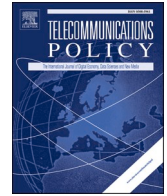




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Regulatory challenges and implications of the European electronic communications code (EECC) for local mobile communication network business

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ABSTRACT

Regulatory provisions pose legal constraints on deploying mobile communication networks and related services. Local 5G and upcoming 6G networks, particularly those that are independent of the big mobile network operators (MNOs), face new challenges due to the incoherent harmonization and implementation of the regulatory provisions and the standby approach undertaken by many EU member countries. This paper analyses the European Electronic Communications Code (EECC) Directive from the perspective of local mobile communication networks by combining business model innovation and legitimacy approaches in an ecosystemic context. Based on the analysis, we recommend regulators focus on terminology, spectrum management, access and interconnection, security and privacy, and competition when enabling local mobile communications business.

1. Introduction

The European telecommunications sector has been radically transformed from a group of state monopolies to increasingly competitive national markets (Robles-Carrillo, 2021). This transformation has been accomplished within a flexible regulation regime, which combines significant deregulatory momentum with detailed implementation by national regulatory authorities. Regulators play a central role in defining and enforcing the rules and conditions for mobile communications. However, the speed of emergence of new mobile communications technologies and services poses significant challenges for regulators, who need to anticipate and manage the consequences of the technological transformation in the field.

The fifth generation of mobile communications (5G) and the upcoming (6G) mobile communication technologies are expected to provide opportunities to improve economic efficiency and the quality of life. These opportunities, however, may come with consequences that trigger new regulatory dilemmas and legitimacy challenges related to the acceptance and deployment of new technologies. 5G technology has been referred to as a change for the mobile communications ecosystem regarding the emergence of local

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networks provisioned and deployed by different ecosystem stakeholders than historically (Ahokangas et al., 2020; Matinmikko et al., 2018). In addition, these new stakeholders may run different business models when providing their services (Yrjölä, Ahokangas, Arslan, et al., 2021). Local and often private 5G networks with new ecosystem constellations and business models have emerged, e.g., for factories and ports, where the role of traditional mobile network operators (MNOs) has been challenged (Matinmikko-Blue et al., 2021). MNOs with countrywide offerings are just one of the possible stakeholders offering local 5G network services. From the technology perspective, 5G has functionalities that makes it suitable for private mobile communication networks, which are common for closed user groups within enterprise and industrial environments. As an evolution of 5G, the upcoming 6G provides advanced network architectures that support dedicated sub-networks and resources, which can be offered as a service that enables flexible and tailored capabilities required for different industries and their various use cases (Yrjölä et al., 2021a). It is anticipated that future 6G networks will integrate traditional communication services with a variety of other services, such as sensing, imaging, and highly precise positioning (Latva-aho & Leppänen, 2019). The new 6G technology is expected to enable local trust zones for homes, communities, smart factories, healthcare, smart cities, and different kinds of other smart environments, e.g., roads for autonomous vehicles (Yrjölä et al., 2021b) for ensured privacy, security, and safety. Indeed, businesses¹ based on the *deployment and use of local 5G and future 6G networks by other organizations than large MNOs* face legitimacy challenges in terms of the policy and regulatory actions required to conduct and scale up such business activities.

In this changing technology/ecosystem/business context of local mobile communications networks, the European Electronic Communications Code Directive (EECC) (EU Directive 2018/1978, 2018) sets out the legal framework for the provision of electronic communications networks and services in the European Union (EU) and leaves room for national-level implementations. Telecommunication regulation in the EU Member States is complex and is undertaken across multiple levels including national, European, and international levels (Cave et al., 2019). However, “a shared concern necessitates a coordinated response” (Robles-Carrillo, 2021). The current landscape for telecommunication regulation is evolving at the EU level (BEREC, 2021), and independently EU Member States are implementing the provisions of the broad EECC *directive*, relying on related hard law and soft law legal provisions (Cave et al., 2019). The EECC sets the parameters around the emergent local 5G and upcoming 6G networks and as such it impacts their future legitimacy and business development opportunities in EU countries. However, when the EECC was first developed, local 5G network businesses without MNO involvement were less common. Indeed, the EU countries have applied different approaches when considering the local mobile communications networks as presented in (Matinmikko-Blue et al., 2021).

This paper considers the EECC in the context of new entrants to the mobile communications ecosystem and proposes a new approach to understanding local mobile communication network regulation for 5G and upcoming 6G. It underlines regulatory challenges in local deployments of mobile communication networks moving beyond 5G and 6G. The Body of European Regulators for Electronic Communications (BEREC) echoes stakeholders’ opinions. In its report from 2021 (BEREC, 2021), BEREC states that an increase in revenue streams for operators is expected to increase in the business-to-business segment, where local networks will play an essential role for specific verticals. Traditional MNO-driven deployment of mobile communication networks is already starting to be complemented by local deployments of 5G networks by a variety of stakeholders made possible by regulators of some EU countries (DG Plan, 2020). The same is expected to continue in the 6G era. Thus, this paper seeks to address two research questions.

- What are the regulatory challenges of the EECC regarding local 5G and the upcoming local 6G network business in Europe?
- What are the regulatory implications for the EECC concerning legitimizing and enabling the local mobile communication business in Europe?

To analyze the context of local mobile communication networks and their regulatory landscape and answer the research questions this research has been conducted using the logic of analytical induction and the epistemological assumptions of social constructionism (Easterby-Smith et al., 2021). The study has adopted a thematic analysis which constitutes one of the cornerstones of qualitative data analysis. A thematic analysis is a method of analyzing qualitative and this can be also applied to qualitative policy data. It focuses on identifying and analyzing patterns (themes) (Aleverson and Sandberg, 2020) and is a versatile, broadly applicable, and affordable instrument for exploratory research (Braun & Clarke, 2006; Terry et al., 2017). We apply four steps: 1) preparatory work and familiarization with the data, 2) identification of regulatory themes, 3) systematization of the themes for identifying regulatory challenges, and 4) development of the regulatory considerations necessary to carry out a thematic analysis with a clear, accessible, step-by-step methodology, which we adapt to the needs of policy research with a focus on the telecommunication sector.

