

# EXPLORING THE MIGRATION TO 4G: A QUALITATIVE INVESTIGATION

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**Abstract:** The acceptance of third-generation (3G) cellular networks have become widespread throughout India, as mobile phones utilize these communication standards to transfer data with the operator base station. The latest advancement, fourth-generation (4G), is creating a revolution in mobile telecommunications technology. To grasp the reasons behind the need for 4G networks and the challenges that may arise during the transition process, a semi-structured interview using grounded theory was carried out. The findings of the study provide useful insights for professionals working on the development of this technology.

**IndexTerms:** Third-generation, fourth-generation, mobile telecommunications technology, grounded theory

## I. INTRODUCTION

In the 1980s, the first generation of mobile phones—large, brick-like devices that transmitted over an analogue signal were typically left behind since they were cumbersome and impractical to carry around. In the 1990s, the second generation, which used a more reliable digital signal and allowed for the use of text messaging, or SMS, replaced them (Short Message Service). The technology was still not dependable or speedy enough to handle the thousands, then millions, of users who wanted to use mobile phones; the signal could not convey enough data at once, and there were many locations the signal did not cover. In addition, the demand for data transfer over mobile devices, such as email and internet access, was growing quickly and 2G was unable to keep up. The next stage was an intermediary technology known as 2.5G or EDGE, but it soon developed into full 3G.

In terms of dependability and coverage for voice conversations and text messages, as well as giving much faster access to the internet due to its capability of transferring bigger amounts of data, the advent of 3G services in the early years of the 21st century was a significant advancement. By providing substantially greater data speeds due to increased bandwidth, it goes beyond 2G and makes it possible for various services like video calling, mobile TV, etc. that were not conceivable with 2G. Our potential maximum download speed under the most recent HSPA+ technology, a 3G standard, is 42 Mbps. Your phone's 3G signal confirms that you have turned on and enabled the 3G service. Mobile providers provide a high-speed data service known as 3G.

The study offers two research queries: First, to understand the need for fourth-generation (4G) mobile telecommunications technology. Second, to explore the challenges involved while migrating to fourth-generation (4G) mobile telecommunications technology.

The current study has been structured as followed: A suitable introduction is provided in section 1. Section 2 provides suitable literature for the current study. The next section describes the methodology employed. Section 4 discusses answers to our research queries. Section 5 and section 6 are followed by the implications and limitations of the study.

## II. LITERATURE REVIEW

Many nations throughout the world now use third-generation cellular networks based on UMTS specifications (Holma & Toskala, 2003, 2005). Wi-Fi WLANs, which are based on the IEEE 802.11 standard, make up the vast majority of wireless data networks today, including the more modern 3G mobile broadband networks, which are mushrooming quickly (Papagiannaki et al., 2006). More people are now involved in the business because of the growth of mobile services, but new technologies and services also need greater collaboration than before. Every participant in such a setting must cope with intricate business networks that may cross several industries (Kuo & Yu, 2006). In 2000, 3G technologies were introduced to address the demands of sophisticated mobile data services for multimedia applications (Dekleva et al., 2007). The top 3G uses include video telephony, mobile Internet access, games, music and video downloads (Basso, 2006; Chung, 2004).

Beyond third-generation (B3G) wireless cellular systems are those that are capable of high-data-rate transmission in addition to what is currently provided by second and third-generation (2G/3G) wireless cellular systems. They can also provide users with a range of services in several contexts and channel circumstances (Lee & In, 2009).

As cellular data networks serve a wide range of applications, including crucial services like remote control, surveillance, safety precautions, e-healthcare, location services, telemetry, and logistical support, their importance to commerce and society is growing. This makes data accessible to all, even machines (Ricciato et al., 2010).

### III. RESEARCH METHODOLOGY

#### 3.1 Research Design

A semi-structured interview questionnaire similar to that in Appendix 1 was used. The interview questions were in line with the grounded theory-based research questions in our current study (Bryant, 2017). Before the main interview, pilot research was carried out to reevaluate the questionnaire's questions (Brito et al., 2007). All respondents provided their consent before the interview. They were given the assurance that the information would only be utilised for research purposes and that all respondents' privacy would be maintained. The author audio-recorded the replies. The responses were written down in English after the interviews.

