

# Strategic Connectivity in 5G and 6G and Remote Surgery: The Case of Germany

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## ABSTRACT

This article addresses the topic of 5G and 6G as a Technological Innovation System (TIS) with the industrial application of Remote Surgery as an empirical case, exploring three main contributions. Firstly, this research contributes to the connection of the Technological Innovation Systems perspective and 5G and 6G networks in a quantitative viewpoint at national and international levels. Secondly, it contributes to Knowledge Production (F2) and Diffusion (F3) studies through Bibliometrics and software uses. Third, it contributes to the studies of a connection in 5G and 6G networks in the Remote Surgery empirical case application on TIS analytical background. Methodologically, the research problem of this study is to explore the publications, patents and collaboration in 5G and 6G TIS concerning the applicability of Remote Surgery worldwide and, consequently, in Germany. The general objective is to improve the industrial relevance of Remote Surgery through quantifying publications and patents and the collaborative networks in these domains. According to publications and patent data, the results reveal a crucial R&D map of Germany until 2021.

**Keywords:** 5G; 6G; Technological Innovation Systems; R&D; Remote Surgery.

## 1. Introduction

Firstly, it is crucial to highlight that the evolution of telecommunications technologies has propelled society from the 5G era, which is fast Internet with low latency, to the nascent horizons of 6G, ultra-fast Internet with ultra-low latency. A deliberate exploration of 5G technology requires, by extension, a forward-looking observation of its successor, 6G. Following this rapid technological advancement, 5G must inherently encompass a proactive consideration of its future manifestations in the form of 6G. Furthermore, standardisation in 6G is already underway for advanced reflection on technological change, which is occurring in increasingly shorter periods (Porter & Kramer, 2018; Louçã, 2023; Freeman & Louçã, 2001).

Therefore, the 5G and 6G networks are key technologies to critical geopolitical disputes, such as those in the semiconductor industry, transistors and integrated systems that lead to software and hardware construction - main components of cutting-edge networks (5G and 6G) (Rikap & Lundvall, 2021; Moldicz, 2021). According to this article's data, 5G and 6G technologies applied to Remote Surgery represent a crucial advantage in the geopolitics scenario, as seen in the Results and Discussion (Rikap & Lundvall, 2021; Moldicz, 2021; Liu et al., 2018; Liefner et al., 2019) because of Remote Surgery.