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DATA DRIVEN SMART CITIES: INTEGRATING THE POWER OF 5G COMPUTING

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A B S T R A C T

The fifth generation of mobile networks is going to transform the way we live, work, and communicate. The shift from 4G to 5G would be a crucial enabler for the growth of smart cities due to its superior speed and minimal latency. Extant literature indicates that 5G technology holds immense potential in implementing and managing smart cities and would provide benefit to citizens and corporates alike.

The purpose of this study is to examine the potential of 5G computing as a smart city accelerator, in terms of enabling data driven decisions and its effects on various economic sectors. Based on primary data collected from 392 respondents based in Delhi NCR, the study attempts to explore the attitude of people towards 5G technology with respect to Connectivity, Infrastructure and Application for development of smart cities in India

1. INTRODUCTION

1.1 Overview

Industry and academics are concentrating their efforts on defining the requirements for the fifth generation (5G) of wireless mobile communication because to the extraordinary expansion in the number of connected devices, mobile data traffic, and the limitations of 4G technology (Gohar & Nencioni, 2021). 5G is one of the important technologies that is anticipated to have a significant impact on the creation of smart cities. The fifth generation of mobile networks, or 5G, is distinguished from earlier generations by having faster speeds, lower latency, and more capacity. With the use of these features, a variety of applications can be supported, including those that demand real-time communication, such as smart grid systems and autonomous vehicles. The creation of smart cities, where numerous services and infrastructure are connected and managed via the use of cutting-edge technologies like the Internet of Things (IoT) and artificial intelligence (AI), is a result of recent technological advancements. (Nam and Pardo, 2011).

The application of cutting-edge technologies is to enhance a city's efficiency and sustainability, as well as the quality of life for its residents, i.e which defines the smart cities. IoT and AI are two of the most significant technologies in this area since they allow for the collecting and analysis of significant volumes of data from several sources, including sensors, cameras, and other devices.

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The high-speed, low-latency, and high-capacity connectivity required to serve these IoT and AI-based applications is provided by 5G. Additionally, 5G's versatility in terms of network architecture and support for a wide range of frequency bands make it possible to provide coverage in several locations and also to support a wide range of applications.

1.2 Need for the Study

We are approaching a future in which automation replaces most of the manual labour. This is a result of technology, particularly wireless communication technology, which is evolving. Like 4G, LTE, 5G is a rapidly developing wireless technology that is going to take the world by storm. High-speed wireless technology has the potential and ability to transform ordinary communities into smart ones. This is supported by faster speeds and increased capacity of 5G networks. In contrast to 4G or 3G, it requires hundreds of thousands of extra tiny cells to support more simultaneous users and high-speed connections. According to a study, 66% of the world's population would reside in urban regions by the year 2030, demonstrating the significance of these thriving cities.

Urbanization will also be accompanied with problems like over-population, scarcity of resources, environmental issues which makes its necessary to make cities smart (Yang et al., 2022). As per the definition by Nam and Pardo (2011) and Kanter & Litow (2009): “smart city is an organic connection among technological, human, and institutional components. A smart city should be treated as an organic whole, i.e., as a network as well as a linked system.” It will be encompassing numerous technologies but the most important of all is 5G, fifth generation wireless network, for future of smart cities (Agiwal et al., 2016).

1.3 Scope of the study

The application of 5G in smart cities is extensive and broad. By enabling the creation of cutting-edge solutions for a variety of industries, including transportation, healthcare, public safety, energy, education, agriculture, and tourism, 5G has the potential to fundamentally alter how smart cities function. (Minoli & Occhiogrosso, 2019) 5G can enable the development of driverless vehicles, intelligent traffic management systems, and transportation systems that can improve mobility for individuals with disabilities, lessen traffic congestion, and increase road safety. In the healthcare industry, 5G can help with the advancement of telemedicine and remote health monitoring, giving residents of smart cities access to high-quality healthcare no matter where they are. Additionally, this could increase rural and distant communities' access to healthcare where resources are limited. 5G can enable the development of smart emergency response systems, smart surveillance systems, and other public safety applications that can monitor public safety and act promptly in an emergency. 5G can help the creation of smart grid systems in the energy sector, which will increase the efficiency and dependability of energy distribution in smart cities (Shehab et. al, 2021) . Smart water management systems have the potential to enhance water quality and decrease water waste, and 5G can promote their growth. In the area of education, 5G can aid in the growth of online and e-learning, giving students in smart cities access to a high-quality education no matter where they are. (Shehab et al., 2021).

