Journal of Social & Organizational Matters

Vol 3 No 4 (2024): 260-289

Addressing Urban-Rural Disparities in Pakistan: A Targeted Smart Village Model

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Keywords: *Urban-Rural Gaps, Urban-Rural Disparities, Rural Development, Smart Village, And Pakistan Social and Living Standards Measurement*

DOI No:
https://doi.org/10.56976/jsom.v3i4.136

Urban-rural disparities are a global challenge, not confined to any specific region. In this paper, we focus on the Pakistani context to explore these gaps and propose a smart village model as a solution. Using secondary data, primarily from the Pakistan Social and Living Standards Measurement (PSLM) 2019-20 survey, we analyzed disparities in four key domains: education, health, Information and Communication Technology (ICT), and Water, Sanitation, and Hygiene (WASH). Our findings highlight significant urban-rural gaps across these variables. Rural areas in Pakistan face critical challenges, including limited access to quality education, inadequate healthcare services, insufficient ICT infrastructure, and poor WASH facilities. These disparities not only hinder the quality of life in rural communities but also slow down sustainable development and exacerbate migration to urban areas. To address these challenges, we propose a smart village model designed to bridge these gaps. The model includes five core components: smart education, which integrates digital and traditional teaching methods; smart health, emphasizing telemedicine and mobile healthcare units; smart ICT, focused on expanding connectivity and digital literacy; smart WASH, promoting innovative solutions for water and sanitation; and smart awareness, aimed at empowering rural communities through information dissemination and capacity building. The implementation of this smart village model has the potential to transform rural areas by improving living standards, reducing urban-rural disparities, and fostering inclusive and sustainable development. This holistic approach can help bridge the socio-economic divide, enhance rural resilience, and contribute to Pakistan's broader development goals. By leveraging technology and community engagement, the proposed model offers a pathway for addressing systemic inequalities and achieving balanced regional growth.

1. Introduction

Urban areas are usually more developed compared to rural areas. Rural residents perceive urban areas to be more attractive because of better educational opportunities and availability of job prospects. Rural areas don't have better food security also, because the food securities are highly influenced by their income levels and their respective ability for affordability. Thus, all this shows that the governments must take actions for rural development by creating more equitable and inclusive environments in rural areas. These efforts are crucial for uplifting rural areas and to bridge the gap between urban and rural regions (Ejaz & Mallawaarachchi, 2022).Smart villages use innovations, usually using digital technologies, to improve quality of life and access to key services in rural areas. The smart village concept addresses urban-rural gaps by providing smart solutions, improving quality of life and promoting sustainable development (Aziiza & Susanto, 2020). A smart village can provide the integrated services to its residents and local enterprises, optimizing both effectiveness and efficiency in service delivery (Somwanshi et al., 2016).

In 2021, Pakistan initiated the Smart Village Pakistan Project with the partnership of International Telecommunication Union (ITU) and Huawei to improve quality of life and ensure inclusive sustainable development in rural Pakistan. The initiative included the programs related to education, health, and business (Okuda, 2023). It is part of ITU's Smart Villages and Smart Islands (SVSI) initiative and first ITU Smart Village in Asia-Pacific. SVSI was inaugurated in Niger in 2020 and then adopted and adapted for Asia and the Pacific to link unconnected individuals and communities by 2030 (Ali, 2023).

Gokina is in the mountainous region of Islamabad, but the area has no essential services, including proper education and health. As a pilot project, the Gokina Smart Village serves as a model for future initiatives aimed at bridging the rural-urban divide and fostering sustainable development. Federal Minister for IT and Telecommunication Syed Amin Ul Haque has said that in line with the Government's Digital Pakistan vision and the UN SDGs, Smart Village Pakistan initiative aims to digitally transform remote and rural communities with Internet connectivity and empower local residents with access to a range of digital services to improve their quality of life and well-being. The Gokina Smart Village Project targets three areas based on a needs assessment: education, health, and digital skills & entrepreneurship. In education, it addresses the absence of science teachers, especially in the girls' school, by partnering with Tele-Taleem. For health, it aims to improve limited services through Sehat Kahani. The project also focuses on enhancing digital skills and entrepreneurship, enabling community members to use both digital and non-digital tools for businesses in areas like fashion, agriculture, and local cuisine, facilitating better market access and financial opportunities (MITT, 2023). Despite the potential benefits, Gokina Smart Village Project could have involved many more initiatives. The initiatives taken under the smart village project are not enough to solve the problems faced by the people of Gokina village and reduce the urban-rural gap.

This research is going to propose a smart village model in order to reduce urban-rural gaps in the context of Pakistan. We utilised the Pakistan Standard of Living Measurement (PSLM) 2019-20 survey data to identify urban-rural disparities, focusing education, health, ICT, and WASH as main variables. We analyzed PSLM data for the development of the targeted smart village model in order to reduce the gap between urban and rural areas in Pakistan.

2. Literature Review

Rural development aims to improve agriculture, education, infrastructure, health, and non-farm employment, and to strengthen rural institutions. It seeks to enhance rural livelihoods equitably and sustainably by providing better access to capital and services, empowering individuals to manage resources effectively. This approach ensures lasting, equitable improvements in the quality of life for rural communities. (Atchoarena & Gasperin, 2003). In this research, we will employ four variables to identify rural-urban disparities in Pakistan: education, health, information and communication technology (ICT), and water, sanitation and hygiene (WASH). Each component significantly influences the quality of life and economic prospects for rural inhabitants. Education is a vital part of life and serves as the foundation for both personal and societal advancement (Wood, 2023). Education reduces inequalities, achieves gender equality, and empowers individuals to lead healthier, sustainable lives. It promotes tolerance and helps establish peaceful societies. Quality education enables people to break the poverty cycle (Education - United Nations Sustainable Development, n.d.). Between 2008 and 2012, an analysis of 63 countries revealed that the average rate of out-of-school children was 16% in rural areas, in contrast to 8% in urban areas (UNESCO-UIS, 2015). Despite significant progress and economic growth in recent decades, the educational divide between urban and rural areas in China continues to hinder educational development. This gap can be seen in various forms, including disparities in resource distribution, teacher availability, and student performance (Tang, 2023).

Health is one of the most important factors of rural development, as it highly influences productivity, quality of life, and economic growth. People in rural areas experience more poor health outcomes compared to urban people, but they also use healthcare services less frequently (UW-CTRI, 2023). People who live in rural locations experience different health inequalities when compared to those who live in urban areas. Exposure to certain environmental risks and restricted access to emergency services and specialist healthcare put rural people at higher risk of death (Centers for Disease Control and Prevention, 2024). Rural people have less health information as compared to people living in urban areas (Chen, et al., 2018). According to a study, women in rural areas receive less regular prenatal and primary care than women in urban areas. Women in rural areas need better access to obstetric and gynaecological services (Burns et al., 2022). Nearly 70% of the population in Pakistan resides in underserved rural regions, where access to healthcare is limited due to a shortage of medical staff, inadequate facilities, and the high costs associated with treatments (UNCTAD, 2021).

Information and Communication Technology (ICT) s essential for rural development, especially in marginalized areas with few resources and opportunities. ICT allows rural people to participate in community life, obtain education, and engage in knowledge-based economic activities (Salemink et al., 2017). According to recent statistics, 81% of individuals residing in urban areas globally use the internet, compared to only 50% of those living in rural areas (ITU, n.d.). Integrating ICT into rural development can accelerate progress and help bridge the gap between the more and less educated, as well as technologically advanced and disadvantaged segments of society (Mukherjee, 2011). Empirical evidence shows that both county-level ICT penetration and household-level ICT usage reduce the rural-urban income gap, with smartphones having a more significant impact than computers. Smartphones notably enhance

agricultural operational income for rural households, contributing to a decrease in income disparity (Dong et al., 2023).

Water, Sanitation, and Hygiene (WASH) is one of the United Nations Sustainable Development Goals (SDGs), specifically SDG 6, it underscores the global commitment to ensuring availability and sustainable management of water and sanitation for all by 2030. Globally, especially in underdeveloped countries, WASH issues persist. Public and environmental health and social and economic growth depend on water, sanitation, and hygiene (WASH) services (Zyoud & Zyoud, 2023). Without water, sanitation, and hygiene (WASH), people's well-being, dignity, and opportunity suffer, especially women and girls (UN, n.d.). Improved global access to WASH practices can reduce the millions of illnesses and deaths caused by diarrhea, cholera, and typhoid fever (CDC, 2024). WASH investment reduces healthcare expenses and boosts productivity. It removes barriers to excluded groups' full participation in society and promotes long-term job development (UN, n.d.). A Zambian survey indicated that 53.4% of rural families lack improved water supplies, compared to 10.5% in urban regions. Rural families lack better sanitation 81.5% of the time, compared to 65.0% in urban areas (Mulenga, Bupe, & Kaliba-Chishimba, 2017). Urban regions have 16% more basic water coverage than rural ones in 2017. The gap for basic sanitation was much higher at 26% (UNICEF, 2020).

2.1 Smart Village

The Smart Village concept involves more than merely the installation of digital technologies, while these technologies are essential to the transformation process. Non-digital methods also have considerable importance. This innovative method of sustainable rural planning prioritizes knowledge-based growth through continuous human resource improvement along with comprehensive village resource development. The objective is to promote rural development within the context of comprehensive regional and national initiatives (Sutriadi, 2018). The environmental dependencies and socio-cultural systems of diverse communities make it difficult to define a "smart village". Thus, the concept must adapt to each rural setting's particular circumstances and obstacles (Zavratnik, Kos, & Duh, 2018).

Smart villages increase infrastructure, healthcare, education, and internet connectivity in isolated rural areas, improving quality of life. These projects attempt to improve living circumstances, prevent rural-to-urban migration, boost agricultural productivity, and encourage local entrepreneurship and job development. Smart Village programs empower communities, boost national growth, and promote social equality by combining modern and traditional traditions. These global efforts aim to provide urban-like benefits while conserving rural living, allowing residents to attain their full development potential by connecting them to global opportunities and providing a viable, healthy lifestyle (Patnaik et al., 2020). Various case studies highlight the success and challenges of smart village projects. Guangxi Xincheng has utilized e-commerce to sell over 80 specialty agricultural products, helping more than 30,000 individuals escape poverty through the "Smart Village Baihu" system. The Chinese government has effectively used the internet for rural poverty alleviation, with 81.2% of users recognizing its role in uniting communities to support poor farmers. Additionally, 77.2% believe rural e-commerce is crucial for increasing agricultural sales, and 75.9% feel it improves access to essential information on employment, social security, and healthcare. The breakthroughs

explain the process of information intoxication among rural village groups in China (Zhang & Zhang, 2020). Smart villages are transforming lives in rural Gujarat and Bihar, India, through private sector initiatives. The projects complement national efforts to improve access to basic services, education, health care, and job opportunities through Information and Communication Technologies (ICT). Experiences from both India and China underscore the significance of smart village supported by government as well as private sector efforts to lead towards improved social welfare that can help increase better socio-economic outcomes (Patnaik, Sethi, & Mahmoud, 2020). A study in Eastern Poland emphasizes the smart village concept's role in sustainable rural development, especially in underdeveloped areas. Studies indicates that rural regions near urban centers can effectively adopt smart growth strategies due to their combination of rural and urban characteristics, larger populations, and strong industrial and service sectors. Being closed to cities offers access to natural resources, technological infrastructure, and recreational amenities, which are essential for smart rural development and foster sustainable growth by integrating the benefits of both environments (Adamowicz & ´nska-Ligaj, 2020).