#### 3.2 Sample Size

A glimpse of the working professional population in India regarding 3G networks is provided by a sample size of 50 respondents who are all working professionals living around the country. These 50 people, who were selected from a bigger group, can shed light on the experiences, viewpoints, and actions of working professionals in India. The 50-person sample size is manageable and effective for data collection while allowing for a broad representation of the community as shown in Appendix 2. It's crucial to keep in mind, though, that a sample size of 50 might not be a representative sample of the total population and might not be sufficiently generalizable.

#### 3.3 Respondent profile

Working professionals between the ages of 25 and 60 make up the respondent profile for this survey. In the sample, men make up 60% of the responses, while women make up the remaining 40%. All study participants have access to and use mobile technology, making them a good representation of the greater group of working professionals in India. The study's goal is to obtain an understanding of working professionals' mobile phone usage patterns and preferences by concentrating on this particular segment of the population. The findings may be more nuanced and complex because the age range of 25 to 60 contains a large variety of life events and professional experiences.

#### 3.4 Sampling method

Convenience sampling was the sampling technique utilised in this investigation. The participants in this strategy are chosen based on their accessibility or availability. The respondents in this instance are approached and requested to take part in the survey; they are working professionals. When there are constraints on time, resources, or accessibility to the target population, convenience sampling is frequently used.

This approach can be useful because it makes it possible to gather data quickly and effectively. Furthermore, the study can be conducted with a smaller sample size because the respondents are readily available, which can cut down on the time and resources needed to collect data from a bigger population. Convenience sampling, meanwhile, might not offer a representative sample of the greater community, so it's crucial to keep that in mind. A sample that is not representative of the target population may result from participants choosing themselves to participate in the study.

### IV. DISCUSSION

#### 4.1 Migrating to the fourth generation (4G)

We learned about migration to the 4G network through our study for a variety of reasons. The following section contains the explanations.

##### 4.1.1 Bandwidth insufficiency

In telecommunications networks, multiple access refers to methods that let several users effectively share scarce network resources. Finite resources in a telecommunications network are typically measured in terms of bandwidth (Jamalipour et al., 2005).

**Interviewer:** What are the problems associated with your current 3G network?

**Respondent 41:** You'll notice that the battery drains more quickly when you switch to a different "G," such as 2G or 3G because the phone has to work harder to receive more signals with the same bandwidth and requires more complex algorithms to handle larger volumes of data.

The lack of adequate bandwidth is a common problem for 3G network users. The third generation, or 3G, of technology, which is quicker and more sophisticated than 2G, was introduced in the early 2000s. Despite their early popularity, 3G networks are today seen as antiquated because of the sluggish data speeds and other problems caused by their constrained bandwidth. This is because the large amount of data that is currently being carried over the internet cannot be handled by 3G networks. Users frequently struggle to download huge files, stream video content, or perform other high-bandwidth tasks as a result. This problem is being addressed by the development of 4G, which offers faster and more dependable connections. Nevertheless, some regions might not have access to this network.

Insufficient bandwidth on 3G networks can affect businesses in addition to the user experience. Employees working remotely, for instance, could find it difficult to access crucial web resources or encounter lag or slowdowns. Reduced efficiency and production may result from this.

There are some options available to deal with 3G networks' lack of bandwidth. For clients who require faster internet speeds, cell companies could offer more bandwidth-intensive plans. These plans, meanwhile, might not be accessible everywhere and they can be pricey. This should result in a connection that is more dependable and stable, as well as better download and upload rates. In conclusion, inadequate bandwidth on 3G networks is a serious problem that may harm both individual users and enterprises. Although there are remedies, not everyone may be able to access or afford them.

#### 4.1.2 The high expense of 3G Packs

The expense of 3G network plans is one of its key drawbacks. Many cell companies continue to charge higher costs for 3G data plans although it is still regarded as an antiquated technology when compared to more contemporary ones like 4G. For people and families, especially those who depend on their mobile devices for internet access, this can be a considerable financial hardship.

Users may incur additional charges for upgrading their equipment to accommodate 3G technology in addition to the cost of the data plan itself. Those who bought 2G devices before 3G was widely accessible and may now need to change their complete gadget to use the speedier network may find this to be especially challenging.

**Interviewer:** What are the problems associated with your current 3G network?

**Respondent 9:** There is little competition in India. Data packs for all big companies are uniform. As a result, there is no need for competition because everyone benefits equally and we are already paying a high price.