It can enable the development of "smart agriculture" in the agricultural sector, which uses IoT and other technologies to increase the productivity and sustainability of agriculture. Precision farming (Tripathi et al., 2023) (Rai et al., 2023). Smart irrigation systems, and other agricultural applications can all benefit from 5G technology. With the use of 5G-enabled devices, tourists will be able to access information about the city, its attractions, and its services. This is known as smart tourism. The development of augmented and virtual reality applications, which can improve the visitor experience, can also be supported by 5G. Hence it becomes imperative to study the future of smart cities backed by 5G technology. Also, we need to understand the attitude of people towards 5G enabled smart cities.

1.4 Objectives of the Study

This study intends to investigate the attitudes of Indian population towards the integration of 5G technology in various aspects of developing a smart city. The study attempts to address the following objectives:

- To study the relationship between Applications in 5G smart city and the attitude of people towards 5G smart city.
- To study the relationship between connectivity in 5G smart city and the attitude of people towards 5G smart city.
- To investigate the relationship between infrastructure in 5G smart city and the attitude of people towards 5G smart city.

2. LITERATURE REVIEW

With the arrival of 5G, interest in examining its potential application and advantages in building smart cities is growing. Smart cities are metropolitan areas that integrate cutting-edge technology to raise resident quality of life, increase sustainability, and spur economic development. With its fast speed, low latency, and widespread connectivity, 5G technology is seen as a crucial enabler for smart cities. This review of the literature will give an overview of the most recent studies on 5G and smart cities.

2.1 Understanding ‘5G and Smart Cities’

The fifth generation of mobile network technology is known as 5G. It is intended to offer more connectivity, higher bandwidth, reduced latency, and quicker data speeds than its predecessors (Agiwal et al., 2016). In a study by Bharti Airtel in 2021, predicts that 5G technology will be 20 times quicker than 4G and have a 1 millisecond latency. Real-time applications like remote surgery and self-driving cars will be made possible as a result.

5G targets to provide three cases this includes enhanced Mobile Broadband (eMBB), massive Machine Type Communications (mMTC), and ultra-Reliable and Low-Latency Communications (uRLLC) (Morgado, Huq, Mumtaz, & Rodriguez, 2018). Massive machine-type communications (mMTC), which allows for the simultaneous connection of many devices, is one of the key characteristics of 5G. The growth of "smart cities," which rely on a large network of sensors, machines, and devices to gather and process data, will be critically dependent on this (Al-Fuqaha, Guizani, Mohammadi, Aledhari, & Ayyash, 2015). Smart cities are metropolitan areas that integrate cutting-edge technology to raise residents’ quality of life, increase sustainability, and spur economic development. The idea of "smart cities" has been around for more than ten years, but with the quick growth of technology, notably 5G, it now faces both new potential and obstacles (Caragliu, Del Bo, & Nijkamp, 2011).

To gather and interpret data, smart cities rely on a massive network of sensors, machines, and devices. This information can be used to increase public safety, reduce waste, optimize energy use, and improve traffic flow (Caragliu, Del Bo, & Nijkamp, 2011). Yet, the capacity to gather and analyse data in real-time is essential for smart cities to succeed, necessitating fast, low-latency networks like 5G. Smart cities and 5G have the potential to completely transform urban life. 5G can enable a variety of applications, from connected cars and smart transportation systems to remote healthcare and immersive entertainment, thanks to its high speed, low latency, and huge connectivity (Al-Fuqaha, Guizani, Mohammadi, Aledhari, & Ayyash, 2015).

