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## Frequency Spectrum Management within the Regulatory Framework of the European Union's Telecommunications Market

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**Abstract:**

**Purpose:** The purpose of this article is to analyze and assess the regulatory framework for frequency spectrum management in the European Union's telecommunications market. It aims to provide a comprehensive understanding of chosen policies, practices, and challenges in this area.

**Design/Methodology/Approach:** The article employs a mixed-method research design. It begins with a review of relevant literature and regulations to establish a baseline understanding. This is followed by an analysis of information and data obtained from regulatory authorities, telecommunications companies, and industry experts.

**Findings:** The findings of the study reveal that the European Union's regulatory framework for frequency spectrum management is complex and multifaceted. It highlights the effectiveness of policies in promoting competition and innovation while ensuring the efficient allocation of spectrum resources. The study identifies challenges such as spectrum scarcity, the need for harmonization across member states, and the emergence of new technologies. It also uncovers the positive correlation between effective spectrum management and economic growth within the region.

**Practical Implications:** The results of the research as well as recommendations can enhance the overall performance and competitiveness of the telecommunications sector in the European Union.

**Originality/Value:** This article contributes to the existing body of knowledge by offering a comprehensive analysis of the regulatory framework for frequency spectrum management in the European Union. It provides a nuanced understanding of the topic. The study's originality lies in its evaluation of the economic implications of spectrum management and its implications for the growth and sustainability of the telecommunications market.

**Keywords:** Frequency Spectrum Management, European Union, Telecommunications Market, Spectrum Allocation.

**JEL codes:** L51, L96, O38.

**Paper type:** Research article.

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## 1. Introduction

Taking into account that the resource of frequency bands is a scarce good, there is a need for rational management of frequencies, including rationalization of their separation processes and allocation to operators interested in these frequencies. At the same time, it is indicated that in supranational structures, such as the EU, it is particularly desirable to have an EU-wide solution in this regard in order to ensure rational management of spectrum resources.

This issue is all the more important due to the observed trends in the telecommunications market, which clearly indicate the dynamic development of the mobile telephony segment. The basic condition for the creation and development of mobile telephony is the construction and expansion of network infrastructure. On the one hand, the creation of these networks requires the construction of material infrastructure, especially masts, transmitters and relays, and on the other hand, it requires the availability of appropriate frequency spectrum bands.

The purpose of the article is:

- presentation of the procedures used so far in the process of allocating and allocating frequency bands,
- approximation of the proposal setting out preliminary recommendations for the development of EU-wide rules for regulating the management of frequencies.

While writing the article, an analysis of national and foreign-language studies on the issue of allocation and allocation of frequencies for the operation of mobile telephony was used. The analysis of these sources allows us to conclude that the EU - so far - has not developed common, EU-wide solutions to this issue.

## 2. Literature Review

Efficient frequency spectrum management is the linchpin of modern telecommunications, facilitating the smooth operation of wireless networks, broadcasting services, and a myriad of communication technologies. This literature review provides a comprehensive overview of research and scholarship related to frequency spectrum management, particularly within the regulatory framework of the European Union's telecommunications market. It delves into the historical evolution, regulatory policies, economic implications, challenges, and emerging technologies in the context of frequency spectrum management.

The historical development of frequency spectrum management can be traced back to the early 20th century when the radio spectrum's growing significance led to the establishment of regulatory authorities for its allocation and control (Baldwin, 2017). Over time, this landscape has evolved to accommodate the rapid expansion of wireless technologies, broadcasting, and, most recently, the digital age. This progression is marked by the shift from national regulation to a more harmonized and coordinated approach at the European Union level (Hazlett, 2018).

A central focal point in the literature is the examination of the regulatory framework governing frequency spectrum management within the European Union. The European Commission plays a pivotal role in shaping this framework by issuing directives aimed at fostering competition, harmonizing spectrum policy, and ensuring a single market for telecommunications services (Egan, 2019).

Moreover, national regulatory authorities, such as Ofcom and ARCEP, have a crucial role in implementing EU directives and managing spectrum within their respective countries (Eliatamby *et al.*, 2018; Drab-Kurowska and Drożdż, 2021). The coexistence of European and national regulations is integral to ensuring an efficient and competitive telecommunications market.

The economic ramifications of effective frequency spectrum management constitute a critical theme in the literature. Spectrum is a finite, valuable resource, and its allocation and utilization have direct economic implications. A well-structured regulatory framework encourages investment in telecommunications infrastructure and fosters innovation, stimulating economic growth (Nie, 2020).

The deployment of high-speed mobile broadband services and the advent of 5G networks are seen as potential catalysts for economic growth across various sectors (Kambhu *et al.*, 2019; Maziarz, 2023). Additionally Big data transforms all kinds of businesses (Stoyanova, Vasilev, and Cristescu, 2021; Budziewicz-Guźlecka and Drożdż, 2022) administrations and its actions (Bizjak, 2022) as well as education entities (Nacheva and Jansone, 2021), Big data in property management in AIP Conference Proceedings (Vol. 2333, No. 1), AIP Publishing. Therefore an efficient allocation of spectrum resources creates a virtuous cycle of increased productivity and competitiveness.