- Step 1: Preparatory work and familiarization with the data comprising the EECC and the related literature focusing on local mobile communications.
- Step 2: Identification of regulatory themes in the EECC from the local mobile communications network perspective.
- Step 3: Systematization of the themes and identifying regulatory challenges for regulators and businesses.
- Step 4: Development of regulatory recommendations.

¹ The term business subsequently used in this paper generally refers to the *deployment and use* of local networks by other than MNOs. The business model, in turn, refers to the way *how companies create and capture value* (Amit & Zott, 2001) with the deployed and used local networks. E.g., Timmers (1998, p. 4) defines business model as “an architecture for the product, service, and information flows including a description of the various business actors and their roles, the potential benefits for the various business actors, and the sources of revenues.”

We chose a thematic approach to explore the selected data, which is consistent with the existing business model literature (e.g., related to opportunity, value, advantage, sustainability replicability scalability). We began by separating the data set of relevant regulations that concerned local mobile communication networks from the total data corpus (mobile communication networks in general). Following this, we started to code the data (Flick et al., 2006; Yin, 2010) into themes. Themes did not emerge passively; we have undertaken an active role in interpreting and reporting them. Next, by further abstraction, consistent with the legitimacy literature, we identified the sub-themes. Finally, we grouped our analytic sub-themes into two main aggregated focus points with regulatory implications. Taking a business-orientated approach towards the regulatory measures reflected in the EEC, we analyzed the relevant legal provisions that may be developed further in the national context.

The paper is set out as follows. After the introduction, Section 2 introduces local 5G network businesses; Section 3 sets out the related research and highlights business model innovation choices and consequences, in addition to the legitimacy and legitimation aspects relevant in an ecosystem context; Section 4 presents the structure of the EEC and analyses the regulatory themes identified and emphasizes the legitimacy challenges for local 5G/6G network businesses. Finally, Section 5, discusses the theoretical conclusions, presents the recommendations for regulators and businesses and underlines the limitations of the study and future research avenues.

2. The local 5G mobile communication network business

Generally, mobile communications can be approached from regulatory, technological, and business perspectives (Ahokangas et al., 2021). Regulations define the boundaries for stakeholders and their operations in terms of deciding who is allowed access to the mobile market and under which conditions, e.g. by granting spectrum licenses and defining rules for competition and collaboration and reflecting standardization (Ahokangas et al., 2021). The future growth of 5G technology and markets is unknown; thus, legislation must be designed with limited knowledge and under unclear conditions. Such circumstances necessitate policy adaptation (Bauer & Bohlin, 2022; Bauer, 2022). The technology domain includes the scope of innovation, maturity of technology, stage of standardization, and scale of use (Matinmikko et al., 2017, 2018). The business perspective, which is often characterized by business models, is influenced by regulatory and technological developments related to business antecedents and outcomes and represents the logic and relationships of the players participating in value creation and capture.

The traditional mobile communications stakeholder roles are transforming, and new roles are emerging (Ahokangas et al., 2019). Location-based and context-driven requirements for wireless connectivity in various verticals, such as factories, have also attracted business interest (Ahokangas et al., 2019). 5G mobile networks are undergoing technological transformation and this enables a variety of new ‘as-a-service’ business models (Ahokangas et al., 2021; Cave, 2018; Morgado et al., 2018). Other stakeholders beyond MNOs in the mobile business ecosystem can also offer this as-a-service model.

Local mobile communication networks are best placed to meet the specialized requirements of certain vertical industries and can offer these as-a-service models better than MNOs such as manufacturing and logistics (Guirao, Wilzeck, Schmidt, Septinus, & Thein, 2017). Examples include ports, factories, and mines, where the area is typically under the jurisdiction of a single organization, but where multiple organizations can operate and benefit from shared infrastructure and locally tailored services to enhance their operations in the area. In such jurisdictions, 5G local mobile networks have started to be deployed.

Several generic business models can be identified for emergent local 5G operators enabled by technological development. There are, however, different business cases for the deployment of emergent 5G networks. For example, in specific high-demand locations, a neutral host (Lehtilä et al., 2023) provides connectivity services to the customers of traditional MNOs in specific sites rather than all MNOs deploying their indoor networks independently (Ahokangas et al., 2017). Another example is the provision of premium or personalized content, such as VR/AR services, or relevant context-specific or locally generated data or information, or when the localization of services may be required.

For heterogeneous localized environments, the local “micro-operator concept” shows the potential to accelerate the deployment of 5G technology while also taking local businesses and ecosystems into new areas (Ahokangas et al., 2016; Kibria et al., 2017; Matinmikko et al., 2017, 2018, 2019). The local micro-operator concept is “an entity that combines connectivity with specific content services in spatially confined domains, being dependent on the availability of spectrum resources” (Ahokangas et al., 2020; Ahokangas et al., 2016; Matinmikko et al., 2017). 5G business models typically focus on a traditional mobile network operator (MNO) (Noll & Chowdhury, 2011; Rasheed et al., 2015; Zhang et al., 2015). Matinmikko et al. (2017, 2018) envisage four key business opportunities for locally confined micro-operators, such as: “a) offering hosted local connectivity to all MNOs in specific locations, b) providing secure local networks for vertical-specific needs, c) providing locally tailored services, and d) acting as a Mydata operator for various customers by increasing consideration of the context- and location-dependent wireless connectivity requirements of various facilities”.