The potential of 5G is to effectively enable IoT which is one of the technology's primary applications in smart cities. IoT is the term used to describe how connected machines, sensors, and gadgets are. With 5G, the IoT can scale up to support millions of devices, allowing for real-time data collection and analysis. The ability to support autonomous vehicles is another use for 5G in smart cities. To navigate and make judgements, autonomous cars use a sophisticated network of sensors and data processing. These vehicles can communicate in real-time with one another and the infrastructure thanks to 5G, enabling quicker and safer mobility (Al-Fuqaha, Guizani, Mohammadi, Aledhari, & Ayyash, 2015).
Gohar & Nencioni (2021) very well summarise the various applications of 5G technology in creation and management of critical industries such as transport, energy, healthcare, manufacturing and media, that come together to create a true smart city. This would seamlessly provide benefits to citizens and corporates as well as ensure environmental sustainability.

2.2 Key Features of 5G in Smart Cities

Smart cities are anticipated to be made possible by 5G technology in a big way. Among the essential characteristics of 5G in smart cities are the following:

- High-speed connectivity is required to serve the vast number of connected devices and apps in smart cities, and 5G technology provides quicker and more dependable connectivity than previous generations of mobile networks. To upload and download of videos over wireless we require large bandwidth on wireless networks that is enabled by 5G technology. (Rao & Prasad, 2018)
- Reduced latency: Compared to earlier generations of mobile networks, 5G technology offers lower latency, which is necessary for supporting real-time applications like autonomous vehicles and remote medical operations in smart cities (Painuly, Sharma, & Matta, 2021).
- Massive Machine Type Communications (mMTC): The ability to link the vast majority of Internet of Things (IoT) devices in smart cities requires huge machine-type communications, which 5G technology supports (Bockelmann et al., 2016; Jovović, Forenbacher, & Periša, 2015; Shehab et al., 2022)
- Network slicing (NS): 5G technology makes it possible for operators to build virtual networks that are specialised for services and applications in smart cities and ensures distinguished QoS in a distributed infrastructure (Zhou et al., 2020).
- Edge computing: 5G technology makes it possible for data to be processed more closely to the source, lowering latency, and enhancing the performance of apps in smart cities (Li, 2019). Edge computing helps in reducing service response time by bringing the capabilities of cloud near the end user and enabling real time IoT applications (Wang et al., 2020; Wang et al., 2020; El-Sayed et al., 2018).

2.3 Research Gap

Despite the potential advantages of merging smart cities and 5G technology, there is a dearth of academic papers on this topic from the perspective of citizens. In a few of the research papers factors enabling and affecting the adoption of 5G have been defined, but there is scope of research on the impact and influence of these factors on each other.
Research papers related to attitude measurement toward 5G-enabled smart cities are still few and far between. The relationship between the attitude and factors for 5G enabled must be established to arrive at the bigger picture concerning 5G adoption. Even though research on 5G-enabled smart cities is expanding, there are still many research gaps that need to be filled to properly comprehend the potential advantages and difficulties of these technologies. Based on the research gap, the research methodology was arrived at.

3. RESEARCH METHODOLOGY

3.1 Conceptual Framework

Design of 5G smart is city is based on three dimensions. All the three dimensions must work in tandem to make the 5G smart city successful (Yang et al., 2022). Lack of coordination between three dimensions make it an ordinary city. These are called backbone of any 5G smart city. These three dimensions are:

1) Connectivity
2) Infrastructure
3) Applications

1. Connectivity: The 5G networks' improved connectivity is the first dimension. In comparison to other generations, 5G, the fifth generation of cellular networks, is intended to provide substantially faster data speeds, lower latency, and more capacity (Rao & Prasad, 2018; Tufail, Namoun, Alrehaili, & Ali, 2021). Several applications for smart cities depend on this incredibly quick and dependable connectivity. Smart cities will be able to connect and support a huge number of devices, sensors, and infrastructure with 5G, allowing for smooth communication between diverse city ecosystem components. (Chen, Yuan, & Jing, 2020)

Four variables which have been taken into consideration for measuring the first dimension called connectivity are:

a) Cellular Networks
b) Data Speed
c) Lower Latency
d) More Capacity

2. Infrastructure: The creation and incorporation of smart city infrastructure is the second dimension. Modern methods and technologies that improve urban efficiency and sustainability can be implemented with the help of 5G. For instance, 5G enables the installation of cutting-edge IoT (Internet of Things) gadgets and sensors all around the city to gather information and keep track of numerous things like traffic flow, energy consumption, air quality, trash management, and more. With the use of data, cities can better allocate resources, cut waste, and provide better services to their citizens. (Miladić-Tešić, Marković, Peraković, & Cvitić, 2022)

