


# Chapter 8

## Eco-Intelligent 6G Deployment: A Data-Driven Multi-Objective Framework for Sustainable Impact Analysis and Optimization

**Gripsy J. Viji**

 <https://orcid.org/0000-0002-6599-3010>

*PSGR Krishnammal College for Women, Coimbatore, India*

**L Sheeba**

 <https://orcid.org/0000-0003-1269-6888>

*PSGR Krishnammal College for Women, Coimbatore, India*

**Deepa Kumar**

 <https://orcid.org/0000-0002-3398-9850>

*SR University, Warangal, India*

**Banu N Sharmila**

 <https://orcid.org/0000-0002-2612-3266>

*SR University, Warangal, India*

**Bobby Lukose**

 <https://orcid.org/0009-0000-3750-2942>

*krupanidhi College of Management, Bangalore, India*

### ABSTRACT

*The sixth-generation technology will transform the world of global connectivity with data speeds never even thought possible, effortless automation, and improved*

DOI: 10.4018/979-8-3373-2220-9.ch008

*interaction with smart cities and IoT. Consequently, challenges arise in implementing this framework through data integration from diverse sources to maintain the accuracy of the models under varying conditions and proactive engagement with stakeholders to enhance model parameters and regulatory standards. This research work addresses these problems by analyzing several 6G consequences, from energy consumption, with the proposed Sustainable Impact Analysis and Optimization Framework (SIAOF) for implementing 6G. The technique of SIAOF encompasses multilayer collecting of data sourced from multiple levels, modelling weighted environmental and socio-economic ratings to optimize both network performance against negative consequences in multi-objective optimization. Advanced methodologies including NSGA-II for Pareto optimization and dynamic feedback mechanisms, allow real-time adjustment of deployment tactics.*

## **1. INTRODUCTION**

Mobile communications began almost 40 years ago with the introduction of 1G networks in the 1980s. The Nordic countries adopted 1G, whereas the United Kingdom opted for the Total Access Communication System (TACS). The earliest mobile phones operated on 1G technology. The shift from analogue to digital technology, which made mobile phones more inexpensive, portable, and tiny, was a key development during the 2G period. Because of its extensive coverage and very high penetration rate, 2G has enabled people to be able to reach anyone by telephone call or text message from just about anywhere. The second huge disruption has been the mobile internet or mobile broadband, made possible by 3G technology. Mobile phones, however, lacked touch screens and the operating systems of the first generation were not yet sophisticated enough to allow people to access the mobile internet. As a result, the mobile internet did not see quick success in the early days of 3G. Full-dimensional MIMO channels were first used widely in wireless technology with 4G. 5G is a complex network that has a much larger capacity than previous generations. It offers a strong platform for new wireless services and applications, especially in specialist fields (Pennanen et al., 2025). It is hard to say whether the 6G design will be revolutionary, evolutionary, or some mix of both.

There is no doubt that 6G will witness network convergence and openness. Wearable and short-range networks make it easier to get and analyze ambient intelligence, cellular and wide area networks give mobility and capacity, and non-terrestrial networks ensure that the whole system is available and covered. This will indicate a wider scope of communications: cloud, edge, data storage, accurate sensing and localization, and network functions defined in software. All these aspects form an

34 more pages are available in the full version of this document, which may be purchased using the "Add to Cart" button on the publisher's webpage: [www.igi-global.com/chapter/eco-intelligent-6g-deployment/378230](http://www.igi-global.com/chapter/eco-intelligent-6g-deployment/378230)

## Related Content

---

### Introduction to Sustainable Prototyping

Romdhane Ben Khalifa (2026). *Materials, Techniques, and Ecological Impact of Sustainable Prototyping* (pp. 1-30).

[www.irma-international.org/chapter/introduction-to-sustainable-prototyping/399024](http://www.irma-international.org/chapter/introduction-to-sustainable-prototyping/399024)

### Promotion of Homestay for the Sustainable Livelihood of the Local Community in the North Eastern Himalayan Region of India

Hawaibam Jhalari Deviand Soumendra Nath Biswas (2024). *Mountain Tourism and Ecological Impacts: Himalayan Region and Beyond* (pp. 134-142).

[www.irma-international.org/chapter/promotion-of-homestay-for-the-sustainable-livelihood-of-the-local-community-in-the-north-eastern-himalayan-region-of-india/343140](http://www.irma-international.org/chapter/promotion-of-homestay-for-the-sustainable-livelihood-of-the-local-community-in-the-north-eastern-himalayan-region-of-india/343140)

### The Potential Impact of 6G Technology on Natural Habitat

Kumar Parmar, Dev Nitesh Gadhvi, Damodharan Palaniappan, T. Premavathi, Rituraj Jainand G. Vidyasree (2025). *6G Impacts on Natural Habitats and Human Life* (pp. 291-318).

[www.irma-international.org/chapter/the-potential-impact-of-6g-technology-on-natural-habitat/378233](http://www.irma-international.org/chapter/the-potential-impact-of-6g-technology-on-natural-habitat/378233)

### Assessment of Factors Responsible for Promoting Religious Tourism in the Himalayan Region: Special Reference to Dev Bhoomi, Uttarakhand

Dillip Kumar Kumar Dasand Susanta Ranjan Chaini (2024). *Mountain Tourism and Ecological Impacts: Himalayan Region and Beyond* (pp. 25-34).

[www.irma-international.org/chapter/assessment-of-factors-responsible-for-promoting-religious-tourism-in-the-himalayan-region/343130](http://www.irma-international.org/chapter/assessment-of-factors-responsible-for-promoting-religious-tourism-in-the-himalayan-region/343130)

### A Study on Adventure Tourism and Mountaineering Practice as a Business Perspective Among the Northern Region of India

Lokesh Kumarand Jaya Bharath Reddy (2024). *Mountain Tourism and Ecological Impacts: Himalayan Region and Beyond* (pp. 1-14).

[www.irma-international.org/chapter/a-study-on-adventure-tourism-and-mountaineering-practice-as-a-business-perspective-among-the-northern-region-of-india/343128](http://www.irma-international.org/chapter/a-study-on-adventure-tourism-and-mountaineering-practice-as-a-business-perspective-among-the-northern-region-of-india/343128)