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Abdul Rahim Ahmadi
Shaikh Zayed University (SZU) Khost, Afghanistan

Dr. Hiroyoky Meyazaki
Asian Institute of Technology (AIT) Thailand

Mohammad Anwar Anwar
Shaikh Zayed University (SZU) Khost, Afghanistan

Correspondence Author:
Dr. Hiroyoky Meyazaki
Asian Institute of Technology (AIT) Thailand

E-government development index (EGDI) estimation and suggestions for improvement: A case study of Khost province, Afghanistan

Abdul Rahim Ahmadi, Dr. Hiroyoky Meyazaki and Mohammad Anwar Anwar

Abstract
Recently, an evolution of ICT has grown dramatically, which is known as e-Gov improvement and top ranked EGDI. EGDI is based on the three criteria, the adequacy of telecommunication infrastructure, the ability of human resources to promote and use ICT, and the availability of online services and content. UN reported in 2016 of estimated EGDI of Afghanistan 0.2313 that shows the lowest rank in the worlds where, the re-estimation value is 0.3634, which is quite higher than the UN 2016 report. Furthermore suitable areas suggested for Internet infrastructure investment. A conceptual framework have been proposed and implemented as a case study, for which data were collect through a purposive sampling method.

Keywords: EGDI, E-Gov, TII, HCI, OSI

1. Introduction

1.1 Background and status of e-Gov penetration

The idea of Electronic Government (E-Gov) have developed in the late 1990s although that the historical backdrop of calculating an instrument in government creations could be followed back to the beginning of PC itself and simply as other e-stage ideas, for example, online business, e-health, e-transportations and etc. The term e-Gov was resulting from web world. E-Gov which is a well-known movement was doubtful before now but from its rapid development, there is a possible future heading for the investigation area (Oseni, Dingley, & Hart, 2015) [1]. E-Gov is the use of information and communication (ICT) to achieve the efficiency, viability, straightforwardness and responsibility of enlightening and value-based trades among Government to Business (G2B), Government to Government (G2G), and Government to Citizens (G2C) (Alateyah, Crowder, & Wills,2012) [2]. Furthermore, e-Gov is the utilization of Information Technology (IT) to empower and enhance the proficiency through which government services are given to employees, organizations, citizens and agencies (Alshehri & Drew, 2010) [3]. As we know ICT has evolved rapidly, this evolution has effected and has brought changes to every day's life of individuals in the world and is likely to change the route, in which governments around the globe collaborate with their agencies, organizations, citizens, employees, and different stakeholders. These quick progressions are considered as e-Gov improvement and top ranked EGDI (Sang & Lee, 2009) [5], (Rehman & Esichaikul, 2011) [4]. So, EGDI can be categorized in three branches, the adequacy of telecommunication infrastructure, and the ability of human resources to promote and use ICT, and the availability of online services and content (UN, 2016) [6]. Without doubt for development of social, economic, and quantifying ICTs are known as an engine (Wentz, Kramer, & Starr, 2008) [7]. ICT infrastructure have rule as a basic requisite for adoption of new technology (Senthil Kumar, 2017) [8]. Additionally, implementation of ICT in government sector provides significance benefits to citizens, business, government and employees but also have some barriers and challenges in adaptation (Alshehri & Drew, 2010) [3]. Most key challenges and barriers confronted to e-Gov services adoption such as leak of infrastructure, security, privacy and citizen's skills etc.

Modern communication technologies arrived to Afghanistan in early 1930th with a small exchange of information only covered Kabul city, the capital of Afghanistan. This limited communication network boundary reached only five campuses of the Kabul city via copper wire (Mohmand, Marjan, & Sangin, 2010) [9]. Due to the 3 decades of wares, the telecommunication infrastructure was mostly destroyed. Government of Afghanistan adopted the ICT modern policy for its improvement in 2002 when transitional government reached to the power. The government of Afghanistan adopted in October 2002, the telecoms development strategies and implemented. For investment promotion of private sector Afghan government pass a telecommunication law in 2005. Besides that, the ministry of communication and information technology (MCIT) has played a role as a leader in ICT implementation in government sector in the country. There are many running and completed e-Gov projects which provide services to citizens, employees, business, and government bodies (MCITprojects, n.d.) [10]. Moreover, a huge number of Companies have been invested in ICT infrastructure for providing e-Gov services.

According to the enormous development of ICT infrastructure some areas of the country are still uncovered by ICT and total 89 percentage residential areas of the country covered by telecom (Habibi *et al*., 2017) [11]. Afghanistan placed 156th out of 167 countries in ranking list of ITU 2015, and UN survey 2016 indicated the lowest ranking in south Asian countries. So, the research answered the question "*GIS-based EGDI Estimation at Subnational Level: A Case Study of Khost, Afghanistan*" and a finding of the research study shows quite higher value of EGDI than the UN 2016 survey report of estimated EGDI value.