Four variables which have been taken into consideration for measuring the first dimension called connectivity are:

a) Traffic Flow
b) Energy Usage
c) Air Quality
d) Waste Management

3. Applications: The third dimension focuses on the use cases and practical applications that 5G in smart cities has made possible. 5G's high speed and low latency enable real-time data processing and analysis, which can be used in a variety of applications, such as Smart Mobility. 5G enables automated driving, intelligent transportation systems, and effective traffic management, which eases congestion and expands mobility options (Gohar & Nencioni, 2021). 5G can improve remote patient monitoring and telemedicine, allowing for better healthcare services and easier access to medical resources. (Zhang, et al., 2020). 5G-enabled smart cities can make use of cutting-edge surveillance methods such as facial recognition and human emotion detection (Tyagi, Rai, Sahw, Tripathi, & Kumar, 2022) and emergency response technologies, enhancing public safety. 5G enables improved energy control and monitoring, resulting in more environmentally friendly and sustainable operations. (Huseien & Shah, 2022)

Four variables which have been taken into consideration for measuring the first dimension called connectivity are:

a) Smart Mobility
b) Health Care
c) Public Safety
d) Energy Management

3.2 Diagrammatic Representation of Conceptual Framework

independent variables and dependent variable. In our framework independent variables are Connectivity, Infrastructure and Applications and our dependent variable is Attitude towards 5G smart city. Through this conceptual framework we are trying to see a relationship between independent variables namely connectivity, infrastructure and applications with the dependent variable namely attitude towards 5G smart city. For analysis purpose Connectivity variables have been represented as V1 to V4. Infrastructure variables have been represented as V5 to V8 and Applications variables have been represented as V9 to V12.

Dependent variable is being represented by V13 to V16. The conceptual model given below is a representation of the same (Figure 1).

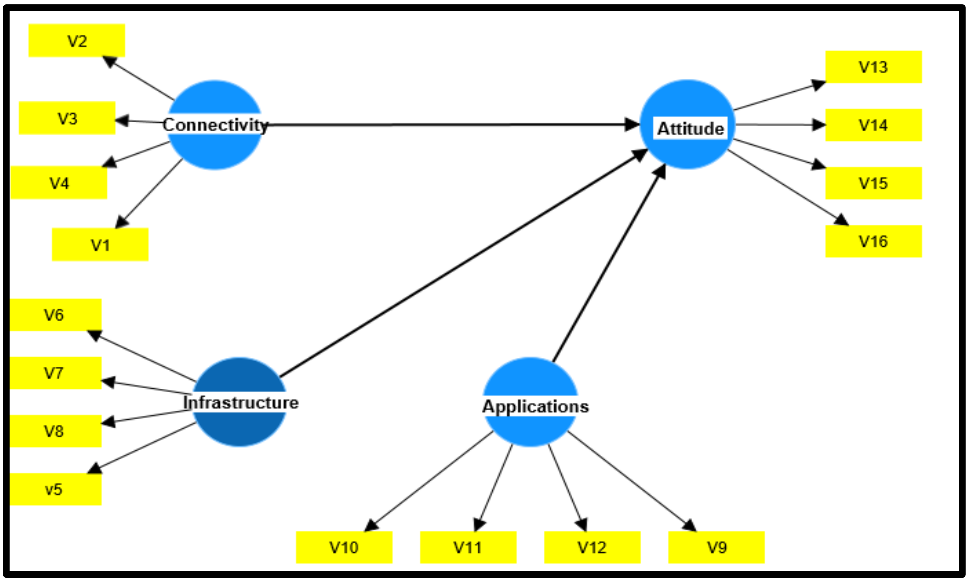

Figure 1. Diagrammatic Representation of Conceptual Framework**.** (Source: Author(s))

3.3 Research Design

There are two types of design while doing the research. The first one is called exploratory research and the second is called conclusive research. In our case, we have used a combination of both exploratory and conclusive research. Exploratory research has been used to write the introduction part and conclusive research has been used for analysing the study by the data. For conclusive research, we are going to use descriptive research as the description will be given by the mathematical analysis using the data of the questionnaire. As data has been taken only once so our study would be cross-sectional study (Marczyk, DeMatteo, & Festinger, 2005).

