Hajj Guide
PakHajj Guide
Hospital Information System
Punjab Wifi
Punjab Police Khidmat (Service)
VSWA Tagging
eGadget
Tracking & Surveillance
MEA PWD
Brickkiln Attendance
AQI EPD
HNCCT
LWMC Waste Collection
Centralized Drug Sales Licensing
LHW
IRRIGATION WATCH
CRVS
MACS Tertiary
DSS (Disease Surveillance System)
NHMP Ticketing System
Lahore High Court
Punjab Crime Mapping
MACS
Punjab Anti Dengue
Mandi App
PakHajj Muavin
Qeemat Sialkot
ePay
Agri Smart
Price Magistrate
AMIS Punjab
SIS Punjab
e-Khidmat Maraakaz
Qeemat Punjab

eLearn App
Rasta
PITB eFOAS
Monitoring
CMS – ISL Club
Election Monitoring Dashbaord
Punjab Spot Pricing
WASA CMS
Child Labour
Awaz e Khalq
DVR
Pest Scan
Ham Watan
Labbaik Bhakkar
School Education Reforms
Punjab Hospital Feedback

Appendix C: PITB Systems Thematic Categorization

Integrated Management Systems

One of the major works that PITB did developing the Integrated database management systems. Those systems were developed on-demand or due to the realization of the need. These databases were made to electronically facilitation to the concerned department, where they are used and updated simultaneously. The following were the databases and their electronic facilitation that was done by PITB.

Database Management

1. Electronic Medical Information Management System
2. BHU Clustering
3. Ensuring Health Service Standards Through MEA Health
4. Maintenance and Cleanliness System
5. Punjab Police HR Management Information System
6. Computerization of Police Stations
7. Criminal Record Management System
8. Tenant Registration System
9. Prisons Management Information System
10. School Information System for Public Schools
11. PITB Data Centre
12. Punjab Floods Disaster Management System
13. Data Warehousing
14. Smart Food Licensing System for Punjab Food Authority
15. Bulldozer Booking Management System
16. Driving License Information Management System
17. Domicile Management System
18. Complaints Management for Overseas Pakistanis
19. Anti-Corruption Case Management System

e-Facilitation

1. Drug Testing Laboratory Automation
2. Electronic FIR
3. Criminal Identifier
4. IG Khuli Kacheri (8787)
5. Automation of Lahore High Court
6. Smart Police Facilitation Centre
7. Motor Vehicles Registration
8. Call Data Records-Based Crime Analysis
9. Punjab Police Toolkit
10. Measuring Student Learning Outcomes – Cost Effectively
11. Automation of Large-Scale Examination Systems
12. College Admissions – Online, Not In-line!
13. e-Learn Punjab – Localized Ed-Tech Solutions
14. e-Filing and Office Automation System

15. PITB's Videoconferencing Facility
16. e-Payment Gateway
17. Automated Fare Collection
18. Ease of Doing Business (Registration Portal)
19. IT Based Profiling
20. Transport Department Automation System
21. Punjab Online Procurement System
22. Imparting ICT Based Trainings to Civil Servants
23. Punjab Residency Programme
24. Job Portal
25. Improving Web Presence for Government
26. Agriculture e-Credit Scheme
27. Potassium and DAP Subsidy
28. Wheat Procurement
29. Kissan Card
30. Modern Farmer Extension Services Through AgriSmart
31. Agriculture Market Information Application
32. e-Khidmat Markaz
33. Revamping of Stamp Duty Collection Through e-Stamping
34. Citizen Contact Centre
35. e-Challaning and e-Testing in Punjab
36. Benazir Income Support Programme
37. Waseela-e-Taleem
38. National Highway and Motorway Police Ticketing System
39. Hajj Operations: End-to-End Automation

Tracking & Surveillance

PITB also developed tracking and surveillance systems for various departments. It helped in taking care of serious issues that emerge in the province. The following were the systems that were developed:

1. Tracking Vaccinators
2. Disease Surveillance System
3. Dengue Tracking System
4. Medicine Procurement
5. Hotel Eye
6. Anti-Vehicle Lifting System
7. Legal Disputes Tracking System for Punjab Police

MEF

To improve the governance in the province, PITB helped the government by developing Monitoring, Evaluation and Feedback MEF Systems. The MEF systems were developed in the following areas:

1. Biometric Attendance System for Health Facilities
2. Monitoring System for Polio Campaign

3. Drug Inspection and Monitoring Evaluation System
4. Health Watch
5. Crime Mapping
6. CTD Geotagging
7. Beat Book for Punjab Police
8. Citizen Biometric Verification System
9. Real-time Monitoring of Public Schools Across the Punjab
10. Smart Monitoring of Development Projects
11. Restaurant Invoice Monitoring System
12. Fertilizer and Pesticide Monitoring System
13. District Management Price Control
14. Citizen Feedback Monitoring Programme

Disruption & HR Development

No city can be developed into a smart city with mere the government interventions. The government works with the private stakeholders to develop innovative solutions for the cities. Government provided necessary supply to various stakeholders in the form of ICT infrastructure and technical and legal support to the grow the potential out of the youth. PITB provided various platforms to address the issue. To develop human resource and providing opportunity to the entrepreneurs was done with the following projects:

1. Province-Wide Connectivity of the Punjab
2. Imparting ICT Based Trainings to Civil Servants
3. Punjab Free Wi-Fi Hotspots
4. Plan9
5. Herself
6. PlanX
7. TechHub Connect
8. Chief Minister's e-Rozgaar Training Programme
9. Arfa Software Technology Park (ASTP)
10. Peaceful Pakistan

Application Development

To provide the customized solutions with the user-friendly application is a serious effort done by PITB. The list of the applications for various departments helped them in maintaining their procedures, keep track on their activities and monitoring and evaluation of the work at hand.

Appendix D: Case Studies of PITB Projects

Digital Reforms in Governance

In the web series "Digital Punjab Web-Series Ep1" Dr. Umar Saif said:

"In any country, government reforms are an extremely difficult process. Government is a complicated machinery which include different departments, persons and processes. In the countries like Pakistan, the problems of the government, are difficult, problematic and complicated, so they do not have superficial solutions that could be resolved overnight. IT can help in modernizing the government and its governance, by bringing efficiency and transparency in it and making life easier for the citizens."

How Technology Helped Fight Dengue

"In 2011, there came an epidemic of dengue in Punjab, at that time, the then chief minster Punjab, call upon all stakeholders, ministers, secretaries at early in the morning at 6 a.m. and ask them, what they and their ministries are doing in prevention for dengue. So, in one meeting, there were being present, some photographs of the work being done for dengue prevention and containment, where someone was doing spray, or the chemical was being mixed in some water lakes to kill the dengue larva, and the tires were being shred and cleaning was being done, so that no dengue could hatch at those places, so there came a photograph, where there was no timestamp, at which chief minister stopped and asked about the timestamp, then he called my attention and asked me to make some mechanism through which It could be possible to asses that the event pictured, happened at the same time and same place as being described and present me that system tomorrow morning. I went back to my office, and we kept on working the whole night to develop an application for the smart phones and present it to the chief minister the very next morning. This application was able to timestamp each picture and the GPS location would determine the exact location on which the picture was taken. We started this project in 2011, after 5 years, 10.7 million dengue prevention activities were recorded and uploaded with GPS and timestamp. This platform helped chief minister to track and review our work being done for the epidemic. We started innovating more things in to it. So whenever a dengue patient comes in a hospital, a team goes to his house and tag their house with GPS tagging. Similarly, the dengue larva, Aedes aegypti, and tag their spots too. This helped us analyze that at what places this epidemic is spreading and where the dengue mosquito is hatching eggs and in result of which, where are the chances that dengue could spread in that region. This intelligent and sophisticated system help us built reports that help us put our efforts at precisely hit and potential places. This system helped government of Punjab to take over the epidemic of dengue in very less time."

Analysis: This dengue epidemic case was the first case in which for the first time, a system of time stamping pictures along with their geographical location was developed overnight. That system was very simple but so much effective that the epidemic that took over the whole Lahore and their was panic in every house in the city, was now under complete observation. After that the similar system was incorporated in other projects to improve their efficiency and effectiveness.

Police Automation (Reforming Thana Culture)

In a web series "Digital Punjab Web Series Ep3 (Part1)" Dr. Umar Saif described:

"There is a lot of discussion about thana culture in Pakistan, that the citizens hesitate to go to thana due to difficulties. Thana culture consists of two things, one that a person taking its complaint to thana, be addressed and their FIRs be registered, and the other side of the coin that the FIR being registered are being registered against the enemies to take some type of revenge.