National regulators’ decisions about spectrum assignment and allocation have an impact on emerging local deployment and new operating models, affecting the economic potential of many organizations. The emergence of novel deployment models that require spectrum availability in a specific location are deployed by various stakeholders and create new challenges for the traditional spectrum management environment. Current spectrum management awarding mechanisms are designed for wide-area MNO networks and do not properly address the emerging local 5G/6G networks (Gisca et al., 2023). To avoid hampering the deployment of local 5G and upcoming 6G networks, regulators have started to look into the potential changes needed to introduce local mobile communication networks by different stakeholders via spectrum assignment decisions. The study by Matinmikko-Blue et al. (2019) showed that MNO market dominance has continued in many countries with the early 5G spectrum decisions, but a subset of countries has allowed market entry for new local 5G networks by introducing local spectrum licensing (Matinmikko et al., 2018). The study by (Matinmikko-Blue et al., 2023) underlines that national regulators are concerned about this and how to establish long-term compromises in spectrum management decisions that balance fostering efficient spectrum usage, fairness, competition, and innovation in the new market

environment of emerging local 5G/6G networks. For example, [Alén-Savikko et al. \(2020\)](#) discuss the network and spectrum regulation and the ongoing legislative reform for implementing EU provisions (EECC) in order to respond to the need to lighten the licensing process in Finland.

A recent study on the global deployment of private mobile communication networks that combine 4G and 5G technology by the [Global Mobile Suppliers Association \(GSA\)](#), provided some high-level figures on the number of deployments worldwide (Study on “[European 5G Observatory phase III](#)”, 2022). According to the GSA report from February 2023, in the fourth quarter of 2022, the number of subscribers deploying private mobile networks reached 1077. This represents a 122-point improvement over the third-quarter total of 955 customers (GSA Report on private mobile networks, February 2023). The deployment of local 5G networks in different EU countries was triggered by the regulatory approach undertaken by the NRAs in relation to spectrum assignment policy by making spectrum available through local licensing ([Matinmikko-Blue et al., 2021](#)).

There are two opposing scenarios for deploying 5G in Europe and a corresponding regulatory dispute ([Lemstra, 2018](#)). The dominance of MNOs persists in the first evolutionary scenario, which is expected to change under the present EECC. The second evolutionary scenario is the need for additional policy and regulatory measures to enable specific industry vertical sectors to be supplied with customized feature sets by new virtual MNOs. Monitoring the experience of regulatory developments at the national and international levels should help to foster global learning, as well as increase the effectiveness of the policy framework itself. However, several critical regulatory factors need to be taken into account to support the development and legitimacy of 5G networks ([Matinmikko et al., 2018](#)). A framework comprised of the interrelated areas of business, technology, and regulation is necessary to understand and strategize the evolving mobile connectivity business ecosystem, operators’ strategic decisions, and the consequent legitimacy challenges.

3. Business models, ecosystems, and legitimacy

This section discusses related work on business, legitimacy, and legitimation in ecosystemic contexts.

3.1. Business models in ecosystemic contexts

The business model concept denotes a way to explain how the organization “does business” and creates and captures value ([Amit & Zott, 2001](#)), answering questions like what companies are offering to their customers in terms of products/services and the value proposition, as well as how and where they are planning to do so in practice, and why and how they think they can do it profitably ([Ahokangas et al., 2019](#)). The business model has become the contemporary paradigm for innovating and communicating about business and researching firms’ behavior in increasingly dynamic business environments. Technology development and business model innovation (BMI) can be considered interrelated. BMI can serve both as a sense-making tool and a legitimizing process for new technology in a given regulatory context ([Ahokangas, Aagaard et al., 2023](#); [Ahokangas et al., 2023](#)). However, given the fast-changing contemporary business environment, business models are only sustainable in the long term with substantial efforts in innovation—yet still, they can quickly be rendered uncompetitive ([McGrath, 2010](#)).

Business ecosystems, in turn, can be seen as communities of independent, yet hierarchically independent heterogeneous participants, each with specialized business models, who collectively generate the ecosystem value proposition that emerges through collective action of the stakeholders ([Adner, 2017](#); [Timmers, 1998](#)). [Ahokangas, Aagaard, et al. \(2023\)](#) argue for a business model approach that includes managerial choices related to business opportunities, value creation and capture in business transactions, and competitive advantages as antecedents. In turn, scalability, replicability, and sustainability are the expected outputs of any business model. A fundamental element of BMI and technology-related research is the concept of change and development at the technological, business model, or ecosystem levels of analysis. Decisions to start providing local mobile communication services are fundamentally business decisions made under the prevailing regulatory conditions and based on the available enabling technologies in the business innovation ecosystem ([Ahokangas, Aagaard, et al., 2023](#)). Thus, deploying a business model that embeds new technology might be considered a way to evaluate the viability of new concepts, provided that regulations permit or encourage it. It is frequently referred to as evolution ([Palmié et al., 2022](#)) as well as transformation ([Burström et al., 2021](#)), dissemination ([Cho, DeStefano, Kim, Kim, & Paik, 2023](#)) and technical transition ([Tongur & Engwall, 2014](#)). The business model and ecosystem in which technology is commercialized are considered part of the embedding nature of the technology, in which business, technology, and regulation perspectives converge for innovation and transactions. From the transaction standpoint, business model innovation is a prerequisite for value appropriation ([Amit & Zott, 2012](#)). Business model innovation, which is regarded as a process or a result, is to some extent a solution for decision-makers to create new value and build competitive advantages, especially in times of change ([Amit & Zott, 2015](#)). A business model innovation’s viability and resilience also depend on its adherence to regional regulatory, industry, and cultural standards ([Amit & Zott, 2015](#); [Snihur & Zott, 2013](#)).

