A Review of Policies concerning development of Big Data Industry in Pakistan

Subtitle: Development of Big Data Industry in Pakistan

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***Abstract*—This In the present globalized smart ecosystem, various suggestions of using data as a new tool for the development of the economy are still going on to be presented. Hence, developed countries are trying to pursue different policy measures to develop the big data industry, including promoting big data R&D sector and investment in human resources to retain the pace of this global trend. The government of Pakistan has supported liberal policies to activate the IT its applications such as big data, Internet of Things (IOT) and electronic government (e-government). We used the Analytic Network Process (ANP) model to prioritize policy measures and find out its implications for Pakistan. This study will convey an important lesson for developing countries and particularly for South Asian countries to establish policies for developing big data as a new tool for economic growth in the context of smart ecosystem environment.**

Keywords— Big data; Internet of things; IOT; Analytic network process; Ecosystem

I. INTRODUCTION

With regard to Information technology recent advancement, the value of big data utilization is increasing day by day. Particularly, with the initiation of a big data smart environment and smart ecosystem, these proposals reveal that at present data is more significant than the industrial value [1]. Due to these developments, many developed countries like USA, Japan, UK and EU and emerging countries like China, South Korea are taking this issue seriously and trying to formulate their policies that include the strengthening of R&D investment and encouraging big data experts to make big data industry as a core industry in the smart globalized environment. Similarly, recognizing the importance of big data for the growth of the economy, the government of Pakistan has put forward effective policies measures to enhance the big data industry with respect to the access of public information. Ministry of IT of Pakistan is pursuing a master plan for big data to link different government ministries through the internet by digitizing government data [2, 3]. Pakistan was the first country in SAARC in establishing the e-government in 2002 [4, 5]. The last but not the least, the largest contributor to the ICT industry that attracted immense FDI into Pakistan over the last couple of decade is the mobile phone companies which are the rich sources of big data activation. The government of Pakistan recently initiated an ambitious project with the People Republic of China, China-Pakistan Economic Corridor (CPEC) which enables the government of Pakistan to develop its economy and technology. China and Pakistan initiated the idea of digital CPEC and working on the laying down of high capacity optical fiber cable in order to promote the ICT industry in the country [6].

In our study, with the help of ANP technique, we propose some useful policy suggestions for the promotion of big data industry. These policies further help the government to utilize its limited resources effectively for the efficient promotion of big data industry in Pakistan. The article is organized as follows. In section 2 gives big data concept and policy related literature of the study. Section 3 discusses the methodology of the study consists of ANP technique. In section 4 we discuss the results and analysis for the study. The section 5 provides the conclusion.

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II. THEORETICAL BACKGROUND

A. Big data domestic policy and concept

There is no solid definition of big data sources and it is rather a vague term [7]. Recently, the concept of big data is represented and believed to bring rapid and enormous changes in our lives, thinking, and standards of living [8]. Jin *et al.* (2015) argued that *"Big data can be used for better understanding of present complex data environment also increased the suitable future predictions regarding the data future as well"* [9]. Currently, big data is playing an important role in up gradation of industry and also is a big source of for IT companies to overcome the storage problems [10]. It attracts the enormous attention of industry, academia, and government organizations globally [11, 12]. The key sources of big data, however, can be divided among industry, media, and academia [13, 14].

Various policies have been proposed by the government of Pakistan in order to develop the big data industry in the country and make it one of the core national industries. Ministry of Information Technology (MOIT), a leading ministry for the promotion of ICT and for sustainable development of the country, which initiated different policy measures for the promotion of internet by re-organization in 2015. Hence, six government ministries of Pakistan including Ministry of Information Technology (MOIT), Ministry of Planning, Development and Reforms, National Database Registration Authority (NADRA), Ministry of Finance, Revenue and Economic Affairs, PTA and Ministry of Interior proposed a draft for the activation of big data industry in August 2016.

B. Developed countries policies for big data development

Many developed countries including Asian emerging countries like the US, UK, EU and Japan, China and South Korea are pursuing various policies for the development of big data in comprehensive ways [1, 15](Table 1).