2.2 Smart Village Models

There is no standardized method for constructing smart villages all around the world. All rural areas are unique; therefore, the smart village model has to be made with careful consideration of the specific characteristics and needs of each village. This strategy is referred to as a place-based approach (Zavratnik et al., 2018). Many scholars have identified key components that contribute to their implementation. One such model is presented by (Somwanshi et al., 2016), they outline a comprehensive set of requirements for smart villages. Table 1 presents these requirements:

Table No1: Services Required for Smart Village

1	Smart security	10	Strengthening CBOs
2	Efficient public transportation system	11	Functional bank account
3	Improving sanitation conditions	12	Facilities regarding to the agriculture
4	Solid and liquid waste management	13	Latest& affordable medical facilities
5	Rain harvesting /Rain water drainage system	14	E-governance
6	Safe drinking water facilities	15	Use of modern technologies for improvement of locality
7	Use of renewable energy	16	Improvement on women empowerment
8	Energy conservation	17	Educational facilities
9	Grievance redresser		

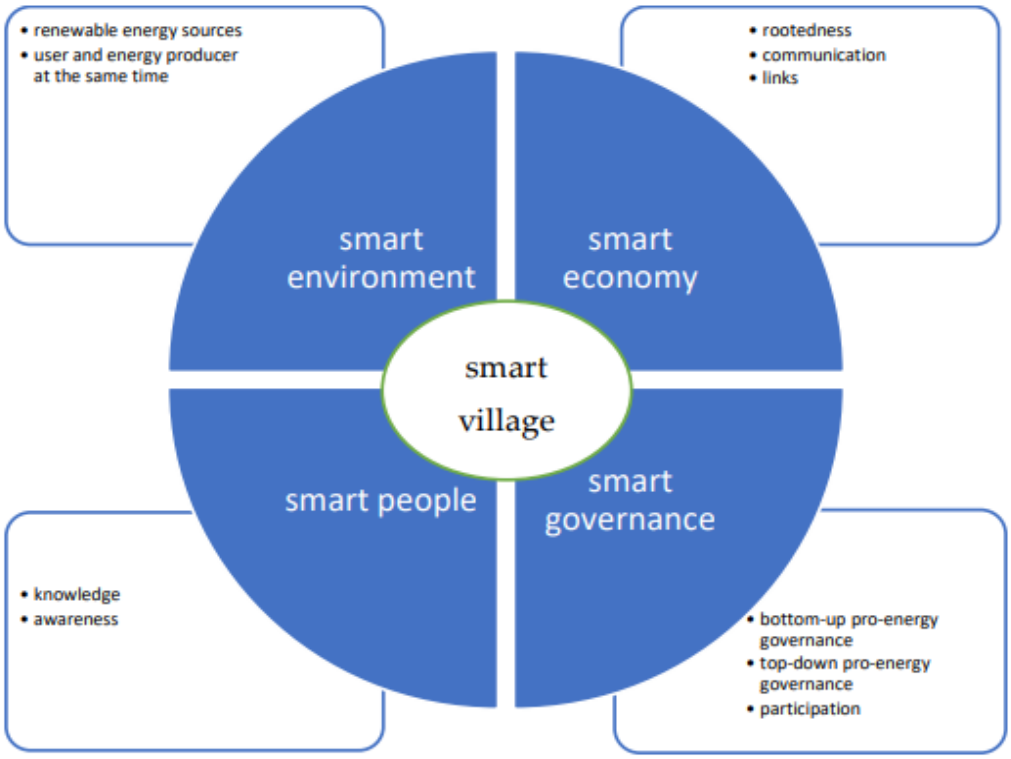
Source: (Somwanshi, Shindepatil, Tule, Mankar, & Ingle, 2016).

Agnieszka Budziewicz-Guźlecka and Wojciech Drożdż (2022) put forward a smart village model. Their approach has four main parts: smart economy, smart environment, smart

people, & smart governance, refer to figure 1 for further details (Budziewicz-Gu´zlecka & Drozd˙z, 2022).

1. Smart Economy: It put the emphasis on the importance of rootedness, communication, and links within the rural community to promote local economic development.
2. Smart Environment: It highlights the role of renewable energy sources and considers rural people as both the users and the producers of energy. It promotes environmental awareness and sustainable practices in rural communities.
3. Smart People: It gives the importance to knowledge, awareness, and rootedness among the rural people. Smart villages create a well-informed rural population by promoting these qualities.
4. Smart Governance: It emphasizes employing both bottom-up and top-down governance approaches to promote the involvement of local communities in decision-making processes.

Figure No 1: Smart Village Model



Source: Budziewicz-Gu´zlecka & Drozd˙z, (2022)

3. Methodology

The study will rely on secondary data from government reports and publications with the Pakistan Standard of Living Measurement (PSLM) 2019-20 report serving as the main data source.

3.1 Data Analysis

The study extracted the secondary data from the PSLM and other relevant government publications to study the extent of urban-rural disparities across Pakistan. We have presented

the data in the form of percentages, graphs, and histograms for comparative analysis between urban and rural areas.

3.2 Proposing a Smart Village Model for Pakistan

A comprehensive literature review is conducted to study the existing smart village models with a focus on developing nations similar to Pakistan. Based on the literature review and the analysis of urban-rural disparities, we have presented a smart village model focused on selected variables.

4. Result and Discussion

4.1 Urban-Rural Disparities in Pakistan

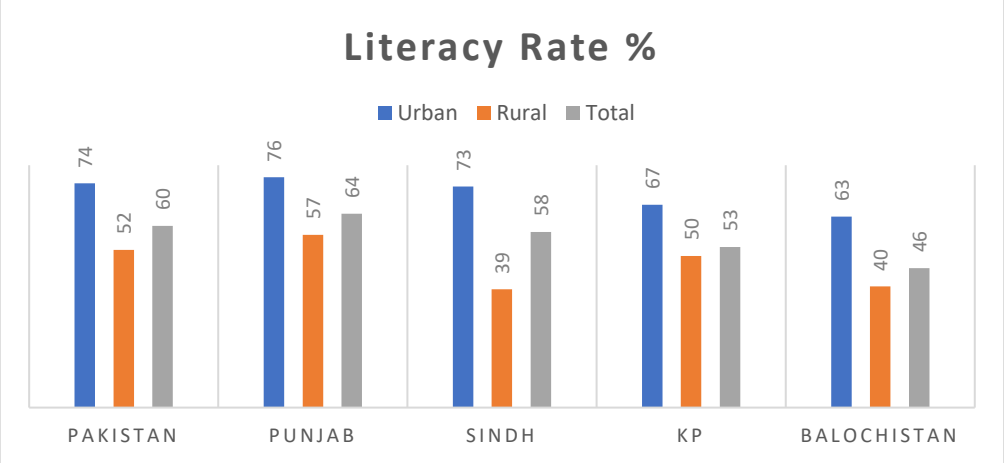
There are very significant urban-rural disparities in Pakistan that span across various dimensions such as education, health, information and communication technology (ICT), water, sanitation and hygiene (WASH).

4.2 Education

We will evaluate the urban-rural disparities in education in Pakistan by using different indicators. We will analyze disparities at both national and provincial levels, and we will also offer a comprehensive understanding of these gaps at national level as well as within provinces. The data being presented is sourced from the Pakistan Social and Living Standards Measurement (PSLM) 2019-20 survey report and the Pakistan Education Statistics 2021-22 report published by Pakistan Bureau of Statistics and the Ministry of Federal Education and Professional Training respectively.

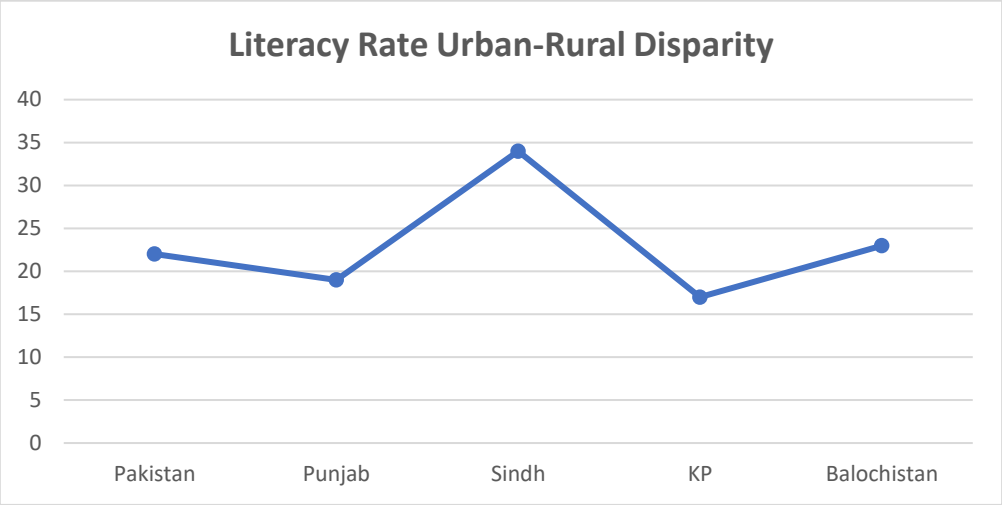
4.3 Literacy Rate: According to the Pakistan Social and Living Standards Measurement (PSLM) Survey for 2019-20, the literacy rate in the urban areas is 74% and rural areas stand at 52%. We can also see a significant gender disparity also, males have a higher literacy rate at 70%, while females have a literacy rate of 49%.

Figure 2: Literacy Rate in Pakistan by Province and Location.



Source: PSLM (2019-20).