1.2 Technical challenges of measuring e-Gov performance

Field survey data important for the research study, although, for the two dimensions Telecommunication Infrastructure Index (TII) and Human Capital Index (HCI) data and for mobile cell towers coordinates data were collected from the field. But, for the third dimension Online Services Index (OSI) and spatial data (Population density, settlements) for suggestion of Internet infrastructure investment were used secondary data.

1.3 Objectives of the research

Main objective of the study is GIS based EGDI estimation for subnational level: A case study in Khost province of Afghanistan. In details the research focuses on the following key points:

1. Proposed and implemented EGDI estimation framework as a case study.
2. Analysis of the status estimated EGDI and suggested Internet infrastructure investment at Least developed EGDI areas.

2. Methodology

2.1 Overview

GIS-based EGDI estimation framework was proposed. Based on that framework EGDI have estimated for subnational level of Khost province. At the end of the research study, appropriate areas were suggested for Internet infrastructure investment based on the population density spatial data, Mobile-Cell towers spatial data and with leased estimated EGDI. A figure 1 shows the whole process of the research.

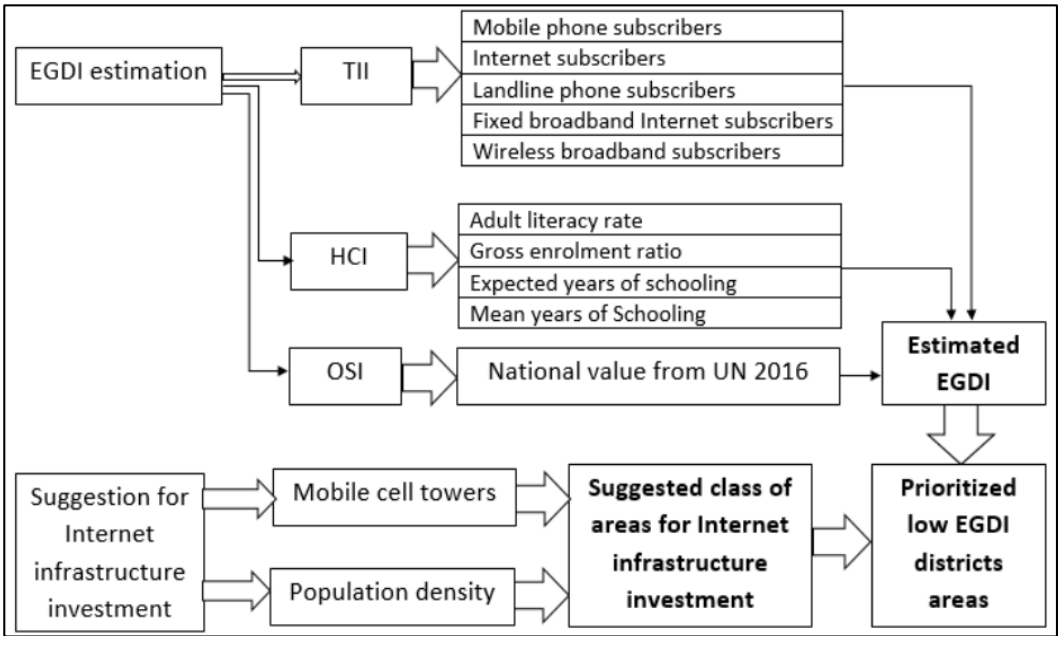


Fig 1: Shows the complete methodology Flowchart

Based on the methodology flowchart, a conceptual framework proposed for subnational level as well as it was implemented for the case study at Khost province, in future researcher can benefits to be able to implement for the rest of provinces, which have been open the door for estimation of EGDI for the whole country.

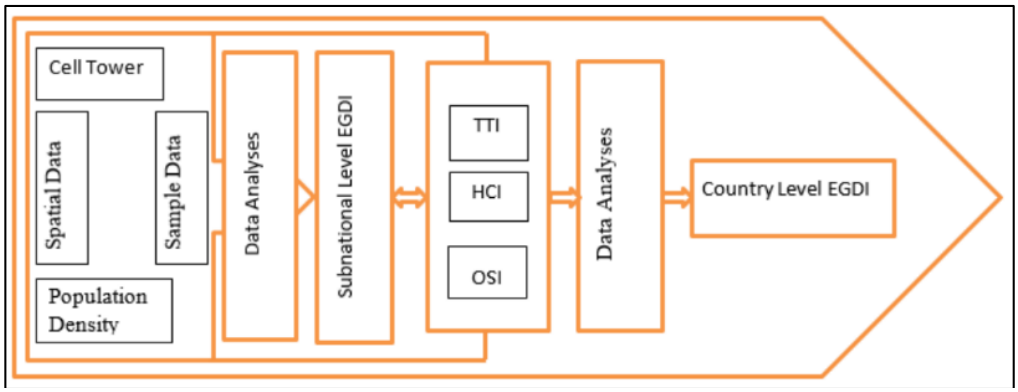


Fig 2: Proposed EGDI estimation framework

According to the UN, 2016 survey report EGDI have three dimensions, TII, HCI and OSI. TII have five indicators which can be seen in methodology chart, for all of five indicators, data was collected through field survey, and each indicator has 1:5 ratios. HCI have four indicators, which are mentioned in methodology flowchart, just adult literacy percentage have 1:3 ratios for calculating of the HCI, the rest of three indicators have 2:9 ratios. OSI is a third dimension of EGDI, the value of his dimension was used from estimated OSI value of UN 2016 survey report. Online services equally offer to the citizens in covered areas of the whole country. After review and validation of the framework by expert bodies, OSI have included to the research study for EGDI estimation.

