


# Chapter 7 Technological Advancement and Phenomenon of Environmental Sustainability (TAPES) in 6G Wireless Communication System

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## ABSTRACT

*Wireless communication has fundamentally transformed the trajectory of human advancement. The swift advancement and proliferation of mobile communication technologies have established an ecosystem that surpasses previous iterations. Nonetheless, challenges such as excessive energy utilization and consequent carbon emissions, inadequate disposal systems for substantial quantities of electronic waste, and the recycling of electronic components hinder progress. As the global community anticipates the rollout of 6G mobile communication technology, it is imperative to address these challenges to ensure the sustainability of 6G innovations. In this review, we elucidate the advantages of 6G in comparison to preceding generations while also highlighting the environmental issues that result in significant ecological harm.*

DOI: 10.4018/979-8-3373-2220-9.ch007

## INTRODUCTION

The art of communication stands as the cornerstone in the grand saga of human evolution. The advent of wireless communication has sparked a transformative wave in the progress and flourishing of individuals worldwide. Our methods of connecting, conversing, and interacting with the surrounding universe have been utterly revolutionized by the leaps in wireless communication innovations. The evolution of communication is quite promising, and it really makes a commendable transformation in recent times due to the application of artificial intelligence (AI) and its subset technologies like machine learning (ML) and deep learning (DL) (Dey, 2024). In shaping the networks of tomorrow as we approach 2030, a vibrant agreement resonates among key players from both the industrial sphere and the academic realm globally, affirming that the evolution of network technology must not only empower but also hasten the journey towards a brighter and more sustainable planet. As we move towards the 6G era, which promises to provide extremely fast connectivity and data transfer rates, it is also capable of doing paradigm-shifting applications such as artificial intelligence (AI), the Internet of Things (IoT), unmanned aerial vehicles, and terahertz communication (Dey, 2025). The below Figure 1 describes the evolution of wireless communication, emphasizing data speed and types of services.

With its thrilling promise of unprecedented velocity, capacity, and reliability, the emergence of 6G technology heralds the dawn of an exhilarating era in connectivity and innovation. Networks powered by 6G foresee data transfers soaring into the tens of terabits per second, potentially revolutionizing diverse industries including manufacturing, transportation, healthcare, and entertainment. The astonishingly low latency and remarkable dependability of 6G technologies facilitate instantaneous communication and control, paving the way for groundbreaking applications such as remote surgeries, immersive augmented reality, and autonomous vehicles. Moreover, the seamless fusion of 6G networks with pioneering technologies like edge computing, blockchain, and artificial intelligence (AI) is set to unveil new pathways and ignite digital transformation across a multitude of economic landscapes.

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