Government developed two systems to cater these problems. One was the front desk or complaint system. So when you will enter a thana, even before meeting Muharar, you will enter your complaint in to the front desk. It can be considered as computerized report, to which police will be asked for; either they have to change it into an FIR or to dispose of, but in both cases, it would be necessary for them to tell the system, complete details about the decision made.

The second big work was the computerization of 26 registers of thanas. In these 26 registers, the first register one is the FIR register, and the other registers are equally important, such as the asset recovery register, or who is in the lockup, how many weapons are available, who are the repeat offender in the boundary of this thana etc. These registers are also important to maintain electronically, because they are the part of the thana culture."

Analysis: This system ended up not only the old thana culture but put a new efficient culture in to practice. Where citizens do not hesitate to go to the thanas due to cumbersome processes. This system was quite lengthy and took a lot of effort and time to implement, but it helped to put a bigger eye on the whole picture of what is going inside the Thanas around Punjab.

Digitalizing Criminal Record Office

In a web series "Digital Punjab Web Series Ep3 (Part 2)" Dr. Umar Saif described:

"There were a lot of discussion on media, that there should be an online system to register an FIR sitting from home. Online FIR is not possible because Code of criminal procedure 1898 (CrPC), in which section 154-173 which deals with the FIR, which declares it compulsory for the police that if an FIR is registered against a person, he/she would necessarily be arrested, money should be recovered, and bring that person before the court. So if it is allowed to file an FIR from home, it would bring restfulness in the society. So it has the above system that we developed, that is the two system, in which the first would be the e-report system, in which your complaint could not be ignored on discretion, and your FIR be registered computerized so that no changings could be made later. This system is deployed in the 713 police stations of Punjab, in which 1194000 complaints, and almost 887000 FIR have been registered. So if you will visit any thana around Punjab, you will be given a tracking-ID against your complaint and you will be informed through SMS. This will bring transparency in the thana culture, save a lot of time for citizens and police and corruption could be eliminated. These systems were so much successful, that these are being replicated to the other provinces of Pakistan, like Sindh.

It would be surprising to you that 75% of crimes are done by repeat offenders. They are the people who are caught by police, court punish them, they go to the jail, complete their

punishment, came back and do the crime again. So it is very necessary to monitor and surveil these repeat offenders, and to put the records of those persons in a way that whenever a crime happens, that record could be consulted. To do this work, there is a department in Punjab Police called CRO, called criminal record office. Earlier, its office was at Qila Gujjar Singh, where any criminal has been taken, and the finger prints of all the 10 fingers were taken on a card. Since this was a manual system, it was very difficult to consult this system and with the help of it, identifying a criminal. PITB, along with the Punjab police computerized the data of 398,000 repeated offenders, where their '10 fingers prints' cards were scanned and computerized. In each thana, a biometric device was installed. So now, where ever the crime happens, the finger prints of the suspects are taken and is matched with the system's data and in few seconds a criminal is spotted. Now one office is available in each of 36 districts, 40 Jails and 712 police stations. Using this device, government of Punjab uses a device called 'Handheld biometric device', about the size of a mobile phone, and on which finger prints are scanned. There are 1000 of these devices, which are used at naaka, and wherever a raid is done, where the criminals finger prints are scanned with it, and the device at once shows the complete information of the criminals. So through this device, any person against whom an FIR is registered, or his/her name is in the Red Book or Black Book, or 4th Scheduler, is at the spot identified. This has simplified the system of Punjab police and made it easy to identify repeat offenders and to secure the life and property of the citizens."

Analysis: It is true that the old developed systems had not such flaws that it could not trace a criminal from its past record. It was all systematic and was being done from decades. The need of developing that system made the system so much efficient that the records that could take months to process can be dig out in few seconds. This system also helped in data analysis of crimes happening in the province.

e-Stamp Paper

In a web series "Digital Punjab Web Series Ep4" Dr. Umar Saif described:

"In Pakistan, there are 1,800,000 pending cases in the courts. A lot of cases among them are related to the sale and purchase of property. The biggest reason behind it is the illegalities that revolve around stamp papers. Unfortunately, in Pakistan, fake stamp papers are available, you can also get stamp papers of the former dates. Most of the property disputes arise due to this fake stamp paper. To counter this, government of Pakistan changed the whole procedure of stamp paper issuance. It has made computerized and automated and is replaced by e-stamp paper all around Punjab. But to do that, we had to amend the act of 1898, i.e. a system of 117 years has been changed. Now to stand in long rows to get a stamp paper for days in Ministry of Finance, is changed with the system where you can go in any branch of The Bank of Punjab in few minutes. This stamp paper is connected to the Chalan/Form 32-A. For which you go online at http://www.es.punjab.gov.pk and fill a form, print it and present it to the bank. After the attestation of the Form 32-A, you pay the fee to the bank. In the bank there is an automated system that will determine your property tax by automatically looking at the DC table. So, now the undervaluation of property transaction is now impossible. After all those procedures, you are provided with a printed stamp paper. This new e-stamp paper carries a QR Code and a serial number unique to that called electronic stamp ID and is an evidence of your property transaction. Its complete record is placed electronically. You

can verify it on SMS, website or mobile application in few seconds. Now it is impossible to get a stamp paper of earlier dates because you are given the only option of this very day and time. This system had completely eliminated the property transaction issues which were arising due to fake stamp papers."

Elimination of ghost schools in Punjab

In a web series "Digital Punjab Web Series Ep5 (Part1)" Dr. Umar Saif described:

"At a time in Punjab, there were so many schools, as in other provinces of Pakistan, where there were ghost schools, which are empty, and there are no teachers and students and other basic facilities. They exist in government papers but they do not exist in reality. And if many of schools exist, then there are a lot of them, teachers remain absent or the students are not enrolled, or the furniture is not available or the sanitary conditions are worse, or there is no boundary wall, no electricity or water at other places. To counter these problems, government of Punjab started a integrated sophisticated computerized system. Where 1143 MEA were assigned a task to visit each school randomly at least once in a month, and evaluate to give us report, whether teachers were present or not, students were there, furniture was available or not, electricity, water and other basic facilities are available or not, and the teaching system was actively done. 1143 MEA had to cover 52231 schools in the whole province of Punjab, and submit their reports in our monitoring system with their tablets. This tablet, costs about 8-10 thousand, could track the GPS location of the MEA. They can take a picture of the register of the school, take a selfie in front of school and also take the picture of Head Teacher to give us the evidence, if they actually visited the school and checked the attendance register, meet the head teacher, and submit their pictorial record with this tablet. This system covers all the schools that exist in Punjab, which is one of the largest systems of the world. In this system, there are 52, 231 schools, enrolling 1,240,000 students, taught by 342, 322 teachers. So each picture taken by MEA is tracked through GPS and real date and time stamp on it and it is submitted only if they are present on their locations. And no one is allowed to change this data. This information is reviewed by chief minister Punjab every three months. All donor agencies, DFIDS, World Bank, other consultants independently analyze this data which MEA have collected from schools. And on the basis of this information, it is analyzed, which schools have performed well, where the teachers were more absent, where there are less schools, and in the light of this information, chief minister Punjab take all of the administrative decisions. This information is sent to all the concerned departments related to education and schools, DCs, EDOs, head masters, monitoring officers, so that wherever the problems are pointed out, they should be eliminated as soon as possible. This data is open to all. It can be visited at http://open.punjab.gov.pk *and this data can be analysed. There exist complete information of each and every school, from its name, to inspection report, district, budget, pictures, performance, all data is available in detail. If you want to monitor a certain school, where your child is enrolled, you can register for an alert from the website, so whenever this school be visited and any picture be uploaded by the tablet, an automatic notification would be sent to the registered parent.*

This system has helped in increasing the attendance of teachers, up to 95%, and students attendance up to 91%. There is no ghost school now in Punjab. In Punjab, there are 52,231 schools, whose data is open to all at any time. Recently, PITB has extended the same system for the monitoring of schools in Islamabad."