3.4 Sampling Type

We are aware that the 5G-enabled smart city is a new phenomenon and not many people might be having information it. Keeping this in view, we have chosen convenience sampling and further snowball sampling, or reference-based sampling has been used.

3.5 Questionnaire

Through questionnaire or survey method, primary data has been collected to for the study. The questionnaire consisted of five dimensions each having 4 variables. The questionnaire consisted of Likert-type items capturing data from respondents on attitudes towards the variables. The total number of variables (questions) were 20. The minimum requirement to start the analysis is 100 responses (20*5).

3.6 Sample size

To calculate the sample size for the quantitative phase, you can use the formula for estimating sample size for a proportion. The formula is:
Where:

n= Z^2×p×(1-p)/E^2
n = Sample size
Z = Z-score corresponding to desired confidence level (e.g., 1.96 for a 95% confidence level)
p = Estimated proportion (You might need to estimate this from previous research or pilot studies, let's assume 0.5 for maximum variability)
E = Margin of error (desired precision)

Let's assume you want a 95% confidence level (Z = 1.96) and a margin of error of 5% (E = 0.05). Plugging these values into the formula:

n=(1.96)2·0.5·(1-.5)(0.05)2n=(0.05)2(1.96)2·0.5·(1-0.5)

n ≈ 384

So, you would need a sample size of approximately 384 respondents who are residing in smart cities for the quantitative phase of your study. Based on this, it was decided that the sample size of qualified responses should be 384 responses in order to have enough numbers to start the analysis. Data was collected from approximately 400 respondents out of which responses 392 were included in the analysis.

4. ANALYSIS AND INTERPRETATION

4.1 Sample size

At the first stage fitness of the model is checked using CMIN values, RMSEA values and base line comparison (Fornell, & Larcker, 1981). The Tables 1 to Table 7 summarize the Model Fit criteria and the sample data indicators against them.

Table 1. Model Fit Summary: CMIN

Model Fit Summary: CMIN					
Model	NPAR	CMIN	DF	P	CMIN/DF
Default Model	33	50.249	45	0.07	1.117
Saturated Model	78	.000	0		
Independence Model	12	1206.466	66	.000	18.280

CMIN the P value is well above the recommended of 0.05 in Table 1. This indicates that the sample data and the hypothetical model is an acceptable fit.

Table 2. Model Fit Summary: Root Mean Square residual.

Model	RMR	GFI	AGFI	PGFI
Default Model	.273	.942	.900	.544
Saturated Model	.00	1.000		
Independence Model	3.082	.397	.288	.336

RMR is called the Root Mean Square residual the smaller the RMR the better it is considered for the model to indicate that there a fit between sample data and the model the value should be above zero (Shi, Maydeu-Olivares, & DiStefano, 2018). Table 2 is suggesting the same. GFI stands for Goodness of Fit, it must be near 0.9 as an acceptable range. Table 2 suggests the same. One leads to perfect goodness of fit. (Yusoff, 2011).

Table 3. Model Fit Summary: Baseline Comparisons

Model	NFI Delta 1	RFI rho 1	IFI Delta2	TLI rho2	CFI
Default Model	.958	.939	.995	.993	.995
Saturated Model	1.000		1.000		1.000
Independence Model	.000	.000	.000	.000	.000

Base line comparison refers to the automatic fit done by the AMOS for a given model the acceptable values for base line comparison are checked by TLI and CFI .TLI stands for Tucker Luis Index and CFI stands for Comparative Fit Index. To have a comfortable fit both TLI and CFI values should be closer to 1. In Table 3, the values are 0.993 and 0.995 respectively (Shu'aibu, 2013).