Figure No 3: Literacy Rate Urban-Rural Disparity in Pakistan by Province



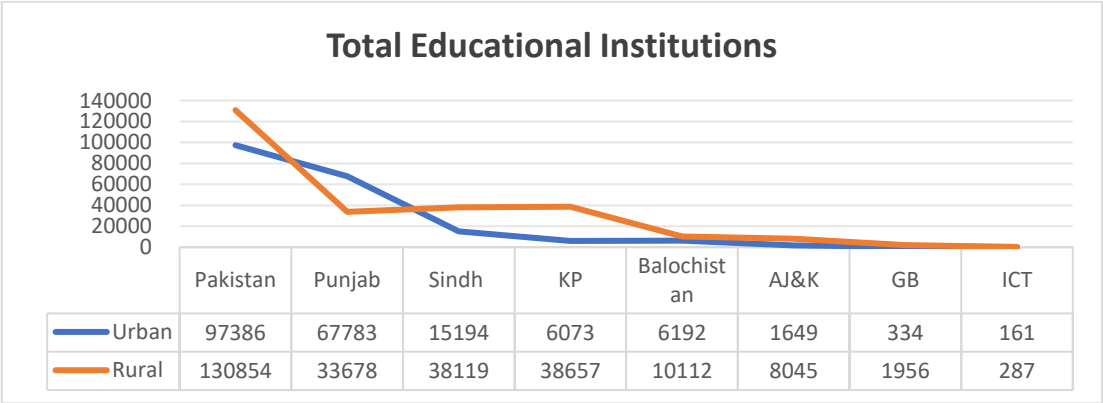
Source: PSLM (2019-20)

The data presented in Figure 2 & 3 clearly shows significant differences in literacy rates between urban and rural areas across all provinces in Pakistan. Sindh has the widest gap, with rural areas falling far behind urban ones. Even though Punjab has the highest literacy rates overall, there's still a noticeable difference between its urban and rural regions. Balochistan and KP also have considerable gaps, highlighting the need for focused educational efforts in rural communities.

4.4 Number of Educational Institutions

The total number of educational institutions serves as a critical indicator of urban-rural disparities in Pakistan, reflecting the accessibility of education available to different populations. As we've discussed, urban areas in Pakistan have a significantly higher literacy rate compared to rural regions across all provinces. Interestingly, despite this disparity in literacy, rural Pakistan has a greater number of educational institutions. In fact, among all the provinces and autonomous regions, only Punjab stands out with more educational institutions located in its urban areas. It is further illustrated in Figure 4. This situation highlights the complexities of educational access and quality in Pakistan, it raises the question on quality of education being provided in rural Pakistan.

Figure No 4: Total Educational Institutions (Public, Other Public, Private Sector) by Province and Location 2021-22.



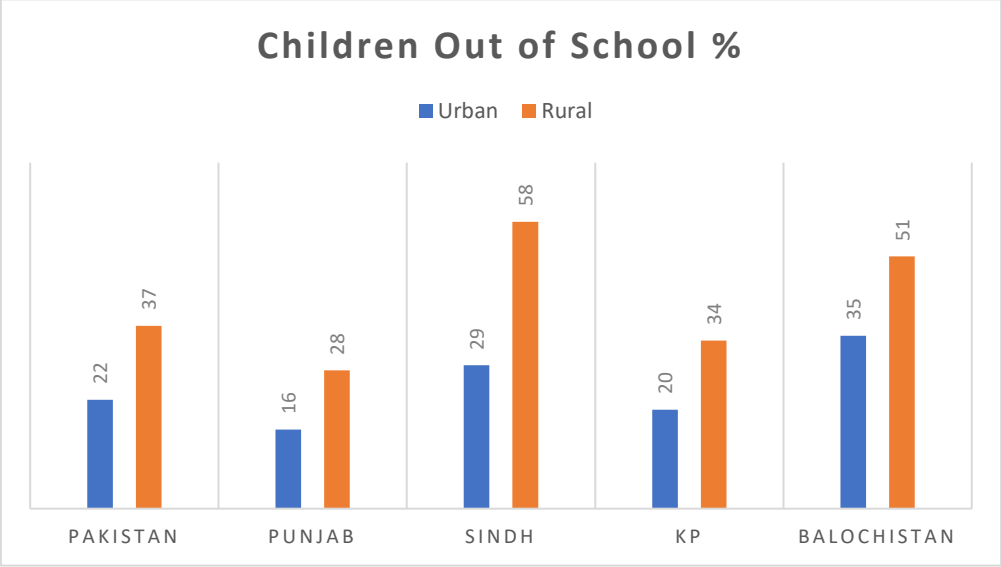
	Pakistan	Punjab	Sindh	KP	Balochistan	AJ&K	GB	ICT
Urban	97386	67783	15194	6073	6192	1649	334	161
Rural	130854	33678	38119	38657	10112	8045	1956	287

Source: Pakistan Education Statistics 2021-22.

The disparity suggests that while rural areas may have more institutions, the quality of education, availability of resources, and the capacity of these institutions may be significantly lower compared to urban areas. This could include factors like poorly trained teachers, inadequate infrastructure, and lack of access to modern educational tools, which collectively contribute to the lower literacy rates despite a higher number of institutions. According to UNICEF, a lot of rural schools lack basic necessities like clean water, sanitation, and electricity. The Pakistan Education Statistics 2020-21 report highlights a significant gap in the student-teacher ratio, with rural areas having fewer trained teachers—only 35% of rural teachers are formally trained, compared to 70% in urban areas. Additionally, about 40% of rural schools don't have enough textbooks, and only 17% have access to computers and the internet, compared to 78% of urban schools, according to the Pakistan Social and Living Standards Measurement Survey (Farooq, 2024) (Pakistan Institute of Education (PIE), 2024).

Despite having more educational institutions in rural Pakistan, the literacy rate remains lower compared to urban areas. Additionally, the "children out of school" data in figure 5 shows that the majority of out-of-school children are from rural regions. This is a serious concern for Pakistan, especially since a large portion of its population lives in these rural areas.

Figure No 5: Children Out of School (%) by Province and Location 2019-20.



Source: PSLM (2019-20).

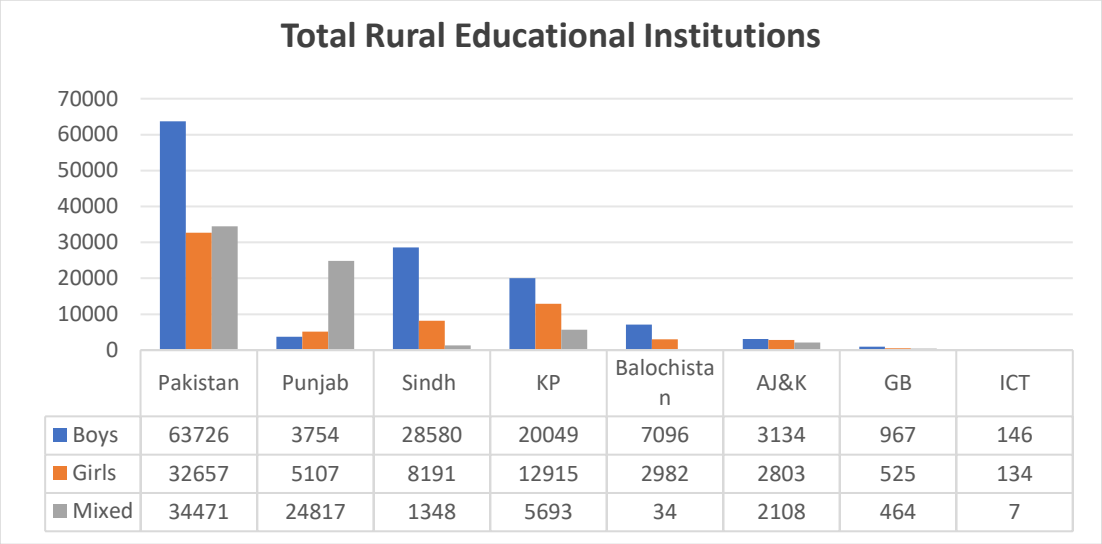
It highlights significant urban-rural disparities in education across Pakistan. Nationally, 37% of rural children are out of school, compared to 22% in urban areas. Punjab has a 12% gap, with 28% of rural children out of school versus 16% in urban areas. Sindh shows the most severe disparity, with 58% of rural children out of school compared to 29% in urban areas. Khyber Pakhtunkhwa also exhibits a 14% gap, and in Balochistan, 51% of rural children are out of school compared to 35% in urban areas. These figures underscore the urgent need for targeted interventions to bridge the educational gap between urban and rural regions.

4.5 Gender Disparity in Rural Education

The distribution of educational institutions in rural Pakistan reveals significant gender disparities that impact access to education for girls. According to the data from 2021-22, there is a notable imbalance in the number of educational institutions available for boys and girls in

rural areas across different provinces. The proportion of barriers to co-education is indeed comparatively high in South Asia, particularly in Pakistan (Iqbal, Anjum, & Ahmed, 2023). The Pakistan Education Statistics 2021-22 reveal that while rural Pakistan has more educational institutions overall compared to urban areas, there is a significant gender disparity against girls when it comes to the total number of educational institutions in rural areas. Punjab stands out as the only province or administrative unit with more educational institutions for girls than for boys, which translates in less gender disparity in literacy rates in Punjab. However, in all other provinces and administrative units, the disparity is notable, with fewer educational opportunities for girls. This contrast is clearly illustrated in Figures 6 and 7.

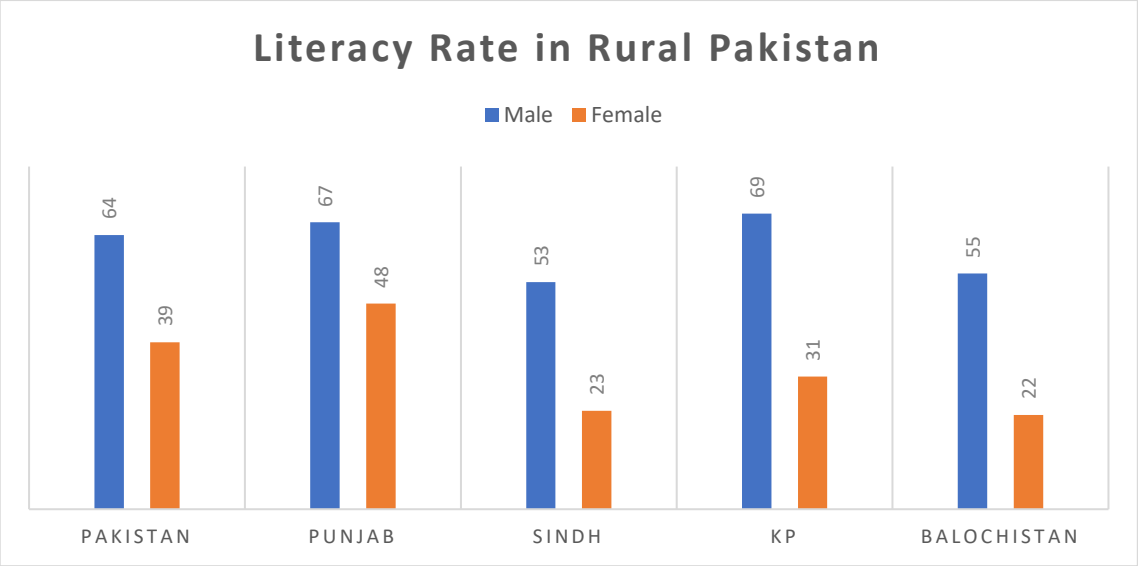
Figure No 6: Total Rural Educational Institutions (Public, Other Public, Private Sector) Gender and Province 2021-22.



	Pakistan	Punjab	Sindh	KP	Balochistan	AJ&K	GB	ICT
Boys	63726	3754	28580	20049	7096	3134	967	146
Girls	32657	5107	8191	12915	2982	2803	525	134
Mixed	34471	24817	1348	5693	34	2108	464	7

Source: Pakistan Education Statistics 2021-22.