2.1 E-Gov development Index (EGDI)

EGDI is a normalized point of average weighted which is combined from three main dimensions of e-government such as an Online services quality and scope (Online Services Index, OSI), The human capital inherent (Human Capital Index, HCI) and status of improvement of infrastructure of telecommunication (Telecommunication Infrastructure Index, TII).

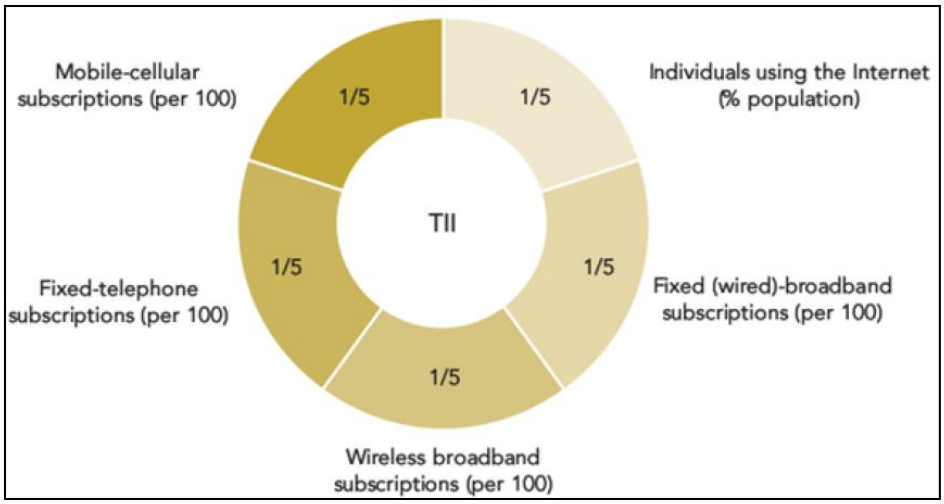
Mathematically, the above three dimension of e-government and three normalized score of weighted average is called EGDI [6].

$$EGDI = 1/3\ [OSI_{Normalized} + HCI_{Normalized} + TII_{Normalized}]$$

To know that the EGDI is equally decided between the three components first of all a standard procedure of the z-score would be implemented. EGDI is serve as a benchmark which is used to show the e-government plan and strategies development of United Nation members' countries (UN, 2016) [6].

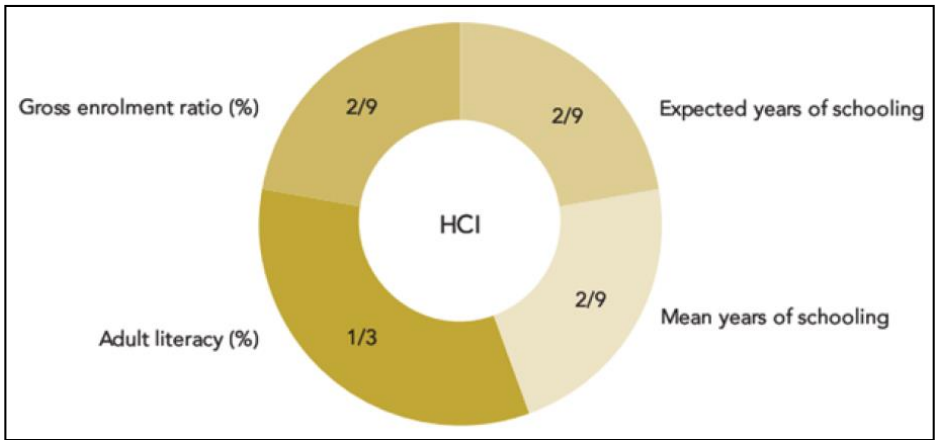
2.2.1 Telecommunication Infrastructure Index (TII)

Telecommunication Infrastructure Index (TII) is the mathematical average of five indicators namely, Users of Internet per hundred inhabitants, fixed telephone line per hundred inhabitants, subscribers of mobile per hundred inhabitants, subscriptions of wireless-broadband and subscriptions of fixed-broadband per hundred inhabitants (UN, 2016) [6].



Human Capital Index (HCI)

Human Capital Index is created from four indicators which are known as: Adult literacy, gross ratio enrolment (combined primary, secondary and tertiary), expected years of schooling and average year of schooling [6]. HCI weighted averages have four components that has similar calculation process to TII, through the z-score procedure all the four indicators would be standardized. The HCI is a weighted arithmetic mean where 1/3 weight is assigned to adult literacy rate and 2/9 weight dedicated to mean years of schooling, expected years of schooling and Gross enrolment ration. The following mathematical formula shows HCI report of United Nation survey (UN, 2016) [6].