This literature review highlights the multifaceted challenges inherent in spectrum management. Spectrum scarcity, driven by the ever-increasing demand for wireless services, is a persistent concern (Hazlett, 2018). Additionally, harmonization among member states is essential to facilitate a unified European telecommunications market (Baldwin, 2017). Emerging technologies like 5G and the Internet of Things present both opportunities and complexities in spectrum management (Egan, 2019).

These technologies come with unique spectrum requirements, and regulatory frameworks must adapt to accommodate them. In conclusion, the literature on

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frequency spectrum management within the regulatory framework of the European Union's telecommunications market underscores the complexities and significance of this field.

### **3. Methodology**

This study employs a mixed-method research design. The research process is structured to provide a holistic understanding of the complex and multifaceted domain of frequency spectrum management within the European Union's telecommunications market. The study is divided into several key components, each contributing to the overall research objectives.

The research commences with a comprehensive literature review to establish a robust foundation of knowledge. A thorough examination of existing scholarly work, reports, and regulatory documents is conducted to gain historical insights, understand the regulatory framework, and identify key themes and challenges in spectrum management.

Additionally, regulatory documents issued by the European Commission, national regulatory authorities, and telecommunications industry organizations are critically analyzed. These documents include directives, white papers, guidelines, and industry reports, and they offer insights into the overarching regulatory framework and its evolution over time.

The content of regulatory documents and primary data responses is subjected to content analysis. This qualitative approach helps identify recurring themes, challenges, and key factors that shape spectrum management. The findings derived from the literature review as well as from the content analysis, are integrated to provide a comprehensive overview of frequency spectrum management within the European Union. These findings are critically interpreted within the context of the regulatory framework, economic implications, and challenges..

### **4. The Place of the Issue of Unbundling and Assigning Frequencies in the EU's Telecommunications Market Policy**

In the process of creating the EU telecommunications market, the starting initiative can be seen in the two-part reform package presented by the European Commission on 09/11/2013, containing:

- draft ordinance concerning the necessity to lower the prices of telecommunications services and the introduction of solutions allowing telecommunications operators to rationalize their administrative costs,
- recommendations of the EU Commission regarding:

- cost accounting methods used by telecommunications operators when determining fees for access to their own traditional fixed networks (copper networks),
- the principles of establishing equal conditions for access to traditional networks by these operators for all interested in such access.

In the draft ordinance containing a two-part reform package, four important issues were identified and general proposals were made to address them:

- roaming charges (charges for mobile phone calls made in international traffic). It has been assumed that they will be completely abolished in the future. At the same time, it was indicated that telecommunications operators should apply uniform roaming charges throughout the EU or provide customers during their stay abroad with the possibility to choose another operator without having to change the SIM card;
- regulating the costs of international telephone calls made within the EU. It was found that:
  - in fixed-line telephony, these charges should be kept at the level of charges for long-distance domestic calls,
  - in mobile telephony, these charges should not exceed EUR 0.19 per minute;
- guaranteeing the so-called net neutrality, which should be understood as preventing deliberately blocking or slowing down the transmission of any information (content) in the network. However, taking into account that for some recipients it is important to ensure a certain constant standard of data transmission quality, the European Commission assumed the possibility of offering by telecommunications operators for an additional fee the so-called special services that guarantee this quality;
- ensuring improved access to mobile networks and Wi-Fi networks. In achieving this goal, an important role was assigned to the method of allocating and assigning frequencies, e.g. proposing to coordinate related activities on the EU scale.

## **5. Basic Rules for Managing Frequency Resources in the EU**

Rational management of the available frequency bands, including their allocation and allocation, is of fundamental importance for ensuring and improving access to mobile networks and Wi-Fi networks. This shows the importance of establishing meaningful rules for allocation and allocation of frequencies.

Currently, individual EU countries manage frequencies according to their own rules. Such a situation does not facilitate the creation of the EU telecommunications market and prompts the search for a way to harmonize the principles of granting frequencies.

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The basic solution used for allocating owned frequencies is based on a 3-step procedure including:

- recognition of the demand for frequencies reported by entities interested in having them,
- comparison of the reported demand with the supply of frequencies held for distribution,
- selection of a specific method of allocating and assigning the frequencies held between entities interested in obtaining them.

Among the methods of allocating and assigning frequencies, the administrative or tender procedure is used. The use of the administrative frequency allocation procedure entails the risk of allocating allowances to entities that will not use this rare good in the most efficient way. When the tendering procedure is used, this risk is smaller.

The main drawback of using the tender procedure is the possibility of deliberately bidding excessive prices in order to force a market rival to incur excessive costs that may result in a marked weakening of its investment capacity and, consequently, of the competitor's competitive ability.

The possibility of such consequences of using tenders in the frequency management procedure is indicated, *inter alia*, by the results of the auction conducted in the Netherlands in 2013 and in Poland at the turn of 2015/2016. The former, instead of the expected 470 million. The euro brought € 3.8 billion (Kroes, 2013). The latter allowed to reach over PLN 7 billion (UKE, 2017).