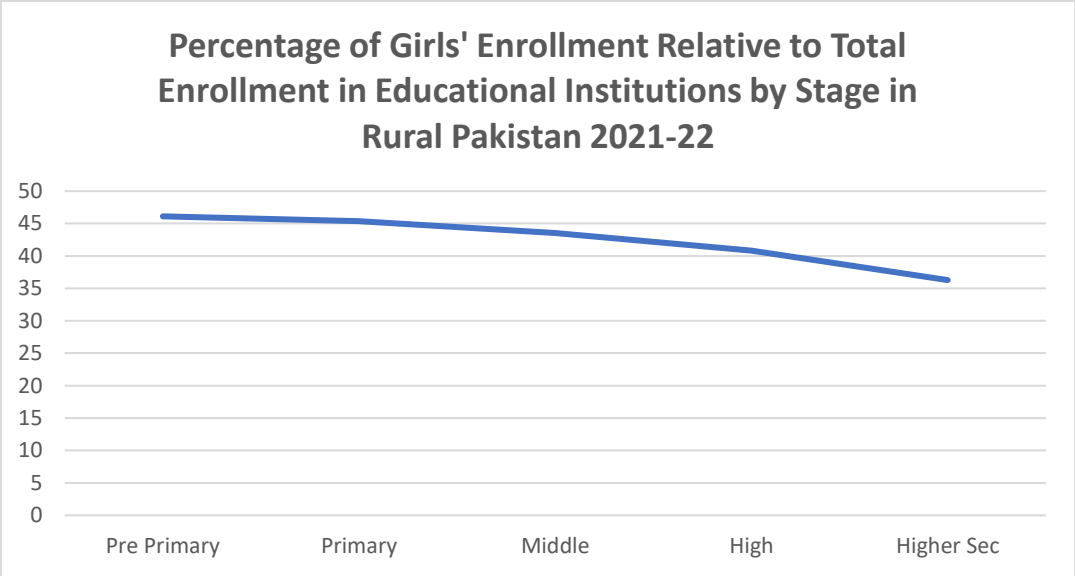
Figure No 7: Total Rural Educational Institutions (Public, Other Public, Private Sector) by Gender and Province 2021-22.



Source: PSLM 2019-20.

The data from Pakistan Education Statistics 2021-22 reflects a declining trend in the percentage of girls' enrollment as the educational level progresses, highlighting the gender disparity that becomes more pronounced at higher levels of education in rural Pakistan. Figure 8:

Figure 8: Percentage of Girls' Enrolment Relative to Total Enrolment in Educational Institutions by Stage in Rural Pakistan 2021-22.



Source: Pakistan Education Statistics 2021-22.

4.6 Health

The health status of a population is an important indicator of overall well-being and development. And we see significant disparities between urban and rural areas in Pakistan. This research will indicate these gaps using different health indicators, including immunization rates, prenatal and postnatal consultations and household satisfaction of basic health units. By analyzing these indicators at both the national and provincial levels, we will provide a comprehensive understanding of the urban-rural health disparities throughout the country. The data utilized in this analysis is taken from the Pakistan Social and Living Standards Measurement (PSLM) survey reports, it offers valuable insights into the health gaps in Pakistan.

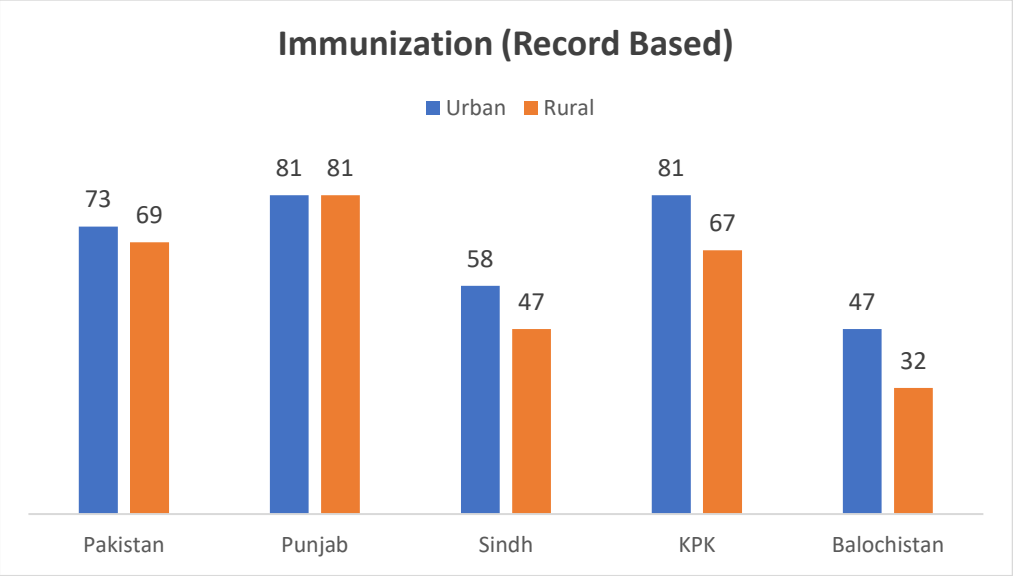
4.7 Immunization

Immunization is a straightforward and effective method to safeguard infants from serious diseases. It involves administering substances that stimulate the immune system to produce disease-fighting antibodies. Health experts emphasize that immunization is as essential to a society's health as nutritious food and is among the most successful and cost-effective health interventions available. It helps curb the transmission of viral diseases among children and has played a crucial role in preventing smallpox, reducing the global incidence of polio, pertussis (whooping cough), influenza, hepatitis B, pneumonia, tetanus, rotavirus, typhoid, and measles (Pakistan Bureau of Statistics (PBS), 2021). Pakistan has made remarkable strides in immunization coverage over the past three decades, achieving a 117.6% increase in the percentage of children aged 12 to 23 months who are fully immunized between 1990 and 2020 (Mahmud & Kashif, 2021).

Pakistan Bureau of Statistics (PBS) employed two techniques to measure immunization data in PSLM (2019-20), record-based assessments rely on documented immunization history, while recall-based assessments depend on parental memory and reporting. There is a significant risk that parents may confuse the immunization with other vaccines, so we will only reply on record-based immunization rates.

As illustrated in figure 9, the national average for immunization coverage is slightly higher in urban areas (73%) compared to rural areas (69%). But we see significant disparities between urban and rural areas of KPK and Balochistan.

Figure 9: Record Based Immunization Rate (%) by Province and Location 2019-20.



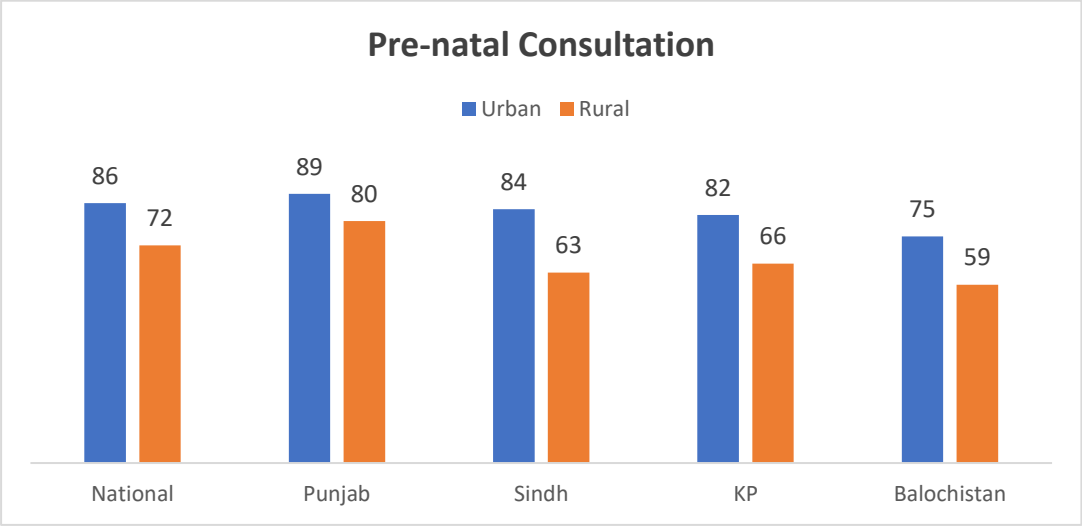
Source: PSLM 2019-20.

4.8 Pre-natal Consultation

Prenatal care involves medical check-ups and screening tests to ensure the health of both the mother and the baby during pregnancy. It includes education and counseling on various aspects of pregnancy management. During these visits, healthcare providers may discuss topics such as nutrition, physical activity, necessary screening tests, and what to expect during labor and delivery (Office on Women's Health, 2021).

At national level, prenatal consultation coverage is higher in urban areas (86%) as compared to rural areas (72%). The data reveals significant urban-rural disparities in prenatal consultation coverage across Pakistan, with urban areas consistently showing higher rates. Sindh and Balochistan show more severe gaps amongst provinces. Addressing these disparities is essential to improve maternal and child health outcomes, and to ensure that all women, regardless of their location, have access to the necessary prenatal care. See figure 10 for details:

Figure No 10: Prenatal Consultation (%) by Province and Location 2019-20.



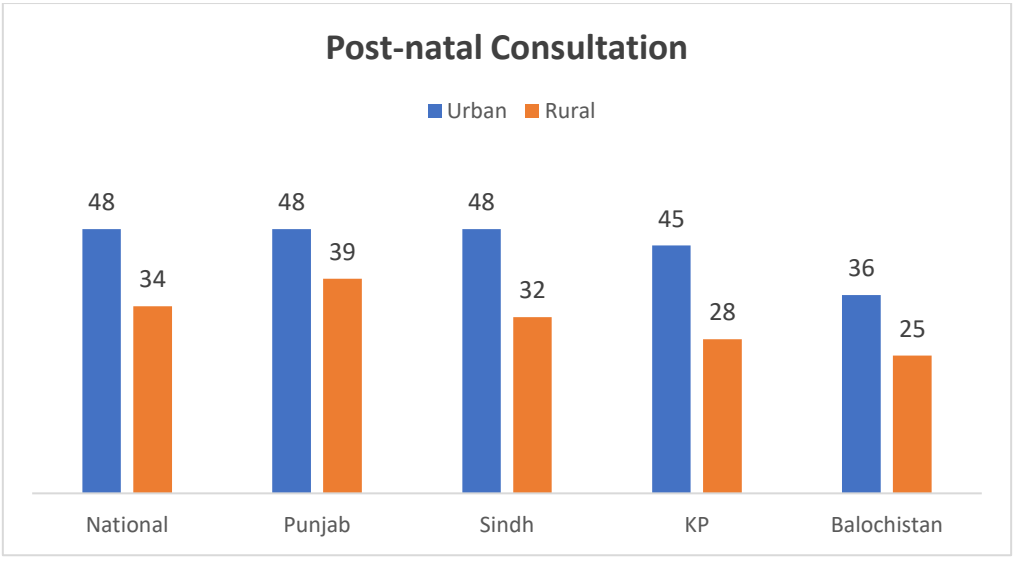
Source: PSLM 2019-20.