**Respondent 6:** There is a general ignorance of the situation. We continue to use 2G as the rest of the world switches to 4G, and since 3G packs offer better speeds, we think they should cost more. Additionally, we enjoy 2G and don't want to question why 3G data packets are so astronomically expensive.

**Respondent 35:** For years, we've been paying absurdly high internet bills, but this isn't because the internet is expensive per se; rather, it's because of the reasons that make it thus. Internet speeds in Indian homes are presently 2Mbps on average.

Furthermore, the constrained bandwidth and slower speeds provided by these networks make the high cost of 3G data plans even more relevant. Given that many users today demand quicker, more dependable internet connections, 3G data plans may not be as enticing due to their high cost. This may prompt some customers to choose different options, such as free Wi-Fi hotspots or limitless data plans provided by more sophisticated networks.

In conclusion, a significant problem that has impacted the drop in popularity of 3G networks is the high cost of 3G data plans. The high expense of these plans is making them less tempting to customers who are looking for more cheap and more flexible options, even though they may still be the only choice in some locations.

#### 4.1.3. Higher power consumption

**Interviewer:** What are the problems associated with your current 3G network?

**Respondent 3:** The truth is that 2G was designed to be incredibly power-efficient for phone services with slow data rates. 3G was created with a higher power need to provide higher-rate data services.

**Respondent 1:** Handovers will drain your battery if you reside in a cell edge location or an area without 2G or 3G connectivity.

One of the main disadvantages of 3G packs is their higher power consumption. In comparison to 2G technology, 3G uses more power to send and receive data over the airways. For devices using 3G technology, this leads to higher power consumption and shorter battery life. The higher power consumption of 3G packs is partly a result of the need for greater infrastructure that consumes more power, such as more base stations and more sophisticated transmission tools. Larger batteries or battery-saving capabilities like power management software are frequently included by device manufacturers in 3G devices to lessen the negative effects of increasing power consumption. The higher power consumption of 3G technology, however, continues to be a problem for both device manufacturers and network operators.

The greater power consumption of 3G technology has effects on the environment and energy sustainability in addition to how long a device's battery lasts. As a result of the increased energy consumption caused by 3G networks and devices, additional greenhouse gases and other harmful emissions are produced.

#### 4.1.4. Lack of accessibility

Accessibility issues are yet another significant problem for 3G networks. Even while 3G networks are widely available, not everyone can use them, especially in rural or distant locations where infrastructure is few or nonexistent. This lack of accessibility may restrict the use of 3G technology and keep many people and communities from making use of its cutting-edge features.

Additionally, there are concerns with 3G technology's cost because it frequently necessitates the purchase of a 3G-enabled gadget and a data plan, both of which can be prohibitively expensive for many people and families. Since people who cannot afford the required services and equipment will not be able to use 3G technology, this lack of affordability has the potential to make the lack of accessibility even worse.

**Interviewer:** What are the problems associated with your current 3G network?

**Respondent 13:** The fact that 3G is simply unavailable in some areas is a downside of the technology.

**Interviewer:** How do you address the limitations of your 3G network?

**Respondent 42:** To take advantage of the greatest network and battery life, it is advised to switch to 2G if you are in a location with poor signals. Cellular reception is of the highest quality on the best 2G network.

To overcome these obstacles, some governments and organisations are attempting to make 3G networks more accessible by making infrastructure investments and offering subsidies or other types of financial assistance to lower the cost of the technology. Future solutions to the accessibility problem may come from the development of alternative technologies like 4G and 5G, which offer better accessibility and reach.

#### 4.2 Migrating towards 4G mobile telecommunications technology

Given that 4G offers faster internet speeds, increased network coverage, and more dependable connections compared to earlier generations of mobile networks, 4G (Fourth Generation) technology will represent a significant leap in mobile communications.

**Interviewer:** Do you think 4G will create an evolution in mobile telecommunications technology?

**Respondent 50:** Newer generations of mobile phone technology can transmit more bits per second because of a combination of more advanced coding methods and the opening of additional radio channels for larger spectral sizes.

**Respondent 15:** It costs a lot of money to install new machinery when upgrading mobile phone base stations to modern technologies. It could be necessary to put in new antennas to use new bands. Because switching to new technology is so expensive, carriers try to do so as infrequently as possible.

**Respondent 17:** The ideal and fair are what we want. People want to pay the least amount of money possible for the finest services. Additionally, remember that higher prices do not necessarily translate into higher quality.