Table 1. Big data-related policies of the major developed and emerging countries

S#	Country	Data Portal	Contents
1	US	Data.gov	▪ Open database to the public ▪ Reform services by using big data
2	EU	Open-data.europa.eu/	▪ Consolidate single data portal ▪ Develop data related technologies ▪ Create suitable environment for data transmission
3	Japan	Openlabs.go.jp	▪ Providing open database for public ▪ Development of big data technologies ▪ Development of data related human resources
4	UK	Data.gov.uk	▪ Reform data sharing platforms ▪ Enhance data accessibility and activate data related services

Source: Kwon, 2015.

In this regard, during the year 2014, the US government announced its "Big Data R&D plan" after recognizing the importance and potential of big data for the solution of various issues related to the national interests. It shows the strategy of willingness of the US to make accessible the data for public. Furthermore, government intends to use the big data for expediting the science development, national security strengthen and reform the health and educational system in the country.

Secondly, for big data development in June 2012 UK proposed a strategic plan in "Open Data White Paper", in which different measures have been announced to strengthen the data accessibility and made reforms in the big data sharing plat forms. Moreover, it has shown progress in evolution of data access methods.

Thirdly, in May 2010, the EU announced an "Open Data Strategy" for implementing the EU digital agenda strategy for big data and Internet of Things (IOT) in EU region. The main issues discussed in the paper are: propose a single data portal for EU data; developing the data processing; fair competition among service providers in data access. Due to these arrangements, EU succeeded in creating new data based businesses and strengthen the security and privacy of public data services, resultantly, creating new opportunities for economic growth.

Fourthly, in May 2012, Japan announced a comprehensive strategic plan "Active Japan ICT" for big data development. The five major components of the strategic plans include resolving the national issues by collecting, translating and transmitting data in real time particularly, disaster management and access of data basis to the public and fostering human resources simultaneously.

III. PRIORITIZATION OF POLICIES

There are many studies conducted on utilizing the ANP model for prioritization in many diverse fields; but, there are few studies that utilize the ANP model for big data related studies. Here we give a summary of few papers which used both ANP model and big data. The first study used both the Analytic Hierarchy Process (AHP) and Analytic Network Process (ANP) for prioritization of ICT policy to maximize the efficiency [16]. The study prioritized the act for low carbon growth, including the main variables like economic and environmental effect, efficiency and stability. Another study that used ANP model for prioritization of policies the growth in South Korea [17]. Besides these studies, another study was conducted on the utilization of AHP to find the priorities of the components of big data information security service [18]. The most recent study to find out the quantitative policy prioritization and identifying the implications as well by using

the ANP model was carried out by Kwon (2015). However, it needs more research to be conducted on this issue, particularly in the case of Pakistan

IV. Research Methodology

The main theme of the study is to find the prioritization policy analysis for promotion of big data industry by using ANP model. According to Thomas L. Saaty (1996), the ANP technique is used for decision making models, in which the importance of factors is measured qualitatively rather than quantitatively. Actually, ANP is the modified version of AHP which was also presented by Saaty (1980) for solving multi-criteria decision problems [19].

In Multi-Criteria Decision Making (MCDM), there are two important techniques, "Analytic Hierarchy Process (AHP) and Analytic Network Process (ANP). However, ANP is widely used for solving the multi criteria decisions due to an advantage of rank reversal and the number of judgment elicitations [20]. The judgment elicitation technique is an effective approach in reducing the decision making errors with the help of decomposition process. Moreover, ANP is an effective technique that can prove valuable to multiple parties and bring them to an agreeable solution, in other words, it can be used as consensus building tool [19]. Before ANP, AHP was used in prioritization of goals, but presently, ANP model is widely used for prioritizing the policy goals (see Fig. 2).