3.2. Legitimacy and legitimation in an ecosystemic context

Legitimacy, as defined by [Suchman \(1995\)](#), is the “generalized perception or assumption that the actions of an entity are desirable, proper or appropriate within some socially constructed systems of norms, values, beliefs and definitions.” Different types of legitimacy are described in the literature ([Tang, 2017](#)). [Suddaby et al. \(2017\)](#) posit three distinct streams of legitimacy research, including property, process, and perception, where legitimacy can respectively be owned, constructed, or perceived, capturing the breadth of scholarly work undertaken on legitimacy. [Suchman’s \(1995\)](#) defined the three-dimensional framework that distinguishes the types of

legitimacy as follows.

- Pragmatic legitimacy
- Moral legitimacy
- Cognitive legitimacy.

Pragmatic legitimacy refers to the self-interested calculations of an organization's immediate audience (Suchman, 1995, p. 578). Legitimacy is pragmatic and relative to the interests of individuals within an organization's audience. Moreover, pragmatic legitimacy is considered to extend to a type of "exchange legitimacy," which provides the organization with both instrumental and practical value. To successfully legitimize a new venture in an emerging industry, managers must alter and/or create a new structural meaning of norms, practices, and values (Turcan & Fraser, 2016). The local 5G mobile communication network business, particularly a non-MNO-operated local 5G network, can generate tangible benefits for an organization, including cost savings, improved reputation, increased profits, and an opportunity to capitalize on new markets.

Moral legitimacy is a normative evaluation of the stakeholders' assessment of "whether the activity is the right thing to do" (Suchman, 1995, p. 574). Such judgments typically reflect explicit individual beliefs, determining whether or not an activity is pro-social (Suchman, 1995, p. 579). Moral legitimacy is another form of legitimacy and can be contextualized in a company that encourages sustainability and is perceived as having moral values based on the normative values of the observers (Reuber & Morgan-Thomas, 2019). It concentrates on the ethical foundations of an organization or activity (Melé & Armengou, 2016) and the reciprocal responsibility norms generated between an organization and its stakeholders (Elms & Phillips, 2009).

Finally, cognitive legitimacy is founded in the culturally embodied reality or shared cultural-cognitive schemas that are so deeply assimilated and widespread that the question of refusing to submit to or transgressing it does not even arise. Here, persuasion plays a role in the cognitive legitimacy relative to new forms of a service or product, in this context this refers to the deployment of 5G or upcoming 6G networks (Nagy et al., 2012).

Scott (2008, pp. 427–428) argues that "legitimation is conditioned and reflects a perceived consistency with relevant rules and laws, normative support and alignment with cultural cognitive frameworks, which are shown in a way that is visible to the outside." Legitimacy is also viewed as the social acceptance of activities and actors (Suchman, 1995; Tost, 2011). Several technological development initiatives, such as the deployment of local 5G and upcoming 6G networks, can be facilitated by establishing legitimacy through institutional alignment in domestic and international settings. In the context of local 5G networks, deployments require widespread approval by regulators to obtain industry-level legitimacy and achieve the scalability of solutions (Ahokangas et al., 2021). Insufficient industrial legitimacy can lead to an industrial crisis due to an insufficient search for new business opportunities outside domestic markets (Kwak & Yoon, 2020). The search direction can encourage the development of knowledge in local 5G and upcoming 6G network businesses in line with the establishment of societal expectations, visions, and beliefs regarding the expansion of an industry (Bergek et al., 2008; Park, 2014; Yap & Truffer, 2019).

Inclusiveness, expertise-based effectiveness, and procedural fairness are also important criteria for the legitimacy of the multi-stakeholder ecosystem (Fransen, 2012). Organizations need to build legitimacy across organizational, industry, and societal levels when a new or differentiated product enters the market (Suddaby et al., 2017). Thus, as the 5G and upcoming 6G network-based business ecosystem is emerging, it is crucial to gain and maintain legitimacy because of the challenges associated with the "liability of newness" in the ecosystem (Freeman & Hannan, 1989; Freeman et al., 1983; Singh et al., 1986; Stinchcombe, 1965). In this context, the liability of newness arises when there is a lack of knowledge and proof regarding the feasibility of the developing ecosystem, which centers on the value proposition of the ecosystem (Aldrich & Fiol, 1994; Autio & Thomas, 2018; Thomas & Ritala, 2022).

External actors, such as regulators, play an important role in facilitating ecosystem emergence and contributing to the construction of broader legitimacy achieved at different levels covering the organization, industry, and society (Suddaby et al., 2017). Ecosystem members who seek to gain legitimation for a particular technology by focusing on the opportunities made possible by that technology invoke technology affordances and relationships between other stakeholders in the legitimation. Therefore, prioritizing the regulatory perspective towards the stakeholders' needs for local mobile telecommunication businesses represents an immediate priority. Legitimacy within and beyond the ecosystem will be broader and more far-reaching for those pursuing the newer elements and 5G and upcoming 6G technologies. When pursuing opportunities with high levels of technological or market newness, the regulatory architecture becomes a milestone for legitimizing their venture within an ecosystem.

Legitimacy can be viewed as a 'proxy indicator' for assessing the complex institutional dynamics that influence the embedding of a new industry in relevant structures including regulations (Bergek et al., 2008). Thus, opening local 5G and upcoming 6G networks in various verticals for actors that are independent of MNOs requires careful consideration by regulators. Moreover, appropriate business models are required as existing regulation restricts local operators' business models (Matinmikko-Blue et al., 2021). This indicates a need for an adapted regulatory framework that supports and enables local 5G and upcoming 6G networks and ensures fair competition, innovation, and the emergence of new services. Whilst some regulatory elements like spectrum bands are harmonized, regulation, however, differs between countries within Europe, creating both opportunities and challenges for the industry and the regulators.