4.9 Post-natal Consultation

Postnatal care (PNC) refers to the health visits that mothers and their newborn babies need within the first six weeks after the delivery. During this time period, health visitors may conduct home visits to provide necessary medical advice and treatment depending on the mother and baby's health conditions. Many families in Pakistan only focus on Prenatal care and often neglecting postnatal needs. This contributes significantly to neonatal mortality rates (Pakistan Bureau of Statistics, 2021).

As illustrated in figure 11, at the national level, the postnatal consultation rate is significantly higher in urban areas (48%) compared to rural areas (34%), a difference of 14%. This disparity highlights the challenges faced by rural populations in accessing postnatal care, which is crucial for the health and well-being of mothers and their newborns in the weeks following childbirth

Figure No 11: Postnatal Consultation (%) by Province and Location 2019-20.



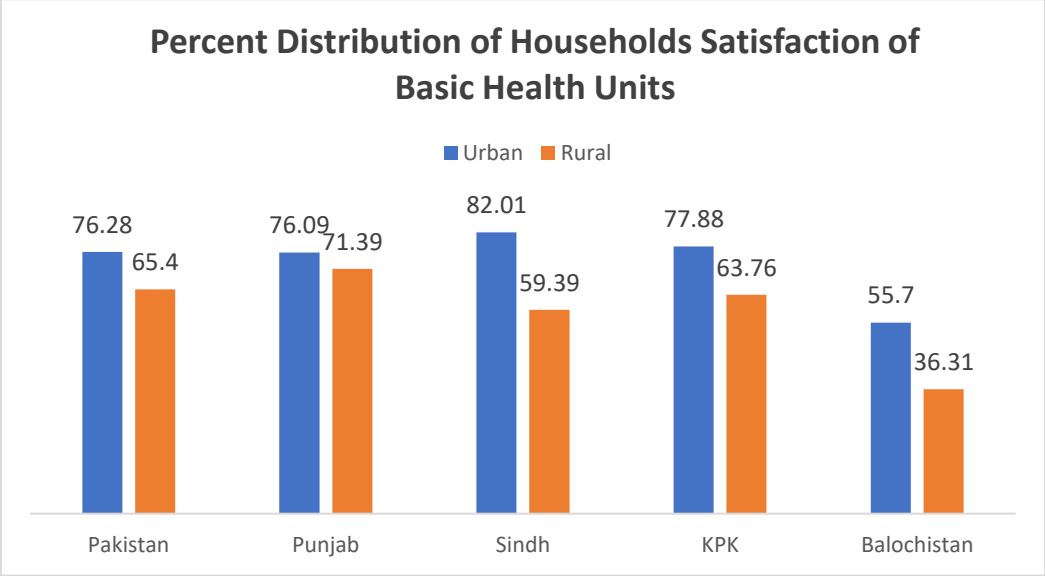
Source: PSLM 2019-20.

Punjab has the highest postnatal consultation rates, with urban areas at 48% and rural areas at 39%, though the rural rate is 9 percent lower. Sindh matches Punjab's urban rate (48%) but has a rural rate of 32%, a 16% gap. Khyber Pakhtunkhwa (KP) shows a 45% urban rate and a 28% rural rate, a 17% difference. Balochistan has the lowest rates, with 36% in urban areas and 25% in rural areas, highlighting a critical need for improved rural healthcare.

4.10 Basic Health Unit

The data on the percent distribution of household satisfaction with basic health units in Pakistan reveals significant urban-rural disparities and variations across provinces. As illustrated in figure 12, at the national level, household satisfaction with basic health units is higher in urban areas (76.28%) compared to rural areas (65.4%). This 10.88 percent difference indicates that urban households generally have a more favorable view of the healthcare services provided by basic health units, suggesting better access, quality of care, and overall satisfaction in urban settings.

Figure No 12: Percentage Distribution of Household Satisfaction of Basic Health Units by Province and Location 2019-20.



Source: PSLM 2019-20.

In Punjab, urban household satisfaction with basic health units is 76.09%, and rural satisfaction is 71.39%, with a 4.7% gap. In Sindh, urban satisfaction is 82.01%, while rural satisfaction is 59.39%, showing a 22.62% gap. Khyber Pakhtunkhwa (KP) has urban satisfaction at 77.88% and rural at 63.76%, with a 14.12% difference. Balochistan has the lowest rates, with urban satisfaction at 55.7% and rural at 36.31%, highlighting a 19.39% gap and the need for better healthcare services.

4.11 Information Communication and Technology (ICT)

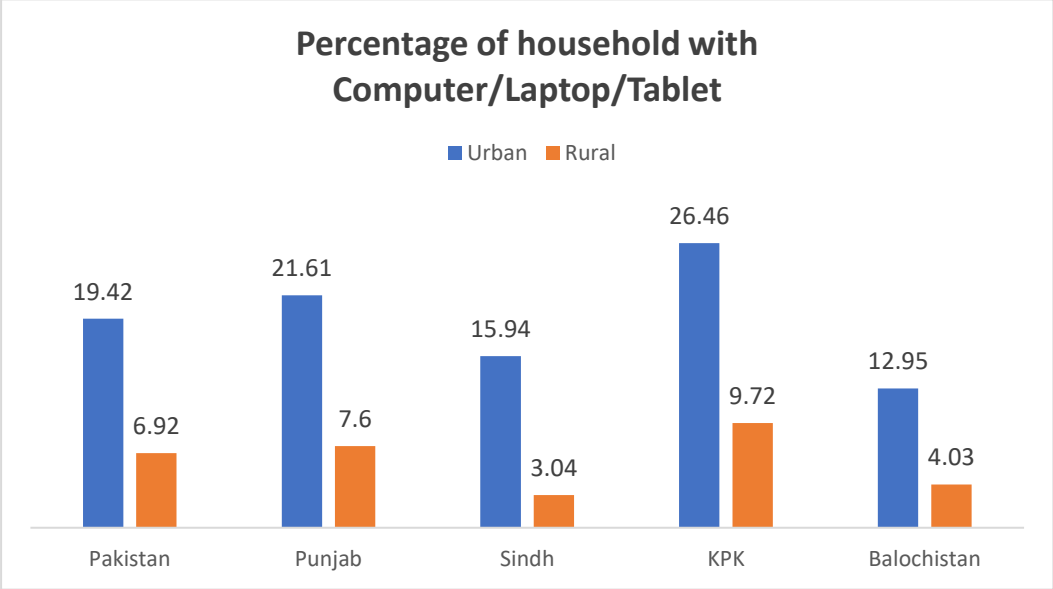
Information and Communication Technology (ICT) has become an essential instrument in advancing rural development, especially in marginalized regions that lack access to resources and opportunities. ICTs enable individuals in rural areas to participate more actively in community life, access educational resources, and engage in knowledge-based economic activities (Salemink, Strijker, & Bosworth, 2017). We will utilize various indicators related to

the percentage of households and individuals with access to computers/laptops/tablets, mobile/smart phones, and the internet to highlight the urban-rural disparities in information and communication technology (ICT).

4.12 Household Access to Computer/Laptop/Tablet

At the national level, only 19.42% of urban households have access to computers, laptops, or tablets, compared to only 6.92% in rural households. This 12.5% difference shows the considerable gap in access to technology between urban and rural areas, it indicates that urban households have significantly better access to ICT. It's further illustrated in figure 13:

Figure No 13: Percentage of Household with Computer/Laptop/Tablet by Province and Location 2019-20.



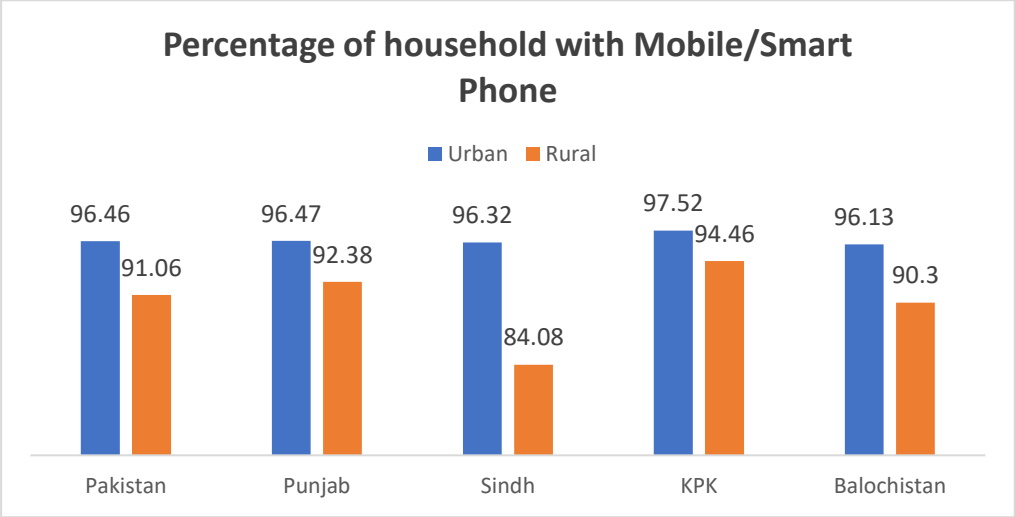
Source: PSLM 2019-20

In Punjab, urban households have a technology access rate of 21.61%, while rural households are significantly lower at 7.6%, resulting in a disparity of 14.01 percent. Sindh presents a more pronounced contrast, with urban access at 15.94% and rural access dropping to 3.04%, highlighting severe limitations for rural households. Khyber Pakhtunkhwa (KP) boasts the highest access rates among provinces, with urban households at 26.46% and rural households at 9.72%, reflecting a 16.74% gap. Conversely, Balochistan has the lowest overall access rates, with urban households at 12.95% and rural households at 4.03%, indicating a critical need for improved technological access in both settings, particularly for rural communities.

4.13 Household Access to Mobile/Smart Phone

At the national level, 96.46% of urban households have access to mobile smartphones, compared to 91.06% in rural households. This results in a disparity of 5.4%, indicating that although while smartphone access is widespread, rural households still lag behind their urban counterparts to some extent.

Figure No 14: Percentage of Household with Mobile/Smart Phone by Province and Location 2019-20.