ANP is more realistic than AHP, it has the advantage of solving the decision problems in which alternatives and criteria have interactions that cannot be expressed in AHP [21]. Another advantage of ANP over AHP is that in ANP the rank reversal problem is more accurate than AHP. In this regard, Garuti and Sandoval used both ANP and AHP for same data and concluded that "the ANP replaces many criteria of the hierarchy by proper connectivity between elements and clusters. They further argued that for the similar goods and data, ANP has more clear and accurate results than AHP [22]. Recently, it is widely used in making complex decisions in different field including economics, commerce and industry, as well as in mathematics and natural sciences. According to Kwon (2015), ANP is more reliable than AHP and unlike the wide adaptation of AHP model in past, presently, the ANP model is extensively used in decision-making process [1]. The above discussion proves that the suggested ANP method is very efficient in the selection of most influential factor among the given ones.

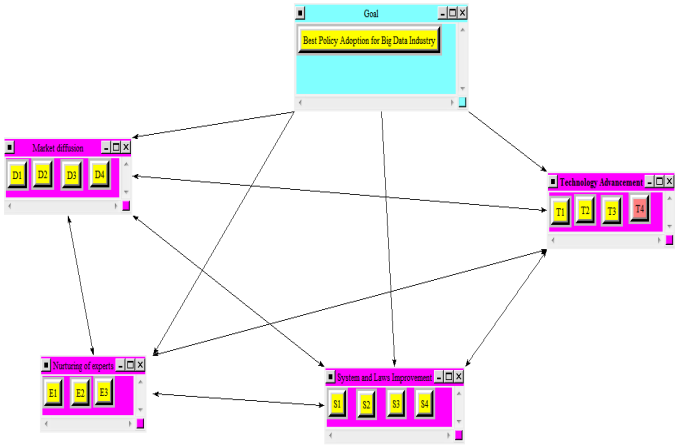

Fig. 1. ANP general correlation for the study.

In order to find out the policy analysis, it is necessary to find out the expert's opinions on the related subject. In our study, we conducted a two-phased interview with experts. We also observed during conducting a survey that the participants selected for the survey had taken part in any national project related to big data or ICT. In Pakistan, the big data is in initial growth stages so we also included the ICT experts having knowledge and experience about big data as well as modern ICT applications. Firstly, we conducted in-depth interviews for analyzing the correlation between different policy suggestions on the subject matter and after that, we assembled recommendations from interviewers. At this stage, we gathered corresponding policy data for activating big data with the help of an in-depth survey. In in-depth surveys, it is easy to adjust the contents of the questionnaire for interviewees. The targets selected for interview were belonged to 20 big data experts groups, working in a big data and ICT research fields, both from academia and industry such as PTA (Pakistan Telecommunications Authority), PTCL (Pakistan Telecommunications Company Limited), NTC (National Telecommunications Corporations) and MOIT (Ministry of Information Technology) and Telenor Pakistan. The 20 experts gave in-depth interviews from 12 to 22 February 2017. In the second phase we conducted surveys, in this process we take the previous literature contain the important policies and correlation analysis. Moreover, later on, this survey was distributed among the group of 20 experts. The second phase was conducted from March 20 to April 15, 2017, for the assessment of prioritization of policies for big data industry. The Super Decision software is used to analyze the data collected for the study; it is widely used for analysis in ANP model. The targets of the survey are as follows (Table 2).

Table 2. List of Interviewed experts

S/No.	Title	Expert Opinion
1	Professor	*Beijing University of Posts and Telecommunications
2	PhD	#
3	PhD	*Beijing Institute of Technology

4	PhD	#
5	PhD	Sarhad University of Information Technology
6	Head of Department	Iqra University
7	Directors	Pakistan Telecommunications Company Limited
8	General Managers	National Telecommunications Corporation
9	PhD	*Beijing Institute of Technology
10	Assistant Professor	Sarhad University of Information Technology
11	Doctor	*Tsinghua University
12	Business Managers	Pakistan Telecommunications Company Limited
13	Team Leader	Pakistan Telecommunications Authority
14	Team Leader	PTA Policy team
15	Head of Department	NTC Policy team

*The Pakistani research scholars currently studying in China's universities.

V. RESULTS OF ANALYSIS

A. Variables for decision making

After conducting interviews and going through existing research, this research study prioritizes policy goals and action plans for the promotion of big data industry. For promotion of big data industry, the government of Pakistan policy goals is as follows: diffusion of markets, nurturing of experts, laws and system improvement and technology development. The action plans by goals are as described below.