4. Analysis of the european electronic communications code (EECC) from a local mobile communication business perspective

Next, we present the results of analyzing the EECC concerning establishing local 5G/6G networks by different stakeholders and

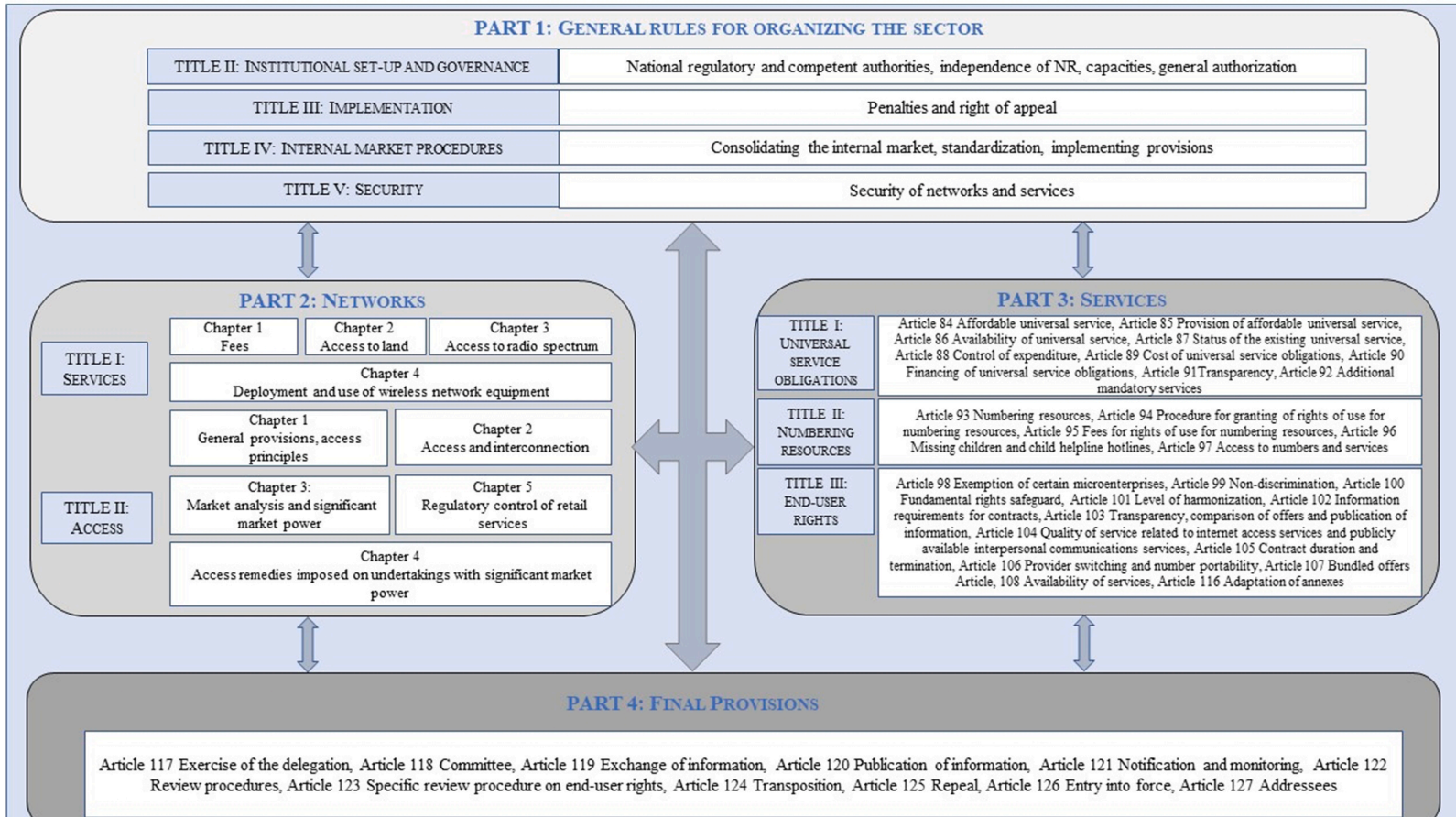


Fig. 1. Structure of the electronic communications code.

present the structure of the EECC, identifying key regulatory themes and challenges to business.

4.1. The structure of EECC

European institutions play a pivotal role in creating a single telecommunications market across Europe that is expected to spur innovation, increase competition, and give consumers more efficient services for their money (Eason et al., 1955). The need to drive responsibility “upstream” in emerging new technology processes is well recognized (Bekar et al., 2018; Hogendorn & Frischmann, 2020). Over several decades, the evolution of regulatory thinking has reflected this (Tilling, 2004), exemplified by the adoption of the European Electronic Communications Code (EECC) Directive by the European Union in 2018 (Directive (EU) 2018/1972), which is a significant milestone in the telecommunications policy of the European Union. Previous research on the EECC has focused on sustainable competition (Vogelsang & Borg, 2019), co-investment and shared infrastructure perspectives (Kawka and Kozera, 2022), net neutrality (Lasota, 2020), and environmental sustainability (Godlovitch et al., 2021; Mester, 2022), the Internet of Things, and artificial intelligence regulation (Hadzovic et al., 2023). Moreover, the EECC has been analyzed from the perspective of innovative developments in the deployment of electronic communications networks such as software-defined networks (SDN) and network functional virtualization (NFV) (Gijrath, 2021), as well as from the social perspective of the universal services relative to technological access and extensive availability; end-user rights; and maximized affordability (Ruck, 2020). As a core part of the EU digital framework, Serentschy (2018) discussed the EECC in light of a new regulatory paradigm. Papakonstantinou and De Hert (2020) also considered the EECC from the perspectives of challenges to personal data protection and GDPR (EU Regulation 201/679,2016) provision and the E-privacy Directive and underlined the big data security and privacy concerns. The academic literature lacks the presence of the structure of the EECC code or to present a comprehensive analysis from the perspective of local mobile communication networks as an emerging stakeholder and this analysis fills that gap.