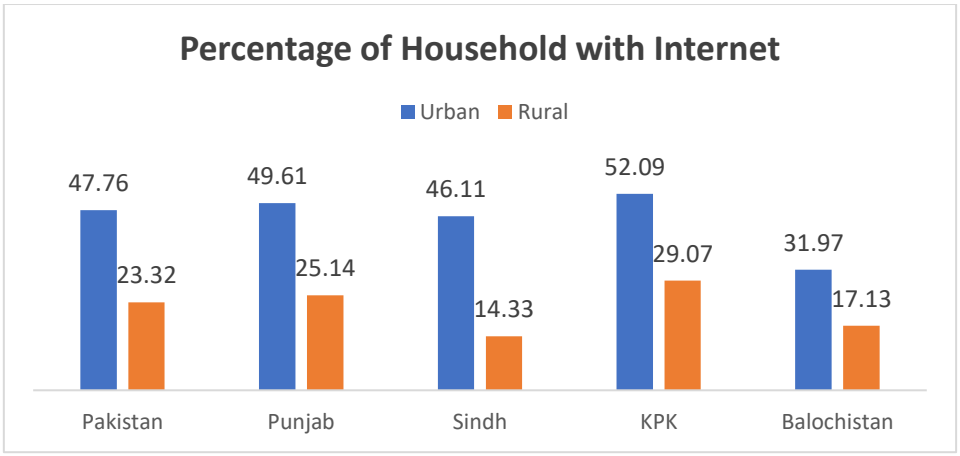
Source: PSLM 2019-20

The analysis of mobile ownership by households in Pakistan indicates that there are minimal urban-rural disparities in access to mobile smartphones, with the notable exception of Sindh. In most provinces, such as Punjab, Khyber Pakhtunkhwa (KP), and Balochistan, the access rates for urban and rural households are relatively close, suggesting that both urban and rural populations have similar opportunities to own mobile devices. However, Sindh stands out with a significant disparity, where urban households have a much higher access rate compared to their rural counterparts. Overall, mobile ownership is high across the country, the disparities are not as pronounced in most provinces. This widespread access to mobile technology presents an opportunity for the government to employ techniques related to mobile services for rural development. However, to fully leverage this potential, the government will need to ensure reliable internet connectivity and strong cellular signals in rural areas.

4.14 Household Access to Internet

In the figure 15, it can be seen that at the national level, 47.76% of urban households have internet access compared to only 23.32% of rural households, resulting in a disparity of 24.44 percent.

Figure No 15: Percentage of Household with Internet by Province and Location 2019-20.



Source: PSLM 2019-20

In Punjab, urban internet access is 49.61%, while rural access is 25.14%, resulting in a 24.47% disparity. Sindh exhibits a more significant difference, with urban households at 46.11% and rural households at 14.33%, reflecting a 31.78% gap that highlights the challenges rural populations face in accessing internet services. Khyber Pakhtunkhwa (KP) has the highest urban access at 52.09% and rural access at 29.07%, leading to a 23.02% difference, indicating better rural service than in Sindh, though disparities remain. Balochistan shows the lowest overall access, with urban households at 31.97% and rural households at 17.13%, presenting a 14.84% disparity. Overall, the data emphasizes the urgent need for targeted interventions to improve internet access in rural areas across all provinces, especially in Sindh, to enhance digital inclusion and support socio-economic development.

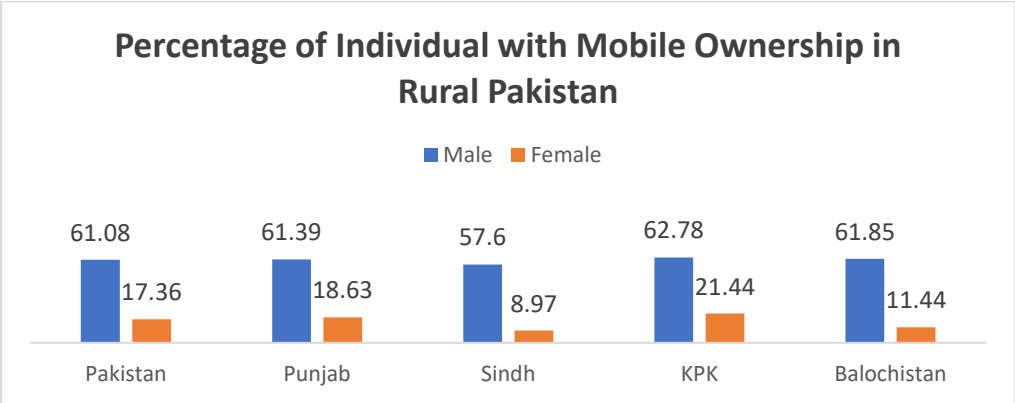
4.15 Gender Disparity related to ICT in Rural Pakistan

In rural Pakistan, access to information and communication technology (ICT) is crucial for socio-economic development and empowerment. However, significant gender disparities exist in the ownership and usage of mobile devices and the internet. We will explore the extent of these disparities, highlighting the differences in mobile ownership and internet access between males and females in rural communities.

4.16 Individual with Mobile Ownership in Rural Pakistan

At the national level, 61.08% of rural males own mobile phones compared to only 17.36% of rural females, it shows a significant gender-based gap of 43.72%. Figure 6 illustrates the disparities across all provinces. Punjab shows a 42.76% gap, with 61.39% of rural males owning mobile phones compared to only 18.63% of rural females. Sindh exhibits the largest disparity, with a 48.63 percentage difference, as 57.6% of rural males own mobile phones, while the rate for rural females drops to 8.97%. Khyber Pakhtunkhwa (KPK) has the highest overall mobile ownership rates for both genders in rural areas, but still maintains a significant 41.34% gap between males at 62.78% and females at 21.44%. Balochistan has the second-largest disparity, with a 50.41% difference, as 61.85% of rural males own mobile phones compared to only 11.44% of rural females. These findings underscore the critical need to address gender inequalities in access to mobile technology in rural Pakistan to promote digital inclusion and ensure that all individuals can benefit from the opportunities provided by mobile devices. See figure 16:

Figure No 16: Percentage of Individual with Mobile/Smart Phone Ownership by Gender, Province and Location in Rural Pakistan 2019-20.

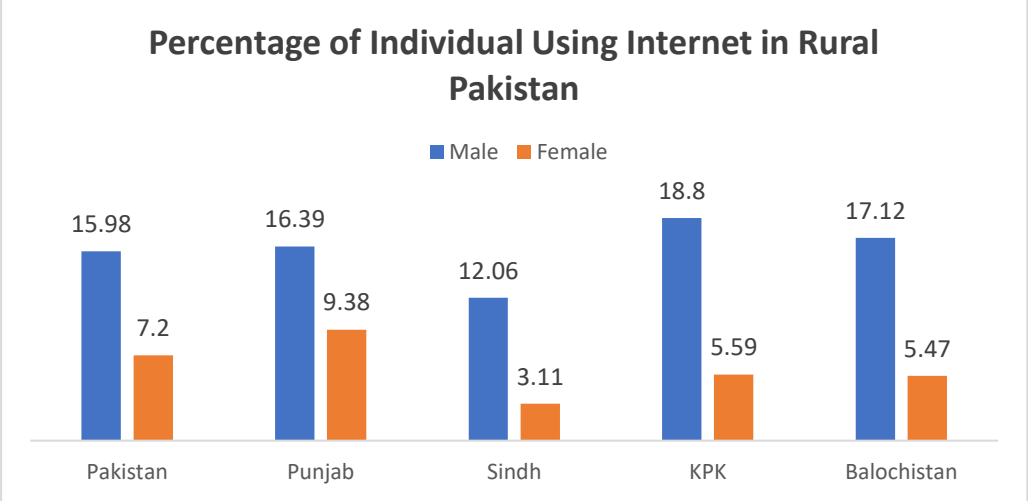


Source: PSLM 2019-20

4.17 Individual internet usage in rural Pakistan

At the national level in Pakistan, 15.98% of rural males use the internet compared to only 7.2% of rural females, resulting in a disparity of 8.78%. Punjab has a 7.01% gap, with 16.39% of rural males using the internet versus 9.38% of rural females. Sindh shows the largest difference, with 12.06% of rural males and only 3.11% of rural females online, creating an 8.95% disparity. Khyber Pakhtunkhwa (KPK) has the highest internet usage rates for both genders, but still shows a significant 13.21% difference, with 18.8% of males and 5.59% of females using the internet. Balochistan has an 11.65% difference, with 17.12% of rural males and 5.47% of rural females online.

Figure 17: Percentage of Individual Using Internet by Gender, Province and Location in Rural Pakistan 2019-20.



Source: PSLM 2019-20

The data highlights significant gender disparities in mobile ownership and internet usage among individuals in rural Pakistan, males have consistently higher rates compared to females. While these disparities are important to address for promoting digital inclusion, it is also important to note that overall mobile ownership and internet usage at the individual level remain quite low. This limited access restricts the ability of both genders to benefit from the opportunities provided by mobile technology and the internet. Therefore, addressing these disparities and improving overall access to ICT resources is essential to ensure that all individuals, regardless of gender, can fully participate in the digital economy and society.

4.18 Water, Sanitation and Hygiene (WASH)

Water, Sanitation, and Hygiene (WASH) is one of the United Nations Sustainable Development Goals (SDGs), specifically SDG 6, it's related to the global commitment to ensure the availability and sustainable management of water and sanitation for all by 2030. Ensuring equitable WASH services is crucial for improving quality of life, particularly in underdeveloped areas, as it contributes to disease prevention, school attendance, and overall well-being (WHO, n.d.). We will employ indicators such as sources of drinking water, sanitation facilities, solid waste management, and hygiene facilities to analyze urban-rural disparities in water, sanitation, and hygiene (WASH).

4.19 Source of Drinking Water in Households

Access to safe and readily available water is crucial for public health, impacting drinking, domestic use, food production, and recreation. Improved water supply and sanitation, along with effective water resource management, can enhance economic growth and significantly reduce poverty. Conversely, contaminated water and inadequate sanitation are linked to diseases such as cholera, diarrhea, dysentery, hepatitis A, typhoid, and polio. Insufficient or poorly managed water and sanitation services expose individuals to preventable health risks (World Health Organization, 2023). Table 2 gives details for the percentage distribution of households by source of drinking water in Pakistan.

Table No 2: Percentage Distribution of Households by Source of Drinking Water by National, Province, and Location (2019-20).

		Tap Water	Hand Pump	Motor Pump	Dug Well	Tanker/ Truck/ Water Bearer	Filtration Plant	Other
Pakistan	**Urban**	36.19	7.32	23.8	0.68	6.18	18.76	7.07
	Rural	13.6	33.44	33.92	5.04	2.44	4.28	7.28
Punjab	**Urban**	18.28	6.3	33.24	0.39	4.84	33.9	3.05
	Rural	9.3	31.4	46.66	1.3	1.91	7.56	1.88
Sindh	**Urban**	56.94	9.51	10.18	0.39	6.52	2.63	13.83
	Rural	8.74	68.68	7.95	7.95	1.61	0.74	4.26
KP	**Urban**	49.08	6.2	35.54	5.02	0.93	0.51	2.72
	Rural	26.66	14.46	27.79	10.12	1.22	0.12	19.62
Balochistan	**Urban**	55	1.28	11.55	0.72	29.31	0.24	0.24
	Rural	23.68	4.42	23.71	11.71	12.97	0.37	23.13

Source: PSLM 2019-20

The table shows the significant urban-rural disparities among the provinces. At the national level, urban households primarily rely on tap water (36.19%), followed by motor pumps (23.8%) and filtration plants (18.76%). In the rural households, we see a different scenario, with a significant reliance on hand pumps (33.44%) and motor pumps (33.92%). This shows a clear gap in water source preferences and availability, with urban areas having better access to piped water systems.