Improving Learning Through Technology

In a web series "Digital Punjab Web Series Ep5 (Part2)" Dr. Umar Saif described:

"But after all that activation, there was another problem, that whether the educational work was of some standard quality, or not, whether teachers were teaching good or not. Students were getting the material they taught. To analyze, we installed another application on the same tablet. This application is a testing application, consisting of quizzes, that are linked to the syllabus of the students of that level. This application is connected to a big data bank or question bank containing thousands of questions. When this application is opened, some questions from the question bank load in to it. Students are asked to give answers of these questions on the spot. Students are given the tablets, and they give answers to the questions that are displayed on the tablet. At any time, seven students are gathered and all of them are asked to answer these questions independently. This information is submitted in our system in a real-time. If this tablet is not found in the boundary of that school whole submitting report, the report is not considered at all. Along this report, all other forms are also submitted. And the answers to the questions given by students and their result is also submitted along with that. This application is giving two clear benefits, one is that it helps in analyzing that if the teachers are teaching good in class or not, or if the students are getting the teaching material. Secondly, students have started giving better results in the final exams. Because teachers know that students would be randomly tested each month through this application. And teachers are focusing on the complete material in the syllabus, which has drastically improved the results of the students, i.e. from 16% to 21%. This is such an innovative and reliable tool that it is being adopted in other provinces of Pakistan."

Centralized Medicine Procurement System

In a web series "Digital Punjab Web Series Ep6" Dr. Umar Saif described:

"In Pakistan, it is normally talked that there isn't enough supply of medicine in the hospitals, that's why not given to the patients. And in the markets, there are a lot of counterfeit medicines available. To resolve this issue, the government of Punjab developed a mechanism to purchase, store, test, delivery to the hospitals, and giving to the patients. This has completely changed the entire previous system. Before this system, in all over Punjab, almost 600 hospitals and Dehi Sehet Marakiz, medicine was separately purchased by themselves. For that reason, its quality and availability was not the same everywhere. Now, in the whole province of Punjab, a centralized medicine procurement system is being deployed. Under which all the hospitals around Punjab, including Basic Health Units (BHUs)- 2520, Rural Health Centres (RHCs) – 315, Tehsil Headquarters (THQs) – 99, District Head Quarters (DHQs) – 26 put their demand and requirements in the centralized system. This automated, computerized system rationalize it, analyse it, and through this, it is centrally tendered, and purchase orders are issued, and medicine is purchased. This centralized, automated system has two benefits. One is that the medicine is procured through a centralized system, therefore, its cost and quality has the same standards and second thing is its central monitoring, that if there is unavailability of medicine somewhere or it is stockout, system automatically raises a flag, that there is a need to purchase and deliver the medicine at that place. Along with all that, this system is linked to a drug testing laboratory. The best thing of this system is that, when a sample

is placed on it, a secret barcode is pasted on it. After that, the system automatically tracks it. Therefore, to influence someone, or pass any medicine through bribes is now impossible. In fact, no one knows, where the sample go, where it is marked, where it is tested, and from where its certificate generated. This whole system is an automated and computerized which works in an anonymous fashion from the collection of the medicine sample to the generation of its report.

Along with that, government has also focused on the issue of counterfeit medicine in the market, and to implement this, two systems were developed. One is centralized drug sales licensing system, under which if you have to open a new drug store, then application is sent to a computerized system, and when this application is filed, then a drug inspector taking this application on his android goes to the store and inspect, and evaluates if that drug store fulfils all the requirements necessary for the license from the government. And when the inspector verifies all details, after that the druggists is issued a centralized license. In 15201 pharmacies, to which licenses were issued, they are continuously monitored. Our drug inspectors go to the stores, taking their androids with an application installed on them, and every month reports that medicine was available, lifesaving drugs were there, refrigeration was available or not, if there were any expired drugs or not, or legal medicines are being sale here. And if any violation is reported, then the license of that store is cancelled from the centralized system and disciplinary actions are taken against them. To monitor the availability and delivery of medicine in the hospitals throughout the Punjab, an independent set of monitors are hired, called MEA or inspectors. They are provided with an application on their phones, where they randomly visit the hospitals, and verify that the medicines reported in our medicine inventory system are verified and independently reported to the system so that, procurement of medicine to the entering of medicine to the inventory system could be verified through these inspectors. This system has improved the availability of the medicine up to 25% to 30% throughout the Punjab. So at this time, throughout the Punjab, a medicine is procured through a centralized procurement system and is entered in to the centralized inventory system, the stock is being cross verified, and the availability of medicine in all the small hospitals completely assured."