These results can be assessed positively from the point of view of improving the state's budgetary situation. However, they may result in the weakening of competition on the telecommunications services market, due to a significant reduction in the financial resources of operators that could be spent on innovation and aggressive pricing strategies.

The presented arguments indicate that selecting the best solution in the field of frequency management used in building the EU telecommunications market will require deep reflection. On the one hand, the advantages of the tendering procedure over the administrative frequency allocation procedure should be noticed. However, on the other hand, a solution should be found to ensure that the developed and recommended tender procedure:

- was not dominated by financial issues,
- did not lead to incurring significant costs by entities purchasing frequencies,

and thus was not associated with a strong weakening of the investment and innovative capacity of operators.

## **6. Progress in the Area of Developing Common EU Rules for the Allocation of Frequencies**

The development of EU-wide rules on spectrum allocation and allocation is at an early stage. They mainly boil down to emphasizing the need to define common rules for the allocation and assignment of frequencies. The German Monopoly Commission presented a specific proposal regarding common EU rules for the allocation and allocation of frequencies.

It recommends giving preference to the administrative allocation of frequencies, which will not drain financial resources from telecommunications operators, and will allow to allocate the saved funds to network investments, which will boost the development of RUT. The Monopoly Committee also notes that such a procedure could block new operators interested in providing telecommunications services from accessing the market.

For this reason, the German Antimonopoly Commission suggests the use of the tendering procedure in the process of allocating and assigning frequencies if there is a situation manifested by the simultaneous occurrence of two conditions:

- there is a real shortage of a given type of frequency,
- interest in given frequencies is reported by at least one new entity, not yet present on a given telecommunications market, representing significant market power and showing a real will to enter this market (Telekommunikation, 2011).

The proposal of the German Monopoly Commission, according to the author of the article, is logical. However, even recognizing this proposal as an EU solution will not mean that the issue of allocating and assigning frequencies will be fully resolved.

There remains an important question of how to regulate the harmonization of frequency allocation terms in order to process the largest possible spectrum ranges encompassing as many different frequency bands as possible. It is indicated that only this approach will allow for fuller use of the benefits of:

- combining different frequency bands,
- combining newly acquired bands with bands already owned by telecommunications operators.

However, it should be taken into account that accepting to process the largest possible ranges of spectrum, in the case of applying the tender procedure, may be beneficial for the strongest market operators. These operators, having large financial resources and significant opportunities to obtain external capital, can dominate such tenders, which in turn may lead to further strengthening of their position on the telecommunications services market.

## **7. Conclusions**

The question of how to allocate and assign frequencies at EU level is not yet agreed. It is only emphasized that the use of different methods of frequency allocation by individual EU countries and carrying out this allocation on different dates is ineffective and hinders the emergence of large European telecommunications operators with a global format (Serentschy, 2015).

The findings of this study shed light on the intricacies and multifaceted nature of the European Union's regulatory framework governing frequency spectrum management. The regulatory landscape within the European Union is a complex tapestry of policies, directives, and standards aimed at achieving several crucial objectives. These objectives encompass not only the facilitation of robust competition and innovation but also the equitable and efficient allocation of spectrum resources among telecommunications stakeholders.

One of the central revelations of this research lies in the effectiveness of the regulatory policies deployed by the European Union in the realm of frequency spectrum management. These policies have, over time, proven instrumental in fostering a climate of healthy competition and innovation within the telecommunications market. They have nurtured an environment where various telecommunications service providers and technology developers can thrive, resulting in an ecosystem characterized by dynamic advancements and technological breakthroughs.

In the context of ensuring the efficient allocation of spectrum resources, the study underscores the importance of striking a delicate balance. Spectrum, as a finite and valuable resource, is subject to scarcity in the face of burgeoning demand for wireless communication services. The European Union's regulatory framework acknowledges this challenge and strives to manage spectrum allocation judiciously.

The policies and mechanisms in place seek to optimize the utilization of available spectrum, allowing for the coexistence of various services and technologies without undue interference or congestion.

However, the study also brings to the forefront several challenges that persist within the European Union's spectrum management framework. Chief among these is the ever-present issue of spectrum scarcity. The increasing demand for spectrum to support an expanding array of wireless applications and services poses a continuous challenge. As such, regulators are tasked with devising strategies to maximize the utilization of available spectrum resources, all while ensuring that new technologies and innovations have the room to flourish.

Additionally, the study highlights the importance of harmonization across member states. Inconsistencies in spectrum allocation and regulation among member states



can hinder the development of a unified and seamless European telecommunications market. Therefore, the regulatory framework aims to encourage alignment and coordination among member states, promoting a harmonious environment that facilitates cross-border telecommunications services and market integration.

An interesting approach to the method of allocating and assigning frequencies at the EU level was proposed by the German Monopoly Commission. This proposal should be considered as an important and logical step towards developing EU-wide solutions on how to allocate and assign frequencies at EU level.

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