2.2.2 Online Service Index (OSI)
Based on the UN Survey, OSI is the third dimension for EGDI estimation. UN in 2016 survey assessed websites of each country with their native and official language in which include e-participation portal, e-services portal and national portal as well as the related ministries websites of the health, education, finance, social services, environment and labor as applicable. The point scored of the total number is normalized through each country by the 1 and 0 range. The formula is used for online services value of country.

2.3 Infrastructure demand analysis
According to the enormous development of ICT infrastructure total 89 percentage residential areas of the country have been covered by telecom (Habibi *et al*., 2017) [11]. Meanwhile, the high speed Internet percentage is lower. As earlier discussed that, only mobile (cell tower) connection are available, so customer have needs for improving the Internet infrastructure investment.

2.3.1 Method of identifying the suitable areas for Internet infrastructure Investment
Based on the analyzed data, suitable areas were proposed for Internet infrastructure investment through the following factors. Firstly, cell towers location spatial data were used for separation of covered areas from the non-covered areas. Secondly, population density data were used for selection the highest population class in the covered areas, but the two highest classes were already covered and we just, shifted to the third class. Furthermore, estimated EGDI have used for prioritization of lease developed EGDI districts associated with selected areas. Though, administrative and settlements spatial data were used just for nomination of the exact locations.

2.3.2 Data acquisition and collection
Mixed research study method were used, qualitative data were collected through face to face interview and discussion from the expert bodies for validation of framework and validation of result. Spatial data were collected from local department and world reliable online sources. Collected data were analyzed through quantitative, qualitative and spatial data analysis methods.

2.3.3 Questionnaire and Interview
Quantitative data were collected through a quantitative survey in order 1300 Paper-based questionnaires and 100 online questionnaires were responded. Furthermore, for expected years of schooling quantitative data were collected from local department of education. Qualitative data were collected through face to face interview and discussion from the expert bodies of local government for validation of framework and validation of result.

2.3.4 Cell tower locations data:
Cell towers location data were collected from the local departments of the related companies of Khost province, these data were used for separation of the covered areas from the non-covered areas.

2.3.5 Population data:
Population data obtained from the online source worldpop site. These data show the population density in square areas. Population density data have used for selection of the higher population areas in the non-covered areas.

2.3.6 Study area
The research study has done in the thirteen districts of Khost province, which located in the south eastern of Afghanistan, between (33.3585 N, 69.8597 E) latitude and longitude. It is divided into 13 districts with 4,152 square km areas. The official language of the big areas of citizens is Pashto.

3. Result and Discussion
3.1 Statistical result of the distributed questionnaires
The following table shows the percentages of the EGDI related field survey variables as well as their related percentages have calculated. The table has also some extra variables namely “total family members and adults”, these variables were prerequisites for calculation of the percentage values of all remained variables. Total family member’s variable was used for all indicators but the adults’ variable jointly used only for calculation of the adults’ literacy rate.

Table 1: Shows the variables of collected data and their calculated value.

No.	Districts	Total Family members	Adults	Adults literacy	Students	Mean years of Schooling	Mobile Phone	Internet	Wireless High speed Internet	Landline Phone	Landline Internet
1	**Tani**	1832	39.96	27.67	27.67	11.14	55.08	7.53	9.40	0.00	0.00
2	**Khost (Matun)**	2894	48.41	36.28	36.28	15.12	59.26	20.77	15.23	0.00	0.00
3	**Bak**	2628	47.41	24.92	24.92	9.53	26.18	5.82	7.25	0.00	0.00
4	**Sabari**	1124	48.49	24.11	24.11	8.95	37.99	7.83	8.89	0.00	0.00
5	**Gurbuz**	1226	47.23	28.55	28.55	9.22	51.88	9.71	6.25	0.00	0.00
6	**Jajimaydan**	2724	63.00	39.54	39.54	10.55	66.01	13.77	9.12	0.00	0.00
7	**Terezayi**	2648	67.75	19.26	19.26	9.14	24.40	7.85	6.14	0.00	0.00
8	**Spera**	2149	42.21	28.11	28.11	7.45	31.04	3.49	5.17	0.00	0.00
9	**Mandozayi**	2195	49.45	26.68	26.68	13.65	50.24	15.30	12.14	0.00	0.00
10	**Shamal**	1453	55.61	15.00	15.00	7.12	27.05	8.74	6.32	0.00	0.00
11	**Nadirshahkot**	2262	45.67	24.49	24.49	9.15	51.50	9.37	7.21	0.00	0.00
12	**Musakhel**	2226	51.08	24.26	24.26	11.34	33.38	8.45	10.12	0.00	0.00
13	**Qalandar**	1201	45.88	30.97	30.97	7.43	18.32	9.99	5.42	0.00	0.00

In the first step, EGDI was estimated for subnational level of Khost province, in a second step, suggested appropriate areas for Internet infrastructure investment based on mobile cell towers, population density and the estimated EGDI. Field survey data were analyzed for all indicators and calculated their related percentage values, then their related mathematical mean and standard deviation values were calculated which were necessary for calculation of associated z-scores. Furthermore, z-score have used for calculation of related composite values, it was used for calculation of normalized values which shows the rank of TII and HCI (UN, 2016) [6].