Automation of Lahore High Courts

In a web series "Digital Punjab Web Series Ep7" Dr. Umar Saif described:

"An important basic need of the citizens is the availability of Justice in time. There are 18, 000, 000 cases are pending in the courts. PITB with the help of Lahore High Court, initiated a Case Flow Management System. This system is completely computerized and automated and helps court in case flow management. There are a lot of constituents in it, through which cases can be resolved in time. In this system, it is necessary to put the next hearing date, so that the cases that are on the list but it is unknown that when the next hearing would be; this problem is completely resolved. The second major component of this system is that cause list generation and calendaring is completely automated. So when a new case is file, then it would be referred to which judge and what would be the hearing date for that, it is now determined by a computerized system. It is also seen, that how many cases are in his docket, or how many cases are on the hearing list. It is also seen, that how many similar cases are there on a judges docket because if similar cases are referred to the same bench then it becomes easy to give decisions, or so many cases can

be resolved in a single ruling, which is called bundling of cases. This system has been linked with NADRA, SECP, FBR so that no bogus case could be filed, or such a case related to tax or company law, then the data automatically could be imported in to this system. Similarly, this system has been linked with the police system, so that any FIR related to the cases, their record should be linked to the cases or attach them to the new cases.

Similarly, many cases and their hearing was adjourned because the lawyers were not present. Their complaint was that they were not informed in time. So now when the hearing of a case is scheduled, an SMS alert informs the concerned lawyer about the case. Similarly a mobile application of Lahore High court has been developed, in which layers can look for the details of their next cases and their hearing dates. This whole system will help in providing Justice to the citizens."

Reforms in Registration of Motor Vehicles in Punjab

In a web series "Digital Punjab Web Series Ep8" Dr. Umar Saif described:

"Excise department is one of the most prominent department in which computerization was carried out. A lot of manual processes of Excise department were computerized and citizens were highly facilitated. One of the important tasks was to computerized the records of the vehicles. In Punjab, 1.6 million vehicles' record is now computerized and centralized. This has bring transparency and efficiency and created facility for the citizens to go in one district for the registration and transfer is not necessary. Now it can be done from anywhere, because the whole system is now, computerized and centralized."

Additional Director General, Excise, Taxation and Narcotics Control Department Punjab, Masood-ul-Haq said:

"Recently, Excise implementing the vision of government of the Punjab, has used technology with the help of PITB, to facilitate the citizens especially the tax payers, done some reforms. Excise use to issue a passport style book on the registration of vehicle. It was realized that some problems are attached to that, due to which it was difficult for the vehicle owners, especially the bike riders to carry that book with then all the time. That was resulting in the unavailability of the book when the law enforcement agencies ask them to provide. Therefore to keep in mind these problems, and taking the benefits from information technology, a registration card, which is named as Automated Registration Card is issued. This registration card carries some special features, due to which its counterfeit would be impossible and to take care and carrying would be easy."

Dr. Ahmad Balal, Secretary Excise, Taxation & Narcotics Control Department Punjab said:

"A lot of initiative in which PITB has helped us is one of them is the Property tax and the distribution of property tax challans. Along with PITB our big partners are Urban Unit and now challans are being distributed in 36 districts through computerized systems."

Central Induction Policy

In a web series "Digital Punjab Web Series Ep 9" Dr. Umar Saif described:

"People usually say that in government hospital, either the doctors are not available, or their quality is low. Its major reason is the government system through which specialist

doctors are selected, sent to the hospitals and trained. This is known as PGD training or Post Graduate Training among doctors. In the old system, in which doctors associate themselves informally with some experienced doctors to become specialists, it was difficult for the government to centrally determine whether in each hospital there is an availability of all specialist doctors in every hospital and their training is being done properly or they genuinely carry the potential to become a specialist. This system also carries the possibility of sifarish. Due to which a brilliant doctor, that completed its MBBS in Rajanpur, it was difficult for him to get training in the big hospitals of Lahore. To counter this, as per the vision of Chief Minister Punjab, doctors apply in a computerized automated system called Central Induction Policy. This system determines the merit according to their performance in their education, for example looking at their MBBS marks, their experience, their priorities of specialization and determines the demand of different hospitals, that what type of specialist they need. The greatest benefit of this system is that it is now easy for the doctor in the backward areas to get training at big hospitals. Its second benefit is that the DHQs where there were unavailability of doctors because no doctor was ready to serve in the remote areas, according to the new merit, 5 to 20 marks are being allocated to the doctors for being serving at the Dehi Health Marakiz. So now if a doctor want to do a specialization at a big hospital, it is very beneficial for him to serve in small hospital and get experience and then come to this system to apply. Resultantly, now the doctors are now moving to the DHQs and want to serve their because on the basis of this, they will get a chance to specialize in some big hospital through this system.