The overall objective of the EECC directive is to promote connectivity and increase the take-up of high-capacity networks, including fixed, mobile, and wireless for all EU citizens and businesses (Directive (EU) 2018/1972). The EECC directive aims to keep pace with the rapid technological developments and the telecommunication sector’s convergence of product and service innovations and developments. It aims to stimulate competition and increase investment in 5G and high-capacity networks. Every citizen and business in the EU should be able to access high-quality connectivity, a high level of consumer protection, and an increased choice of innovative digital services (Robles-Carrillo, 2021). In addition to replacing and repealing existing legislation, the directive introduces a series of new objectives and tasks related to strengthened consumer rules that aim to make it easier to switch between service providers while offering better protection. Consumers will benefit from a similar level of protection across the EU (Directive (EU) 2018/1972).

The EECC (Directive (EU) 2018/1972) is an ambitious piece of telecommunications regulation. Part 1 establishes the general rules for the organization for the sector, Part 2 is dedicated to networks, Part 3 covers services, and Part 4 comes with the final provisions related to the implementation of the Code (Directive (EU) 2018/1972). We have elaborated Fig. 1 as a visual representation of the structure of the EECC and present the areas of critical concern for future local mobile communication networks.

In Part 1, Title I clarifies the scope, aim, and objectives and is divided into two chapters highlighting the radio spectrum’s strategic scope. Title II sets the provisions for national regulatory and competent authorities and general authorization of electronic communications networks and services. It establishes the minimum rights derived from general authorization and consequences such as restrictions or withdrawal of rights, cross-border dispute resolutions, transparency, and radio spectrum coordination between the Member States. Title III refers to the implementation and underlines the penalties and rights of appeal. Title IV establishes internal market procedures and provides measures for consolidation of the internal market, standardization, implementation procedures, consistent radio spectrum assignment, and harmonized assignment of the radio spectrum. Finally, Title V includes norms on the security of networks and services and their implementation and enforcement.

Part 2 of the EECC introduces the provisions on networks with two Titles. Title I, “Market Entry and Deployment”, sets the requirements for: the fees for rights of use of the radio spectrum and rights to install facilities; access to land; the particularities on rights of way, co-location, and sharing of network elements and associated facilities; access to the radio spectrum; authorization and management of the radio spectrum; authorization of the use of the radio spectrum including that being shared under the general authorization; conditions attached to individual rights of use for the radio spectrum; the rights of use and the provisions on the granting of individual rights and their duration; the process of renewal and transfer of leases; and the competition provisions. A particularity of the title is the provision on coordinating the time of assignment of the radio spectrum and a separate provision on the coordination of timing for the assignment of specific 5G bands. The last chapter of Title I is dedicated to deploying and using wireless network equipment by underlining the specific provisions on access to local radio areas, deployment and operations of small/areas wireless access points, and technical regulations concerning electromagnetic fields. Title I comprehensively elaborates on access provisions and principles and establishes the general framework for access and interconnections at the state level, rights and obligations of undertakings, powers and responsibilities of the national regulatory authorities regarding access and interconnections, and what the coordination mechanism of the access and other facilities should be. Title II introduces the concept of market analysis and market power, the procedure for identification and definition of markets, the procedure for identification of transnational markets, market analysis procedure, access remedies imposed on undertakings with significant market power, price control, and costing account obligations, and what should be considered the termination rates. Furthermore, under Part II, we have the regulatory treatment of the new very high capacities network elements and their functional separation, voluntary separation under the vertical integrated undertakings commitment procedures and their conditions for access, co-investment applicable to their network, wholesale, and migration from legacy infrastructure, and the control of retail services from the regulatory point of view.

Part 3 introduces the provisions related to services, universal service obligations, availability of universal services, status, control of

expenditure, cost, financing, and transparency concerning the cost of universal service obligations. Part 3 provides the numbering resources and the procedure for granting rights of use for numbering resources, fees, access to numbers, and services. Title III foresees the end-user rights provisions; exemptions for certain microenterprises; non-discrimination provisions; fundamental rights and safeguards applicable to end-users; information requirements for contracts; contract durations and terminations; provider switching, number portability; bundled offers; and the availability of services. Part 4 provides the final provisions of the directive regarding the exercise of delegation, how the committee should be assigned, the process of information exchange, publication of the information notification, monitoring of the implementation, review procedures, and particularities of the review of end-user rights, transposition, repeal and entering into force of the EECC directive for EU member states.

4.2. Identified regulatory themes and challenges

Next, we identify key regulatory themes and their challenges. The considerations of the directive and relevant provisions of the EECC were analyzed, revealing critical aspects regarding local 5G/6G network deployment in the future. The theoretical lenses used to view the EECC Directive resonate with the need to identify whether existing regulations cover the innovation potential of local mobile communication networks and what gaps exist to achieve legitimacy for local 5G and, later, for 6G networks. [Table 1](#) presents the

Table 1

Outcomes of the analysis of the EECC.