Table 4. Model Fit Summary: Parsimony – Adjusted Measures

Model	PRATIO	PNFI	PCFI
Default Model	.682	.653	.679
Saturated Model	.000	.000	.000
Independence Model	1.000	.000	.000

P-RATIO means parsimony ratio that calculates the number of constraints in the model and is used to calculate the PNFI and PCFI indices. Value of 0.65 if PNFI and 0.679 of PCFI is an acceptable range to confirm the acceptable fit of the model (Hu & Bentler, 1999).

Table 5. Model Fit Summary: Non-Centrality Parameter

Model	NCP	LO 90	HI 90
Default Model	5.249	.000	26.816
Saturated Model	.000	.000	.000
Independence Model	1140.466	1031.438	1256.900

NCP means Non-Centrality Parameter value with boundaries expressed by LO (NcpLo) and Hi (NcpHi) respectively the lower and higher boundaries of 90% confidence interval for the NCP. LO 90 = Lower boundary (NcpLo method) of a 90% confidence interval for the NCP.

Table 6. Model Fit Summary: FMIN

Model	FMIN	F0	LO 90	HI 90
Default Model	.378	.039	.000	.202
Saturated Model	.000	.000	.000	.000
Independence Model	9.071	8.575	7.755	9.450

FMIN stands for Model Fit Index. The close to 0 is called perfect fit for the model. The acceptable range should between 0.3 to 0.5. In the Table 6, FMIN value is falling under the range of between 0.3 to 0.5. (Banerjee & Dey, 2013).

Table 7. Model Fit Summary: Root Mean Square Error of Approximation

Model	RMSEA	LO 90	HI 90	PCLOSE
Default Model	.064	.000	.067	.780
Independence Model	.360	.343	.378	.000

RMSEA stands for Root Mean Square Error of Approximation where values higher than 0.1 are considered poor, values between 0.08 and 0.1 are considered borderline, values ranging from 0.05 to 0.08 are considered acceptable, and values ≤ 0.05 are considered excellent (MacCallum, Browne, & Sugawara, 1996).

4.2 Conclusion of Model Fit Summary

All the tables of model fit summary are suggesting that model is representing the data. CMIN RMSEA and TLI values are giving clear indication that the model can replicate more than 80% of the raw data used to create the SEM model. The model is ready for further interpretation.

4.3 Measurement of Reliability and Validity

In Table 8, Cronbach's alpha is more than 0.70 for all the above-mentioned dimensions which is fulfilling the reliability criteria. The average variance extract is over and above 0.55 which completing the convergent validity criteria. (Van Saane et al., 2003)

Table 8. Measurement of Reliability

Dimensions	Cronbach's Alpha	Composite Reliability (rho_a)	Composite Reliability (Rho_c)	Average Variance extracted
Connectivity	0.822	0.81	0.842	0.66
Infrastructure	0.756	0.70	0.782	0.73
Applications	0.866	0.81	0.872	0.71
Attitude	0.94	0.91	0.93	0.69

Table 9 is giving the information of discriminant validity of the model. The square root of AVE (Average Variance Extracted) is higher than the correlations between the dimensions. Hence it proves that all the dimensions are distinct from each other. (Voorhees, Brady, Calantone, & Ramirez, 2016).

Table 9: Discriminant Validity

Dimensions	Applications	Attitude	Connectivity	Infrastructure
Applications	0.81			
Attitude	0.73	0.83		
Connectivity	0.72	0.76	0.84	
Infrastructure	0.69	0.68	0.81	0.83

R square shows the goodness of fit of the model. The higher the value the stronger is the model considered. The moderate strength is between 0.25 to 0.50. The strong model is considered over and above 0.50. In Table 10, value of the model is depicting 0.98 which indicates that the difference between actual values and the predicted values are very less (Colin Cameron & Windmeijer, 1997).

Table 10. R square

Dimension	R-square	R-square adjusted
Attitude	0.98	0.987

Table 11 is showing the empirical values of linear relationship of Applications, Connectivity and Infrastructure with Attitude towards 5G smart city. Path coefficient table is showing the coefficients are showing the relationship between dependent and independent variables. Attitude is showing 58% responsiveness towards applications and with connectivity it is showing 54% which is slightly lessor than responsiveness towards applications. Last but not the least attitude is showing 49% responsiveness towards infrastructure.