The data reveals that urban areas across all provinces in Pakistan have a great access to safer and more treated water sources like tap water and filtration plants. But rural areas depend highly on hand pumps and motor pumps, which may not always provide safe drinking water. Addressing these disparities is crucial for improving access to safe drinking water in rural communities.

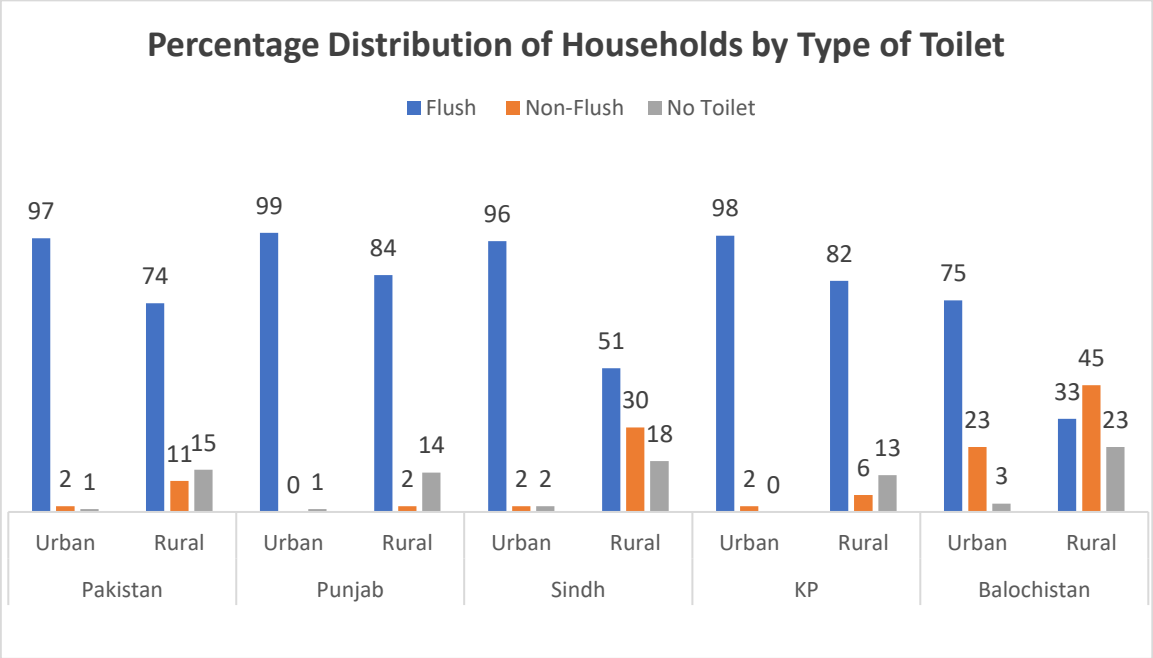
4.20 Type of Toilets in Households

Research has indicated that access to sanitary toilets in rural households significantly improve residents' self-rated health, respondent-rated health, and life satisfaction (Chen et al.,

2022). We have illustrated the percentage distribution of households by type of toilet across Pakistan in the figure 18.

At the national level in Pakistan, 97% of urban households use flush toilets, compared to only 74% of rural households. Additionally, 15% of rural households lack toilet facilities, significantly higher than the 1% in urban areas. This highlights the challenges rural communities face in accessing improved sanitation. The analysis reveals considerable urban-rural disparities in sanitation across all provinces, with urban areas having much better access to flush toilets. Sindh and Balochistan show the most significant disparities, particularly in rural areas, where the lack of sanitation facilities poses serious public health risks.

Figure No 18: Percentage Distribution of Households by Type of Toilet by National, Province, and Location (2019-20).



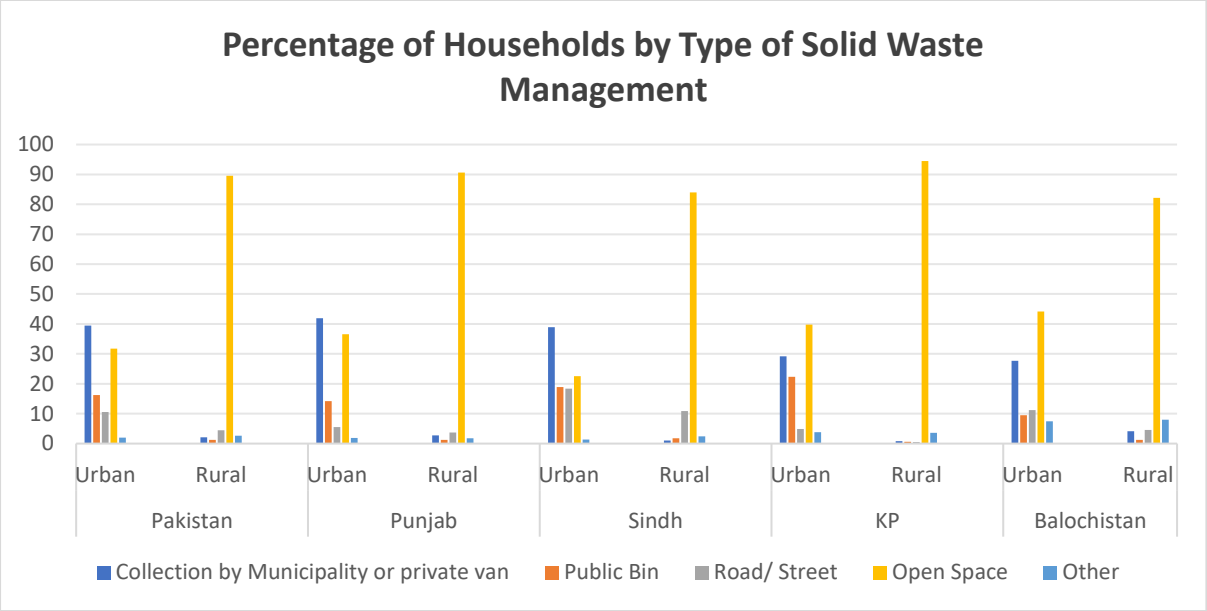
Source: PSLM 2019-20

4.21 Types of Solid Waste Management

Municipal solid waste generation and disposal are major environmental issues in both urban and rural areas, especially in developing countries. This problem is worsened by population growth and the lack of proper waste management services (Emara, 2023). We will look at the percentage of households using different types of solid waste management to find out the differences between urban and rural areas in Pakistan, both at the national level and in the provinces. Further illustration is in figure 19.

At the national level, urban households have a much higher percentage of solid waste collection by municipal or private services (39.45%) compared to rural households (2.1%). In contrast, a staggering 89.57% of rural households dispose of their waste in open spaces, highlighting the lack of proper waste management services in rural areas. Urban areas also show a higher reliance on public bins (16.27%) and less on open space disposal (31.71%).

Figure No 19: Percentage Distribution of Households by Type of Solid Waste Management by National, Province, and Location (2019-20)



Source: PSLM 2019-20

The significant urban-rural disparities in solid waste management are evident across all provinces in Pakistan. Urban areas generally have better access to waste collection services, while rural areas are heavily depending on open space disposal, which may cause serious environmental and public health problems.

4.21 Handwashing facility in the households

Improved hygiene and health in rural areas serve as fundamental pillars for the comprehensive advancement of rural communities (Krishna, 2024). Inadequate handwashing practices and limited access to sanitation facilities contribute to the transmission of disease-causing germs (Veerapu, Subramaniyan, Praveenkumar, & Arun, 2016). According to the Pakistan Social and Living Standards Measurement (PSLM) 2019-20, 54% of households across the country have access to a designated handwashing facility equipped with a washing agent such as soap or detergent. There is a significant disparity between urban and rural areas, with 77% of urban households having access compared to only 39% of rural households. In terms of provincial comparison, Punjab leads with 61% of households having access to such facilities, while Balochistan has the lowest percentage at 31% (Pakistan Bureau of Statistics, 2021).

4.22 Smart Village Model

In order to reduce the urban-rural gap in Pakistan, the proposed smart village model integrates innovation technology into sustainable development. The main objective of the model is the upliftment of quality of life, economic opportunities, and social equity in rural areas. There are five areas of concentration: Smart Education, Smart Health, Smart ICT, Smart WASH, and Smart Awareness. Based on a comprehensive literature review and an analysis of gaps between cities and rural areas, all of these components have been constructed. Each component has been designed to address the requirements of rural communities, thus making them self-sustained, empowered, and progressive villages. This focused smart village model

implements modern technologies and sustainable practices in order to bridge the gap between urban and rural areas.

4.23 Smart Education

The Smart Education will uplift the educational sector in rural areas by providing quality education to students. The component encompasses the following initiatives: 1. Digital Classroom 2. Digital Skills and Entrepreneurship 3. Teacher Training Program The Digital Classroom initiative aims to set up classrooms equipped with the latest digital technologies. With digital classrooms, students can be able to have access to videos on different curricular subjects or even online courses, hence making learning interesting. This also means that remote villages can be able to access science classes online. Many remote villages in Pakistan lack science teachers, and since these villages are normally quite far from other places, it becomes hard for teachers from elsewhere to come to teach at such distant places. This initiative will provide the students of remote villages with an education in science, thereby helping to fill the gap that arises due to the deficiency of local teachers. This idea has been practically developed in Pakistan's first smart village, Gokina Smart Village (Ali, 2023).

The Digital Skills and Entrepreneurship program will ensure that people living in rural areas are equipped with the basic digital skills and entrepreneurial abilities. It includes integration of technological aspects to effect digital literacy combined with practical skills training to address the short-term gaps in skills and more sustainable economic development. The program addresses digital and computer literacy to enable sharing in e-government services and freelance job opportunities available online. Apart from that, the program will include uneducated people from the rural landscape through practical teaching of crafting, stitching, and carpentry skills. In this way, this will allow them to create their own jobs and earn revenues that will help the local economy grow.

The Teacher Training Program forms a very important part of the smart village model, and this is aimed at the betterment of the quality of education of the students in rural areas. This program aims to equip teachers with the skills and knowledge necessary for the effective integration of state-of-the-art teaching methodologies and digital tools into the classrooms. Teachers will learn modern teaching techniques from professional trainers through regular workshops and gain specialized training to teach science, especially where online teaching is not feasible.

4.24 Smart Health

The Smart Health component is designed to address the significant health disparities between urban and rural areas through the use of innovative, sustainable healthcare solutions. This component includes two key initiatives: Telemedicine and Mobile Health Clinics to improve overall health services in the village. Services under this program would also target immunization rates, prenatal and postnatal consultations, and basic health units to address the earlier-identified gaps between urban and rural areas.

The Telemedicine initiative would use digital communication technologies to bridge the gap between rural patients and urban healthcare professionals as implemented in Gokina Smart Village (Ali, 2023). This approach addresses the challenge of lack of access to specialized medical care in rural areas, where healthcare facilities and professionals are often not available. the telemedicine initiatives will have patients served in due time with diagnosis,

consultation, and follow-up, thus greatly improving health outcomes. It will foremost help in improving prenatal and postnatal consultations through expert advice and support from a distance to expectant mothers and new parents. By providing continuous care and monitoring, telemedicine would help in early detection and management of potential health issues, ensuring better maternal and child health.