Identified regulatory themes for the EECC	Description of the regulatory themes and relevant provisions	Regulatory challenges identified for local 5G/6G network business based on regulatory themes
Terminology	Consider an adjusted uniform terminology (Part I, Title I, Chapter I, Article 2)	<ul style="list-style-type: none"> - Lack of defined and approved terms for the local network cause challenges in all parts of EECC. - The EECC does not consider private (non-public) local 5G/6G networks, which leaves ambiguity in interpreting what applies to private networks.
Spectrum management, authorization, and licensing	Spectrum authorization decisions regarding granting of access rights to use frequency bands and rights and obligations under licensing models. The effective management of the radio spectrum for electronic communications networks and services (Part II, Title I, Chapter III, Section 1, Article 45, Section 2, article 48–51)	<ul style="list-style-type: none"> - Lack of defined and approved terms for the local network poses challenges ensuring objective, transparent, pro-competitive, non-discriminatory, and proportionate criteria for spectrum assignment. - Current spectrum awarding mechanisms are designed for wide-area mobile network operator networks. - In new spectrum awarding mechanisms, including valuation and pricing, there is no provision referring to clear tools and implementation mechanisms. - In the absence of a clear definition of the rights and obligations of local 5G/6G networks, challenges appear in ensuring the promotion of the shared use of radio spectrum between similar or different users of radio spectrum under competition law. - The use of market mechanisms is still limited, and transactions in practice seldom occur if operators possessing the spectrum access rights do not wish to sell them in fear of increasing competition. Therefore, more research needs to consider market mechanisms in the 5G/6G era.
Access regulation and interconnections	Access to infrastructure, interconnections, and interoperability for private stakeholders (Part II, Title I, Chapter I, Article 43–44, Title II, 59–60, Chapter II 61–62)	<ul style="list-style-type: none"> - There is a need to ensure end-to-end connectivity also for local 5G/6G networks. Local access network deployment may need to connect with other operators' networks. The challenges appear in establishing an effective network connection architecture while lacking an elaborated definition for the local network. - There is a need to consider aligning the solutions for the regulatory challenges with the technical and social ones and to extend the relevant rights and obligations on undertakings for private networks. - Provide a minimum agreed standard for ensuring interoperability.
Personal security, privacy, and personal data	Safeguarding service providers' and end users' services against risks to personal security, privacy, and personal data (Part I, Title V, Article 40–41)	<ul style="list-style-type: none"> - The role of data sharing, collection, and analysis will increase in 6G services provisioning. However, there are challenges in managing and ensuring the confidentiality of data, data ownership, and exploitation confidentiality of personal data.
Competition, price control, and cost	Specific criteria for market analysis to ensure that holders of significant market power are not allowed to abuse their dominant position. (Title IV, Chapter I, art. 32–34, Chapter II, art.35, 37, Part II, Title I, Chapter I, art. 42, Chapter II, art, 43–44, Chapter II, section 1, art. 45–47, Section 2 art. 48–52, Section 3 art. 53–55)	<ul style="list-style-type: none"> - Lack of market analysis updates poses challenges to reflecting new market dynamics and structure. - Less concern with a low number of MNOs or regarding consolidation of MNOs in the presence of a highly dynamic retail market. - The EECC does not provide clear rules and monitoring measures to ensure competition for local 6G networks to serve vertical-specific needs in specific areas.

identified regulatory themes. The identification of the five regulatory themes was based on earlier research by [Bauer \(2015\)](#), [Matinmikko et al. \(2018\)](#) and [Ahokangas et al. \(2022\)](#), and the material is ordered according to the structure of the EECC and the impact of the provisions on the deployment of local electronic communication networks. We focus particularly on the relevant provisions of the EECC that cover the regulatory themes assessed. This provides a better understanding of the business perspective arising from the rights and obligations of the EECC for local electronic communication networks but also underlines and depicts the regulatory challenges.

The identified challenges based on the regulatory themes in [Table 1](#) pinpoint different opportunities, value creating factors, and advantages as choices to be made by the mobile communications ecosystem stakeholders and the ecosystem itself. Further, the EECC has scalability replicability, and sustainability implications for local mobile communications businesses. The European policy frameworks and regulations must be aligned and implemented coherently and in a timely fashion to reach the task level required to create a solid future 6G business. Having the main requirements for electronic communications comprehensively covered in the provisions of the EECC, our analysis suggests that Europe lacks the framework required to support the efficient deployment of local mobile communication networks. Europe also lacks specific requirements that will facilitate the emergence of new businesses and stakeholders with local mobile communication networks. In addition, there is lacking a clear terminology, and a comprehensive framework on spectrum management, authorization, licensing, as well as tailored provisions on access and interconnections, and adapted norms for security and privacy of personal data, as well as on competition, price control and costs. Since individual countries form small markets for communication networks and services, achieving this at the single European market level is critical. Notably, as societal needs continue to evolve, there has been a marked rise in many emerging use cases that cannot be satisfactorily covered by 5G. The lack of a proper legal definition of local 5G/6G networks and operators and the characteristics of local architectures are core primary provisions that require further elaboration and acceptance. The absence of a definition has a cascading effect on the Titles of Parts 1, 2, and 3. The effect extends to the following provisions that were identified as main regulatory themes that pose challenges for local 5G/6G businesses such as terminology, spectrum management including authorization and licensing, access regulation and interconnections, security, privacy, and personal data and competition, price control, and cost.

The analysis of the main provisions of the EECC that impact the future deployment of local 6G networks identified five themes with several essential priorities for consideration. These need to be explored, assessed, and evaluated to provide appropriate insights for policymakers. [Table 1](#) presents the main regulatory themes and highlights the regulatory challenges identified, which are described below. The following analysis focuses on the legitimization-related issues in the EECC. The analysis indicates the existence of different types of legitimacy challenges—both pragmatic, moral, and cognitive—being embedded in the EECC and its implementation.

First, the need for defined and approved terms for the local network creates legitimacy challenges in all parts of the EECC. The terminology used within the EECC provisions is not uniform and is adjusted to the characteristics of local 5G/6G networks. The EECC does not consider private (non-public) local 5G/6G networks, which leaves ambiguity when interpreting what applies to private networks. 5G and 6G network characteristics are expressed in a variety of terminology that needs to be aligned with the relevant EECC provisions better to enable the implementation of local mobile communication networks. A future vision and technology trend for elaborating a global definition for 6G mobile communication needs currently under consideration by the ITU-R should coherently reflect the 5G/6G local network terminology.