**Respondent 14:** Due to the network's lack of investment in a location where there are few users, 3G is typically slow or nonexistent in rural areas. As a result, you will be linked to a tower that is far away.

**Respondent 6:** There is a general ignorance of the situation. We continue to use 2G as the rest of the world switches to 4G, and since 3G packs offer better speeds, we think they should cost more. Additionally, we enjoy 2G and don't want to question why 3G data packets are so astronomically expensive.

When compared to earlier mobile network generations like 2G and 3G, fourth-generation (4G) technology would significantly improve the world of mobile communication. Users may anticipate higher internet speeds, wider network coverage, and much more dependable connections with 4G. With download speeds of up to 100 Mbps offered by 4G networks, it is possible to stream videos, download huge files, and browse the internet at breakneck speeds. High-speed internet access is made possible even in isolated and rural regions by the expanded 4G network coverage.

Additionally, the 4G networks' more consistent and dependable connections solve the 3G networks' issues with dropped calls and sluggish data speeds. Users may take advantage of multimedia experiences like high-definition video conversations, mobile gaming, and live streaming thanks to the quick speeds and excellent connections provided by 4G technology. Businesses can connect and transfer data more effectively because of the higher efficiency of 4G technology, which boosts productivity and lowers expenses. In summary, 4G technology has transformed how people communicate and access information while on the go, and its advantages are being seen in a variety of industries.

## V. IMPLICATIONS

By investigating the opinions of working professionals on the need for increased network coverage, the current study offers both theoretical and practical consequences. The survey offers insightful information on how they perceive the need for network technology advancement and how 4G technology has the potential to alter the industry. The results of this study will be helpful to industry professionals because they may utilise this knowledge to create and enhance 4G networks. The study also emphasises how important it is to take working professionals' viewpoints into account when designing and implementing new technologies because they will be the ones most directly impacted by the changes. The study's theoretical and practical implications can serve as a manual for experts in the field and researchers, enabling better-informed choices and developments in 4G technology.

## VI. LIMITATIONS

The current study has some drawbacks. The study's small sample size of 50 professionals, which could have been raised for a more thorough grasp of the problem, is one of its key shortcomings. The study does not represent the opinions of the broader public because it only considers the perspectives of working professionals. This restriction limits the findings' generalizability and emphasises the need for future studies to use a bigger and more varied sample. The study's regional focus, which might not accurately represent the experiences of people in other areas, is another drawback. The extent to which the study's findings can be transferred to other places and populations may be constrained by its limited geographical scope. These limitations highlight the need for more investigation that will solve these problems by increasing the sample size, geographical reach, and taking into account the opinions of a larger spectrum of people. Conclusion: Despite its flaws, the current study offers insightful information about the viewpoints of working professionals on the demand for enhanced network coverage and the contribution of 4G technology to the changing industry.

### Appendix 1

Questionnaire used in a semi-structured interview.

1. Do you own a mobile phone?
2. Does your mobile phone utilize 3G mobile telecommunications technology?
3. What are the problems associated with your current 3G network?
4. Is there a requirement for the fourth generation of mobile telecommunications technology?
5. How do you address the limitations of your 3G network?
6. Do you think 4G will create an evolution in mobile telecommunications technology?

### Appendix 2

Table 1: Demographics of the respondents

Respondent	Age	Gender
R1	32	Female
R2	52	Female
R3	38	Female
R4	51	Female
R5	56	Female
R6	50	Female
R7	29	Female
R8	55	Female
R9	33	Female
R10	28	Female
R11	57	Female
R12	30	Female
R13	32	Female
R14	32	Female
R15	51	Female
R16	40	Female
R17	48	Female
R18	50	Female
R19	31	Female
R20	40	Female
R21	34	Male
R22	59	Male
R23	41	Male
R24	36	Male
R25	52	Male
R26	33	Male
R27	54	Male
R28	30	Male
R29	27	Male
R30	54	Male
R31	46	Male
R32	29	Male
R33	41	Male
R34	36	Male
R35	31	Male

R36	55	Male
R37	41	Male
R38	53	Male
R39	54	Male
R40	41	Male
R41	53	Male
R42	40	Male
R43	34	Male
R44	53	Male
R45	45	Male
R46	27	Male
R47	43	Male
R48	48	Male
R49	26	Male
R50	42	Male

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