Similarly, an imbalance is also seen where, one type of specialists are in abundance while, there is a shortage of other type of specialists, so the system balances the different specialist to serve in different hospitals so that availability at each hospital could remain as per their requirement."

Citizens Feedback Monitoring Program (CFMP)

Dr. Saif says:

"For me, the citizen feedback model is a very simple and very effective way to one interface with the citizens and remind them, that the state is still alive."

Ali Inam, ICT Consultant, LUMS, Batch of 2010 says:

"For me citizen feedback model is an act of state being bold and say to the citizens, 'Hey! We are here for you, help us, help you better".

Ali Cheema, Associate Professor, Economic Department LUMS say:

"One thing that we are constantly noticing in Pakistan, that the gap between the state and the citizens is increasing, which on the one hand is a cynicism among the citizenry, but it is also leading to acute demoralization of service delivery institutions of the state and that is very dangerous scenario to have."

Nadeem Mehboob, Secretary Implementation, Chief Minister's Secretariat Punjab said:

"Provision of service delivery is one of the basic tasks of the government, and it cannot achieve its stated objectives, without having the feedback of the citizens."

The following is the voice heard on the feedback call received by a citizen who availed government services:

"Assalam o Alaikum! Main Khadim e Aala Punjab, Muhammad Shehbaz Sharif Aap say mukhatib hon, Aap nay kuch rooz pehlay, apni property register karwai thi, agar aap ko kisi bhi qisam ki pareshani ka samna karna parha, ya kisi nay bhi najaiz paisay wasool kiay ya mangay, to mujhay barah-e-karam lazmi bata'ain."

An old citizen named Abdul Aziz, made License in District Sialkot says:

"License banan to baad na menu Wazir -e- Aala Sb di na call aai si, oo main na sunrh k barha acha mehsoos keetay jae. Oohna nay pochiya si k tuanoon koi pareshani tay ni hoi, kisay kam day waich, kisay aan di ya jaan di, tusan jerha othay kam karwaya ae, othay tuanu kisay nay tang tay ni keeta".

Azmat Mahmood, DCO Gujranwala says:

"People are getting information that the government is actually reaching out to them and asking them about the transaction between them and the government. So we actually want to make our officials accountable."

Sanan Aslam, registered property in District Gujranwala, says:

"Hakoomat ka rawayae is trah say bilkul saaf aur clear hai, k waqai agar CM sab chahtay k system theek na ho, to system kabhi aisa develop na kartay. Kion k wo khud chahtay hain k system theek hona chahiay, aur kisi ghareeb ko tang na kia jaey."

Fasieh Mehta, Joint Director, Punjab IT Board say:

"So whenever, a citizen goes to avail any service from the government office, so for example obtaining a driving license or domicile for that matter, the idea was to ask about the service and the level at which it is delivered to him. Is that satisfactory or not"

Dr. Saif say:

"So this feedback model, sort of flips the polarity entirely, instead of waiting for the citizen to be dissatisfied enough that he goes on the trouble of filing a complaint, this system proactively calls them"

Then on giving the response, a call center representative calls to the citizen and asks them about the details from the citizens to take action against the officials. These call center services are outsourced to a private call center group, so that the extra burden of employment do not fall on the government.

Tariq Qambo, registered property in District Gujranwala say:

"Jab aap nay registry karwai hai, to kaheen bhi branch main kaheen bhi aap say koi paisa lia hai, koi problem aai hai aap ko, to ham say yeh sab detail main pocha jata hai."

Dr. Umar Saif said:

"And here it what I have learned, not all citizens are dissatisfied".

So, the system shifted from just receiving end to a stage where government can proactively follow up on the complaints, redress the complaints and in the process if a

government official is identified, as lacking in providing services, necessary actions are then undertaken.

Marium Afzal, ICT Consultant, LUMS, Batch of 2010 says:

"This is a great initiative because of its simplicity, since the beauty is in simplicity, reaching to the citizens via cell phones, which everybody have at a low cost, which makes it quite scalable."