3.2 EGDI estimation

EGDI is composed from 3 dimensions, each dimension has more variables (indicators). For each indicator data were collected and processed according to UN survey report. A table 2 doesn't shows z-score values of two indicators, landline phone and landline Internet (Fixed broadband Internet), because both of them have zero"0" values, so their services are not available. Additionally, composite values were calculated with the following formula.

TII composite value = Average Z-Score of (Internet User + Telephone line + Mobile Subscribers + Wireless broadband + Wired broadband)

The calculated composite values have normalized with the following equation for related district which produced a related normalized or TII rank of related district.

$$\text{TII (District"X")} = \frac{[0.1556 - (-0.6618)]}{[1.2485 - (-0.6618)]} = 0.4279$$

The above equation shows composite value for districts X = 0.1556 with lowest composite -0.6618 and highest composite value 1.2485.

Table 2: Shows TII related z-score, composite values and normalized values

No	Districts	Mobile z-score	Internet z-score	Wireless broadband z-score	Composite values	TII Normalized values
1	Tani	0.9560	-0.5508	0.3728	0.1556	0.4279
2	Khost (Matun)	1.2388	2.5414	2.4624	1.2485	1.0000
3	Bak	-0.9993	-0.9505	-0.3978	-0.4695	0.1007
4	Sabari	-0.2003	-0.4815	0.1900	-0.0984	0.2949
5	Gurbuz	0.7395	-0.0429	-0.7563	-0.0119	0.3402
6	Jajimaydan	1.6955	0.9057	0.2724	0.5747	0.6473
7	Terezayi	-1.1198	-0.4755	-0.7957	-0.4782	0.0961
8	Spera	-0.6705	-1.4953	-1.1434	-0.6618	0.0000
9	Mandozayi	0.6286	1.2632	1.3548	0.6493	0.6863
10	Shamal	-0.9405	-0.2686	-0.7312	-0.3881	0.1433
11	Nadirshahkot	0.7138	-0.1210	-0.4122	0.0361	0.3653
12	Masakhel	-0.5122	-0.3375	0.6308	-0.0438	0.3235
13	Qalandar	-1.5311	0.0238	-1.0538	-0.5122	0.0783

HCI is a second dimension of EGDI which have four indicators their related z-score have calculated, the following two formulas were used for composite and normalized values of HCI dimension. HCI composite value = 1/3(Adult literacy rate Z-Score) + 2/9 (Gross enrolment ration Z-Score) + 2/9 (Expected years of Schooling Z-Score) + 2/9 (Mean years of Schooling Z-Score)

As well as the related composite values were normalized for all districts with the same method of TII.

Table 3: Shows HCI related z-score, composite values and normalized values

No	Districts	Z -Score of Adult literacy	Z-Score of Gross enrolment ratio	Z -Score of Expected years of Schooling	Z-Score of Mean years of Schooling	Composite values	HCI Normalized values
1	Tani	0.2142	0.1241	-0.6180	0.5088	0.0747	0.4628
2	Khost (Matun)	1.2081	1.5214	2.4045	2.2544	1.7761	1.0000
3	Bak	1.5279	-0.3224	-0.4326	-0.1974	0.2977	0.5332
4	Sabari	-0.0254	-0.4545	-0.1910	-0.4518	-0.2523	0.3595
5	Gurbuz	-0.1585	0.2659	0.6180	-0.3333	0.0695	0.4611
6	Jajimaydan	1.8971	2.0499	-0.4888	0.2500	1.0348	0.7659
7	Terezayi	-1.1913	-1.2419	0.1798	-0.3684	-0.7150	0.2134
8	Spera	-0.0738	0.1942	-1.0112	-1.1096	-0.4527	0.2962
9	Mandozayi	0.1623	-0.0371	1.0674	1.6096	0.6407	0.6415
10	Shamal	-1.3849	-1.9329	-0.9944	-1.2544	-1.3909	0.0000
11	Nadirshahkot	-0.1462	-0.3926	-0.3933	-0.3640	-0.3043	0.3431
12	Masakhel	-0.8185	-0.4304	1.0843	0.5965	0.0050	0.4408
13	Qalandar	-1.2122	0.6598	-1.2247	-1.1184	-0.7781	0.1935

OSI is a third component of EGDI, based on the [6] survey report OSI has a higher value 0.3043 and countywide in covered areas offer the same services. The following formula shows the equal 1:3 ratios of all three criteria for estimation of EGDI.