Table 11. Path Coefficients

S. No	Dimensions	Attitude
1.	Attitude	1
2	Applications	0.58
3	Connectivity	0.54
4	Infrastructure	0.49

5. MANAGERIAL IMPLICATIONS

During the analysis we saw that higher responsiveness is exhibited by variables associated by applications of smart mobility or we can say better and modern and faster ways of transportation. The modern idea suggests that cities must be built for the cities not for their vehicles. Other important variables are public health care and safety which showed more weightage in the responses of the sample. Last but not the least is energy management as there is always need of energy to run the city. As people are able to highly relate themselves to those issues probably that could be the reason that they have responded highly towards those issues.

Respondents have shown a positive attitude towards connectivity which includes variables like Cellular Networks, Data Speed, Lower Latency, More Capacity. The reason being same as for Applications. In case of another dimension called infrastructure the responsiveness of attitude towards it is slightly lower than any other dimension as the variables in infrastructure are mainly, traffic flow, energy usage, air quality, and waste management. The moment we talk about these issues people have very lukewarm response towards them as they do not see these issues as their top priorities and I think these are the changes that we must bring in our citizens if we have to make them citizens of the smart city, the smart citizens. There is a need to change the attitude of the people towards those issues which are related to the environment and future generation and is quiet unfortunate that people are also not very much interested in those issues which are not impacting them immediately.

6. CONCLUSION

In conclusion, considerable thought and planning are needed to address the difficulties and security issues presented by AI and blockchain in the context of 5G. Governments, corporations, and individuals will need to work together to build interoperability standards, strong security safeguards, objective training data, and scalable and decentralised solutions in order to address these difficulties. 5G technology has enormous potential to alter smart cities and raise the standard of living for citizens.

Numerous advantages and opportunities can result from the integration of 5G in various industries, including transportation, healthcare, public safety, energy, education, agriculture, and tourism, including improved mobility, access to high-quality healthcare, increased public safety, energy efficiency, accessibility to education, sustainable agriculture, and improved tourism experiences. However, there are a number of obstacles to overcome for the deployment of 5G in smart cities to be successful, including high costs, infrastructure needs, and security issues. Nevertheless, 5G technology holds the possibility of revolutionising how smart cities run, and it will be essential for achieving this technology's full potential to continue research and development in this area.

The research currently suggests that the hazards are negligible when the technology is utilised within advised exposure limits, notwithstanding worries over the potential health problems linked with the introduction of 5G technology in transportation and smart education. To ensure that 5G technology is utilised safely, it is crucial to keep an eye on any potential health concerns linked with it and to put the necessary rules and regulations in place. Additionally, informing the public on the advantages and potential drawbacks of 5G technology can assist people in making well-informed choices regarding its use. Overall, 5G technology has the ability to significantly advance a number of industries, thus it's critical to balance utilising its advantages while reducing potential concerns.

6.1 Limitations of the study

The study focuses only on a small segment of the population and therefore the viewpoint of a large part of the population who are unaware of the complexities of the technology is missing from this study.

The exploratory nature of the study requires that similar studies be taken up in India in order to further establish the full dynamic of implementation of 5G technology.

The face-to-face survey conducted for this study involved respondents from Delhi NCR only; generalisation may not be made for the entire population of India.

6.2 Future Scope

Based on the results and limitations of our study, the following areas of future research could be investigated to further our understanding of the adoption of AI and IoT in India's smart cities:

1) Future studies may compare the adoption of AI and IoT in India's smart cities with that of other countries and regions. This will clarify the unique advantages and challenges that smart cities in India encounter.
2) Given the complexity of smart cities, research that combine perspectives from various fields, such as engineering, social sciences, and environmental studies, may be more fruitful in the future.
3) Case studies: In-depth case studies on the usage of AI and IoT in certain smart cities in India may be conducted. These studies will provide insightful information about the contextual factors influencing the development of smart cities in India.
4) Extensive research: Future studies may look at the adoption of AI and IoT in additional smart cities in India, using a bigger, more representative sample size that would enhance the generalizability of the findings.
5) Long-term studies: Long-term studies might be conducted to track the adoption of AI and IoT in smart cities over time and assess the impact of various programmes and regulations on the development of smart cities.

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