The theme of following the big data technology international standardization is classified into initial development of standards for globally newly invented big data industry. So the international standards defined by ITU must be followed and implemented by a government by participating in international joint research conferences and projects, moreover, a government should actively participate in international meetings with the agenda followed by international standardization from ITU. The details of all these factors are given in Table 3.

Table 3. Policy goals and action plans for developing the ICT industry

S#	Policy goal (cluster)	Action plan (node)
A	Market diffusion	D1. Big data projects expansions and forecast system D2. Reforms in existing big data & ICT infrastructure D3. Easy access to public data D4. Facilitating private sector research in big data industry
B	Nurturing of experts	E1. Nurturing big data experts E2. Big data qualification testing and management foundation E3. Big data experts safe and smooth supplying system
C	System and laws improvement	S1. Liberal policies adoption for big data diffusion S2. De-regulation & re-organization of big data industry S3. Friendly environment for investment in big data industry S4.Effective rules and laws to ensure the enhancement of big data security and privacy
D	Technology development	T1. Big data R&D sector improvement T2. E-culture development throughout the country T3. Follow the ITU standards while adopting the big data technology T4. Medium and long term big data development road map

B. Results of ANP

The policy variables taken in our study were prioritized and are given in Table 5. The ANP model is an effective tool and is widely used to prioritize the establishment of policies and decision to establish policies in an effective way. The analysis of our study revealed that the policy prioritization for big data industry activation among different clusters is based on the weighted values derived from a super decision and shown in Table 4.

Table 4. Analysis of upper variables weighted values

S#	Cluster	Diffusion of Markets	Experts nurturing	System and laws improvement	Technology development
A	Diffusion of Markets	0.082298	0.158790	0.150393	0.133333
B	Experts nurturing	0.259921	0.169876	0.152591	0.354033
C	System and laws improvement	0.32748	0.332576	0.323682	0.152773
D	Technology development	0.412599	0.336768	0.345221	0.357073

The action plans for big data industry activation were prioritized and are given in Table 6. The analysis revealed that the first priority action plans are "follow the ITU standards while adopting big data technology" (13.8%) and "provide a friendly environment for investment in big data industry" (12.8%). As described earlier, Pakistan is lagging behind in key technologies in comparison with developed and emerging Asian countries. It is essential for Pakistan to follow the international standards while adopting the big data technology by increasing joint collaboration with international research conferences and projects.

VI. CONCLUSIONS

This research study describes policy recommendations for quantitatively prioritizes resultant policy measures via ANP model for the promotion of big data industry. Therefore, this study has some interesting policy insights for the development of big data industry in Pakistan.

Firstly, the results of the study shows that the technology policies development should be on the top of policy agenda to decrease the technological gap between Pakistan and other developed and emerging Asian countries. Unluckily, Pakistan does not have a worldwide big data company that's why the big data industry lag behind around 5-10 years.

Secondly, providing resources in an industrial policy is like a bid for the development of a newly convergence industry, similarly, for big data it is found as an inappropriate method. In this regard, the government of Pakistan is taking positive steps for the development of big data and ICT sector, as it has now become a key tool for a growing economy.

Thirdly, the analysis shows that in order to formulate and prioritize the policies for big data industry, an industrial platform must be created initially on high priority as a policy action plan. Particularly, in the early development stages, the policies for industries should be properly prioritized in terms of securing and encouraging the experts, upgrading the existing industry and promote the use of big data by administration and agencies by providing an easy access to the public.

Fourthly, Pakistan should not follow the similar approach like the other developed countries for the development of big data industry due to different culture, maturity and approach towards big data utilization. In the US, UK, Japan, and EU, the respective governments made arrangements for the availability of data to the public and it has become a leading sector among the private sectors of these countries. Although, Pakistan has a liberal approach from the very beginning towards ICT as compared to other countries such as South Korea, China, but it still needs more attention to make possible an easy access to the data for the public as well as invite the private sector to invest in the big data industry.

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