$EGDI = \frac{1}{3}(TII_{Narmalized} + HCI_{Normalized} + OSI_{Normalized})$ In addition, the following table contains all three criteria with each district related values.

Table 4: Shows three different components values

No	Districts	TII	HCI	OSI	EGDI
1	Khost (Matun)	1.0000	1.0000	0.3043	0.7681
2	Jajimaydan	0.6473	0.7659	0.3043	0.5725
3	Mandozayi	0.6863	0.6415	0.3043	0.5441
4	Tani	0.4279	0.4628	0.3043	0.3983
5	Gurbuz	0.3402	0.4611	0.3043	0.3685
6	Masakhel	0.3235	0.4408	0.3043	0.3562
7	Nadirshahkot	0.3654	0.3431	0.3043	0.3376
8	Sabari	0.2949	0.3595	0.3043	0.3196
9	Bak	0.1006	0.5332	0.3043	0.3127
10	Terezayi	0.0961	0.2134	0.3043	0.2046
11	Spera	0.0000	0.2962	0.3043	0.2002
12	Qalandar	0.0783	0.1935	0.3043	0.1920
13	Shamal	0.1433	0.0000	0.3043	0.1492

Finally, a table 4 show the estimated EGDI in a district level, the average values of all districts 0.3634, known as estimated EGDI of Khost province. The calculated value indicated the development of e-Gov services which is quite higher than the UN 2016 e-Gov survey report.

Furthermore, figure 3 shows the rank level of estimated EGDI in different districts which helps in selection of suitable areas for suggestion of Internet infrastructure investment.

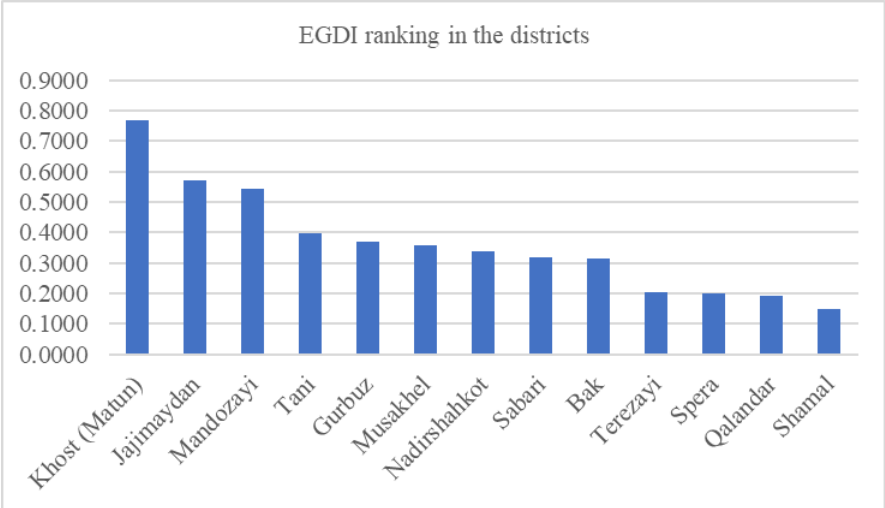
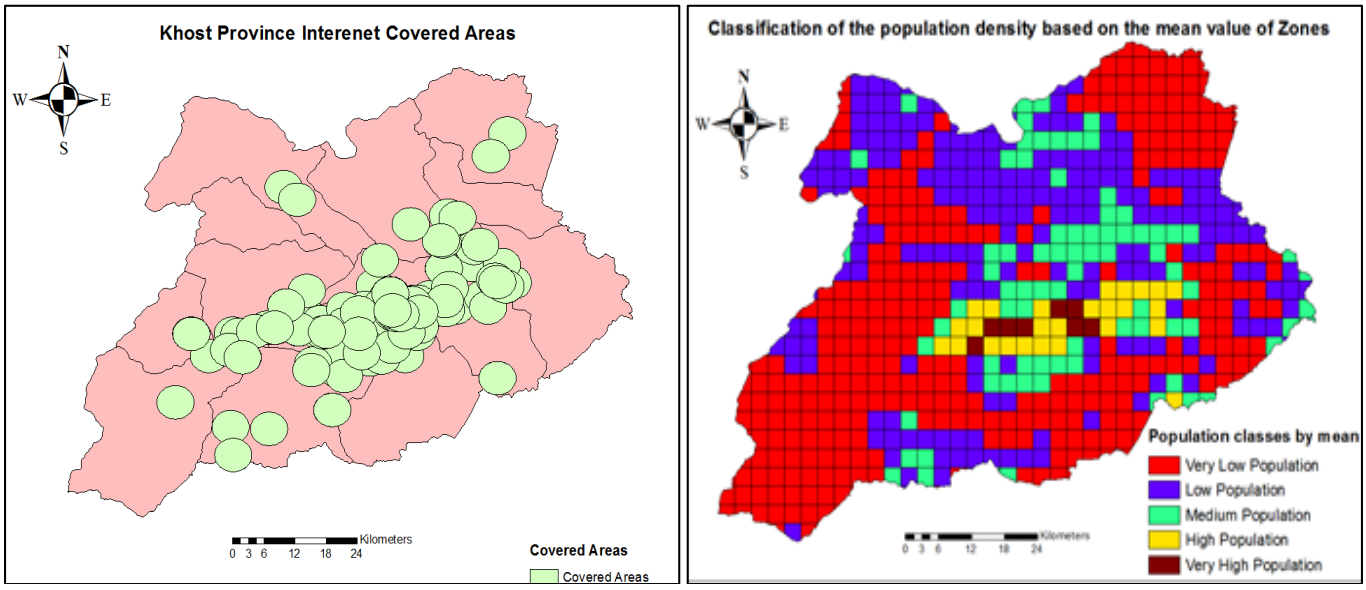