Asim Fayaz, ICT Consultant, LUMS, Batch of 2010 says:

"Ultimate goal of this program is to leave a better Pakistan, for our generation and the generation to come so that the government works better."

CFM is having the ownership of the public, because it's very important that they know about it. So when they will start using it, they would feel that they are being empowered. Citizens require good services, and in order to get these services, they need to become partners with the government.

Muhammad Abbas, Registered Property in District Gujranwala says:

"Hamari Jaga hamaray barhay taya abbu k naam pay thi, jo ham nay apnay naam par karwani thi, Jab mujhay call aai to CM sahib ki awaz thi. Pehlay mujhay laga k yeh koi jhoot hi ho ga, laikin jab main nay ghaur say suna to wo waqai CM sb ki awaz thi, Mujhay khud par yaqeen nhi howa. Unhon nay aik baat kit hi k Qaum ki islah aap ki madad k baghair mumkin nahi hai, to mujhay yeh baat un ki achi lagi, aur wo waqai sahi keh rahay thay, kion k is say pehlay kisi bhi CM nay ya government nay aisa koi qadam nahi uthaya, aur un ka yeh jo qadam hai yeh mujhay acha laga hai."

When someone receives a complaint or information from a citizen, it creates an expectation among them that some action will be taken. It's a way to give citizens a voice, with in the state system.

Dr. Saif:

"For me, CFM is a real way of hope because it lets us from our offices, really monitor what is actually going on at the interface of the citizen with the government".

Mobile Phone Governance

In Pakistan, there are almost 123 million or 12 to 13 Crore, cell phones and the population of Pakistan is about 18 to 20 Crore. It makes Pakistan the 6th largest mobile phone using country in the world.

Faseh Mehta says:

"Today about 67% of mobile density prevails in Pakistan, which means al least one person in a household has a mobile phone".

Saqlain Ahmad, Senior Program Manager, PITB says:

"When Dengue epidemic came in Lahore, it was the time which cannot be easily described in words. There were the cues all around in hospitals and medical centers and a lot of people were completely unaware of the disease".

Faseh Mehta says:

"I remember that, In 48 hours, we trained 150 doctors, started a helpline. It was a toll-free number, but we observed that, on our going on air, in one or two days, 5000-6000 calls were being received per day. Then at its backend, we developed a complaint management system. We started a smart phone monitoring, purchasing 1500 smart phones, started with City District Government Lahore (CDGL), and gave them smart phones by installing a small mobile phone application, that we call dengue activity tracking system. "

CM Punjab Mian Shehbaz Sharif in an interview said:

"When dengue epidemic spread in Lahore, we took very important information and feedback from the people, their complaints were redressed, and all of this system was managed by doctors and millions of people got help through this system."

Jehan Ara, President Pakistan Software Association (PASHA) said:

"I think, it is necessarily important for the governments, and the provinces to start using it, since they have a lot of manpower, and they can do this at great level. You and me can develop and application, we can sell it or can use it, but when government uses it, then its scale actually increases a lot"

Economist wrote a story on this, similarly, Washington post, New York, Times, MIT Technology Review wrote on the efforts we made on dengue. Now other cities, provinces and countries and a lot of donor agencies, want to replicate our work, in different areas, that how we can use technology for better governance.

Sardar Ahmad Naeem, Registrar Lahore High Court said:

"There were times, when we cannot even imagine that If you will register a case in the court, you will be informed through an SMS, that your case has been fixed at that certain number, on that certain bench on a certain date."

Appendix E: Locale Pictures

Locale Picture 1: TDCP Head Office, Garden Town Lahore

Locale Picture 2: TDCP Tourist Information Center, Temple Road, Lahore

Locale Picture 3: TDCP Sightseeing, Terminal-1, Qaddafi Stadium, Ferozepur Road, Lahore

Locale Picture 4: WCLA Head Office, Majeed Nizami Road, Lahore

Locale Picture 5: WCLA Media & Tourism Information Centre, Delhi Gate, Lahore

Locale Picture 6: PHA Head Office, Jilani Park, Lahore

Locale Picture 7: National History Museum, Greater Iqbal Park, Lahore

Locale Picture 8: Pak Tea House, New Anarkali, Abkari Rd, Anarkali Bazaar Lahore