The Mobile Health Clinics initiative involves deploying fully equipped medical vans to deliver essential healthcare services directly to rural communities. These clinics would be comprised of trained medical personnel and equipped with the necessary medical supplies to address a wide range of needs related to healthcare. Mobile health clinics would play a crucial role in increasing immunization rates by conducting vaccination drives in remote areas, ensuring that children receive their essential vaccines on time. Additionally, these clinics would provide prenatal and postnatal care, general health check-ups, and health awareness. By bringing healthcare services to the doorstep of rural residents, this initiative would help overcome geographical barriers and ensure that even the most remote areas have access to quality healthcare.

4.25 Smart ICT

The Smart ICT aspect of the smart village model will focus on the bridging of the digital divide between urban and rural areas in terms of reliable internet connectivity and access to basic digital tools. This addresses the disparities in ICT, as highlighted in the previous sections.

This would involve the deployment of high-speed broadband infrastructure that would eventually enable the residents of smart villages to use the internet for educational, healthcare, and economic uses. Access to the internet in a smart village would be free in certain areas, such as schools, health centers, and community centers, to ensure that reliable access is provided to all, even if full village-wide internet coverage may not be possible initially.

Given that rural households are less likely to own computers, laptops, or tablets compared to urban households (as illustrated by PSLM 2019-20 data), the government would provide incentives or subsidies to help smart village residents purchase these essential devices. This could include financial support, discount programs, or installment plans to make laptops more affordable. Additionally, an awareness campaign would be launched to highlight the importance of having a laptop in the household, educating residents on how these devices can improve educational outcomes, access to information, and economic opportunities.

4.26 Smart WASH

The Smart WASH component of the smart village model is designed to address critical issues related to water, sanitation, and hygiene in rural areas. This initiative aims to ensure access to safe drinking water, improve sanitation facilities, and establish effective solid waste management systems. By implementing these initiatives, the Smart WASH component seeks to enhance the overall quality of life for residents in rural communities.

To provide safe drinking water, the government will construct water filtration plants in strategic locations within rural areas. These facilities will ensure that community members have access to clean and safe drinking water, which is essential for health and well-being. The government will provide incentives and subsidies to rural households to encourage the construction of appropriate toilets equipped with flushing facilities. In addition to financial

support, awareness campaigns will be launched to educate rural households about the importance of using proper sanitation facilities. These campaigns will emphasize the health benefits of improved sanitation and promote hygiene practices. This initiative will also address the issue of solid waste management in the rural areas. Under this smart village model, government will provide public bins and garbage collection service by the municipality or private vans.

4.27 Smart Awareness

The Smart Awareness component of the smart village model aims to empower rural communities through education and awareness on critical social issues. This component focuses on four key areas: family planning, gender inclusivity, health and nutrition, and civic education. By raising awareness and providing education in these areas, the Smart Awareness initiative seeks to promote healthier, more equitable, and well-informed communities.

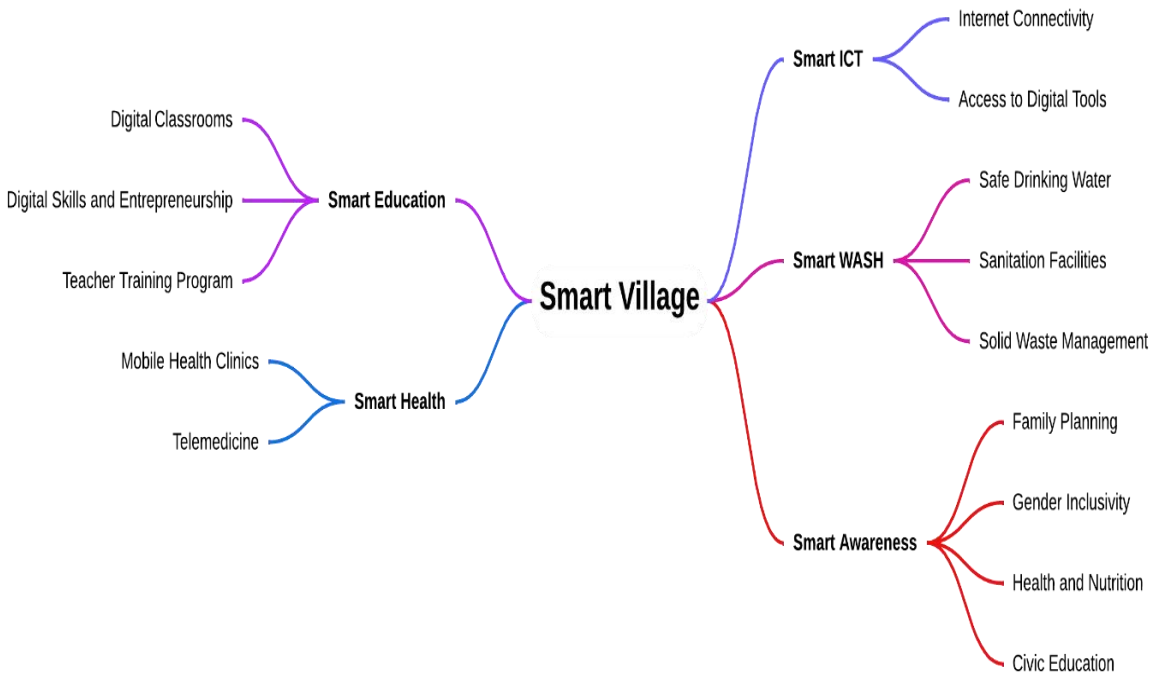
Family planning education is essential for empowering individuals to make informed decisions about their reproductive health. A study in Pakistan shows that as family size increases, so does the level of poverty (PIDE, 2021). This initiative would provide information on contraception methods, reproductive health, and the benefits of family planning.

As we have illustrated through PSLM 2019-20 data that severe gender disparity exists in rural Pakistan, the gender inclusivity initiative would focus on educating both men and women about the importance of gender equality, the benefits of empowering women, and the need to challenge traditional gender roles.

This component of smart village model would also include spreading awareness on health and nutrition. This initiative would provide information on maintaining a balanced diet, the importance of regular physical activity, and preventive healthcare measures. As we have discussed previously that there is a notable disparity between urban and rural areas in having access to designated handwashing facility equipped with a washing. A study in Sindh province, Pakistan, indicated that maternal health vulnerabilities (MAV) were high in rural areas due to a lack of education and awareness among women (Agha, et al., 2024). Mass media serves as a powerful means to spread essential health information and enhance health awareness within rural communities. The significance of mass media in health communication for rural development in Nigeria is undeniable. Mass media platforms enable health promoters and stakeholders to rapidly disseminate vital health messages to rural populations. Research has demonstrated that the media's persuasive communication and sensitization efforts have contributed to the success of numerous health campaigns in rural areas (Aondowase, Udoudom, & Pam, 2023).

Civic education awareness aims to create informed and active citizens who understand their rights and responsibilities. As we have elaborated earlier that rural children are more likely to be out of schools than urban children. And, in rural Pakistan, females tend to leave education at a higher rate as they progress to higher levels of education. These issues can be resolved by spreading awareness to defeat false cultural norms and beliefs in rural areas. This initiative would also focus on rural residents about their civic duties and how to engage in community development activities. Workshops, informational sessions, and community projects would help residents become more involved in the decision-making processes that affect their lives.

Figure No 20: Smart Village Model



Source: Author own Development

This holistic framework of smart village model not only focuses on immediate improvements but also ensures long-term sustainability and empowerment of rural populations. Through initiatives like digital classrooms, telemedicine, high-speed internet connectivity, water filtration plants, and awareness campaigns, the Smart Village Model paves the way for self-sustaining and progressive villages.

By bridging the gap between urban and rural areas, the smart village model promotes social equity and economic growth, contributing to the overall development of the nation. This model serves as a blueprint for future rural development projects, demonstrating that with the right combination of technology and sustainable practices, rural communities can thrive and prosper.

5. Conclusion

Urban-rural disparities are a significant challenge in Pakistan. These disparities consist of different socio-economic dimensions; we employed Education, Health, Information and Communications Technology (ICT), Water, Sanitation and Hygiene (WASH) as variables to measure the urban-rural disparities. These disparities extend beyond the urban-rural divide, encompassing significant gender-based inequalities as well. Gender disparities are particularly pronounced within rural areas, where women and girls face greater challenges in accessing essential services and opportunities. We also conducted a provincial comparison and found that Punjab and KP are ahead of Sindh and Balochistan in most of the assessed variables and

indicators. Based on this finding, we conclude that Pakistan should prioritize building more smart villages in Sindh and Balochistan than in Punjab and KP.

This research addresses the significant urban-rural disparities in Pakistan and proposes a viable solution through the smart village model. By analyzing secondary data primarily from the Pakistan Standard of Living Measurement (PSLM) survey, we identified substantial gaps in education, health, ICT access, and WASH between urban and rural areas. Based on our findings and analysis of these disparities, we proposed a smart village model comprising smart education, smart health, smart ICT, smart WASH, and smart awareness, which aims to bridge these gaps and promote sustainable development in rural communities. Although Pakistan launched its first smart village model, Gokina Smart Village, in 2023, this model is not sufficient to significantly reduce the urban-rural gap. We have proposed various initiatives under each component of the smart village model, which will significantly uplift rural areas and reduce urban-rural disparities.

The study makes several important contributions. It provides a focused framework for addressing urban-rural disparities in Pakistan, targeting specific areas that significantly impact quality of life. The proposed smart village model offers practical solutions tailored to the unique socio-economic context of rural Pakistan. Additionally, by highlighting provincial disparities, the study underscores the need for targeted interventions in regions like Sindh and Balochistan, where the gaps are more pronounced.

This study primarily relied on secondary data from the PSLM survey, which may have limitations in terms of data accuracy and comprehensiveness. Additionally, the findings are based on the specific socio-economic context of Pakistan, which may limit their generalizability to other countries. Furthermore, the reliance on existing datasets means that the study could not account for real-time changes or specific local nuances that might affect the urban-rural disparities. The analysis was also constrained by the availability of data on certain key indicators, which may not have captured all dimensions of the urban-rural divide. Lastly, while the proposed smart village model is tailored to the conditions in Pakistan, further validation and adaptation may be necessary to apply it effectively in different regions or countries.

Future research should consider incorporating additional variables and primary data collection to validate and expand upon these findings. A more comprehensive approach can provide a deeper understanding of the complexities of rural-urban disparities and inform more effective interventions for rural development.

In conclusion, while the Gokina Smart Village Project initiated a valuable step towards reducing the urban-rural gap, the proposed model aims to significantly uplift rural areas by addressing specific disparities in education, health, ICT, and WASH. With targeted interventions, Pakistan can move closer to achieving sustainable development and equitable growth across its urban and rural landscapes.

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