Fig 3: Shows a level of EGDI in district level

3.3 Suggestion of suitable areas for Internet infrastructure investment

A GIS program was used for analyzing of spatial data, for suggestion of suitable areas for Internet infrastructure investment, based on the cell towers spatial data and population density spatial data. Additionally, estimated EGDI have used for prioritization of lease developed EGDI districts associated with selected areas. Though

administrative and settlements spatial data were used for the nomination of exact location for Internet infrastructure investment. In the first step we have separated covered areas from the non-covered areas based on the cell towers GPS point, a device used in the towers can cover around 3km areas. Cell towers spatial data were collected from the local department of related company at Khost province. In figure 4.2 a, the circles pointed out the covered areas and the rest of the area is the non-covered area. In the second step, the whole area of the province has divided into 3km zones with the consideration of the standard cell tower, based on the population density the zones were divided into five classes.



A. B.

Fig 4a, b: Shows the covered and non-covered areas and 4.2 b pointed out the five classes

Third step, the two processed maps were matched to each other, in non-covered areas a higher population density class (third class) have selected for Internet infrastructure investment. Though, first and second classes have higher population density, but they are already covered via mobile cell towers, a figure 5 shows the match form of the previous two maps.

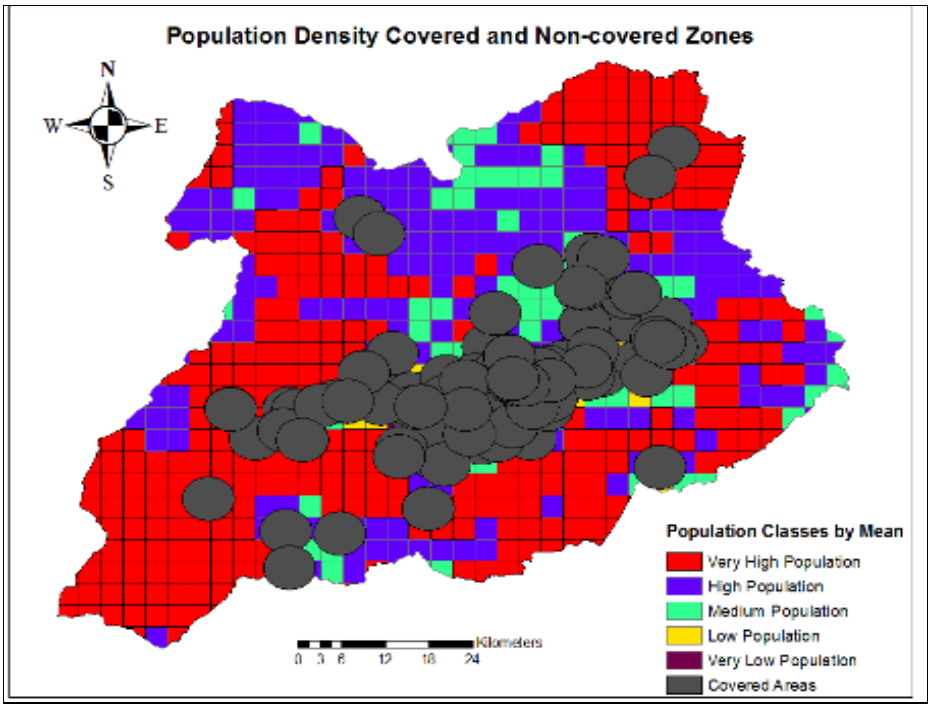


Fig 5: comparative form of the two maps

Fourth step, based on the estimated EGDI the priority has been taken to those districts related areas which have leased developed. Additionally, all zones of the suggested areas in a third class have considered for five different phases where private and public sectors have to invest for Internet infrastructure, in a first phase the zones of the least developed EGDI and then in the second level leased developed EGDI then third level, fourth and fifth level leased developed EGDI.

Table 5: Shows five suggested classes of Internet infrastructure Investment

No	District Name	Settlement Name	EGDI	Priority Queue
1	Terezayi	Kadam Tana	0.2046	First Priority
2	Terezayi	Khoramay and Motuni	0.2046	
3	Sabari	Bakhtana and Uqbay	0.3196	
4	Sabari	Parokhel	0.3196	
5	Sabari	Taray Lewankhel	0.3196	
6	Sabari	China	0.3196	
7	Sabari	Guldar and Lewankhel	0.3196	
8	Sabari	Zambar	0.3196	
9	Sabari	Cheray and Tanda	0.3196	
10	Nadershahkote	Asar	0.3376	Second Priority
11	Nadershahkote	Badal Kalay	0.3376	
12	Nadershahkote	Telgar	0.3376	
13	Musakhel	Ghozak and Ayubkhel	0.3562	
14	Musakhel	Lador Kholeh and Kosin Kholeh	0.3562	
15	Musakhel	Ghorang and Gerenay	0.3562	
16	Tani and Gurbuz	Jan Shareh Kalay	0.3834	Third Priority
17	Tani	Cunjay	0.3983	
18	Tani	Yarine kalay and Matak	0.3983	
19	Khost (Matun)	Khargay and Goda Khera	0.7681	Last Priority
20	Khost (Matun)	Khabshkhil and Khanikhawr	0.7681	
21	Khost (Matun)	Zandakhel and Tobay	0.7681	

A guidance to public and private sector for Internet infrastructure investment to invest according to the above table from the first priority class to the last class.

3.4 Discussion

Proposed EGDI estimation framework and suggested areas for Internet infrastructure investment results were validated and supported by qualitative data, the data which were collected through interview from the local expert bodies. The accuracy of result is depended on collected data, therefore, a new filed survey for data collection of population density and settlement may generate more accurate result.

4. Conclusion

To achieve the objectives of the research study, a purposive sample was created to understand and estimate the most currently EGDI rank of Khost province. In order 1400 questionnaires were distributed in all districts and responded by 1400 families. Additionally, spatial and statistical data were obtained from local departments and online sources. Furthermore, EGDI estimation framework was proposed and implemented for the case study. The two dimensions TII and HCI were estimated with the showing of the related maps and tables, and a third dimension OSI value was taken from UN 2016 e-Gov survey report.

According to the study scope and limitation, in Khost province, all thirteen districts were selected as study areas and EGDI was estimated for all districts. The table 6 shows estimated EGDI values in subnational level Khost province with the related dimensions values. Field survey data which were collected from the local departments, were used for estimation of EGDI rather than expected years of schooling indicator. All districts estimated EGDI average values are known as a Khost province EGDI value.

Based on the spatial data of population density and mobile cell towers appropriate areas were suggested for Internet infrastructure investment. Through mobile cell towers spatial data pointed a coveredareas. Additionally, population density data were divided into 3 square km zones and divided into five classes, based on this two factors in the non-covered areas a higher population density class was suggested for Internet infrastructure investment. According to the estimated EGDI, in a suggested class those districts which have lower EGDI values were prioritized. Proposed EGDI estimation framework and suggested areas for Internet infrastructure investment results were supported by qualitative data analysis that were collected through interview from the local expert bodies.

4.1 Recommendations

- The study revealed that the EGDI rank is still lower as prioritized for the districts level in Khost province. Therefore, the provincial educational and telecommunication relevant organizations need to pay more attention to the lowest EGDI ranked districts to improve the areas' residents' literacy and ICT usage skills. Additionally, appropriate ICT infrastructure is needed for providing citizens' centric public services for 24 hours a day and 7 days a week.
- The study finds out that most of the province is covered by GSM and mobile phone services. However, some rural areas are still not covered by mobile services regarding citizens' demands and needs. The public-private ICT sectors which are providing GSM and mobile cellular services in the province should consider the remaining rural area for investing of GSM and mobile services infrastructure. It is recommended for the provincial government and presidency of communication and information technology of Khost province with the advisee of MCIT to design and develop mobile-based e-Gov services, because mobile based ICT infrastructure could be the best pathway for an easy and suitable e-Gov services provision.
- Using reliable and accurate data for estimating EGDI of the subnational and national level is more important. The study findings show that the estimated EGDI rank is quite different and higher than the results of the e-Gov survey conducted by UN in 2016. It is recommended for all national and international organizations to collect and use the accurate data for estimation of the EGDI both for the subnational and national level.

- E-Gov services' infrastructure in many districts are still in a preliminary stage in the context of Khost province. The research findings are opening the door for the Public and Private Partnership (PPP) and other governmental organizations to invest in providing Internet, e-public services, e-educational services, e-health services and etc.

4.2 Future work

Regarding future work, the proposed GIS based EGDI estimation framework is recommended to be implemented for other provinces too. This implementation will help national and international organizations to estimate EGDI accurately for subnational and national level in context of Afghanistan. Additionally, the study re-estimated two dimensions of EGDI including TII and HCI. It is recommended to re-estimate the third dimension OSI too, because the TII and HCI values for calculating EGDI were quite different from the value of UN survey conducted in 2016. The OSI re-estimation may explore more accuracy in the estimation of EGDI.

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