Second, the lack of objective, transparent, pro-competitive, non-discriminatory, and proportionate criteria for spectrum assignment for local networks creates challenges. The current spectrum awarding mechanisms are designed for wide-area MNO networks. No provisions refer to clear tools and implementation mechanisms in new spectrum awarding mechanisms, including valuation and pricing. In the absence of a clear definition of the rights and obligations of local 6G networks, it is challenging to ensure the promotion of the shared use of radio spectrum between similar or different uses of radio spectrum under competition law. The use of market mechanisms is still limited. In practice, transactions seldom occur if operators with spectrum access rights do not wish to sell them for fear of increased competition. Spectrum management, including related authorization and assignment of spectrum access rights are all challenges to local 6G network businesses since their deployment entirely depends on local spectrum availability. MNOs can deploy local 5G networks using their current spectrum usage rights, but for other stakeholders, the timely availability of affordable spectrum locally is a key regulatory challenge. Spectrum awarding decisions are a national matter, which causes challenges when treating the topic at the EU level. Therefore, regulation needs to consider efficient spectrum awarding for potentially many non-MNO stakeholders to deploy local networks in the 6G era.

Third, the absence of clear, tailored provisions on access and interconnection and an effective network connection for the local network significantly impact local telecommunication network businesses. According to Part I Title V of the EECC, Member States must ensure that “providers of electronic communications and services adopt adequate technical and organizational measures to manage the risks posed to their networks and services”. There is a need to ensure end-to-end connectivity for local 6G networks; therefore, local access network deployments need to connect with other operator networks. There is also a need to consider aligning the solutions for the regulatory challenges towards the technical and social requirements and extend the relevant rights and obligations on undertakings for private networks. Furthermore, there is a need to provide a minimum agreed standard to ensure interoperability.

Fourth, there are challenges related to managing and ensuring the confidentiality of data, data ownership, and exploitation confidentiality of personal data. The EECC supports the notion of confidentiality and privacy of users by design and the integrity and availability of the network. At the same time, it urges the need for risk assessment (Articles 40 and 41) ([Directive \(EU\) 2018/1972](#)). The EECC further introduces definitions of the security of services apart from networks and a toolbox of risk mitigation measures for 5G networks that are developed in the broad provisions of the EU (NIS2) ([Directive \(EU\) 2022/2555, 2022](#)) and General Data Protection Regulation (GDPR,) ([Regulation 2016/679, 2016](#)). Both the NIS 2 ([Directive \(EU\) 2022/2555,2022](#)) and GDPR ([Regulation 2016/679, 2016](#)) require a national regulatory approach.

Local 5G/6G networks appear in complex multi-stakeholder situations, such as industrial facilities, where data ownership and use challenges are present. There is a lack of systematic studies on the methods and procedures for identifying the risk to MNOs, even though the role of data sharing, collection, and analysis will increase in 6G services provisioning. For example, the Finnish regulator, Traficom, issued guidelines for cyber security and risk management in local mobile communication networks (Traficom, 2023).

Lastly, specific criteria related to preventing businesses with a strong market position from abusing their position of influence are lacking. The question of whether new cost-based service pricing is acceptable, or other forms of asymmetric or symmetric price regulation are rational arises because of the difficulty in reflecting changing market dynamics and structural changes when market analyses need to be updated. There is less concern with the low number of MNOs or the consolidation of MNOs in a highly dynamic retail market and this requires more critical scrutiny. The EECC does not provide clear rules or measures of monitoring to ensure competition for local 6G networks to serve vertical-specific needs in specific areas. Following the assessment of the provisions of the EECC, the identified themes will increasingly play an important role in the 6G network business. Legal challenges have already commenced in 5G and will expand to 6G due to divergent approaches and levels of implementation and harmonization of the provisions of the EECC.

5. Conclusions, recommendations, implications and future research avenues

This research addresses two questions related to regulatory challenges and implications of the EECC regarding the local mobile communications business in Europe. To date, local 5G/6G communication networks have not received special attention in the EECC at the EU level, even though local mobile networks are starting to emerge within the current national arrangements designed by several countries, a prominent one being Finland. The findings that arise from the analysis of the EECC depicted in this research provide observations and implications for regulators as a contemplation of the regulatory impact on mobile communication innovation as well as for stakeholders considering deploying local 5G mobile communication networks. Next, we present the theoretical conclusions, recommendations for regulation and business, and limitations and future research avenues.

5.1. Theoretical conclusions

This research pays attention to regulatory challenges and implications of the EECC combining the business model innovation perspective (in terms of the *choices* regarding opportunities, value, and advantages and the *consequences* regarding scalability, replicability, and sustainability) with legitimacy considerations (pragmatic, moral, and cognitive) in the ecosystemic mobile communications context. Earlier research has considered the importance of regulation to business (e.g. Matinmikko et al., 2018), but has often lacked a systematic approach to how business could or should be considered for regulation. Similarly, the role of legitimacy has not been directly considered in regulation-related research in the mobile communications context. Our analysis indicates that the EECC already contains elements that can be considered from these two perspectives, shedding light on the regulatory challenges and implications for future local mobile communications business. In addition, the outcome of this research exemplifies how legitimacy and legitimation processes relate to business perspectives in the context of regulation.

For local mobile communications businesses to thrive, regulation should systematically consider both a business model perspective and legitimacy because organizations and businesses need to make choices regarding what opportunities to pursue, what sort of value to create, and which advantages to develop. Likewise, they cannot avoid the question of how to make their business scalable, replicable, and sustainable. A business model can act as a tool for creating and ensuring practical legitimacy in business while also aligning with the requirements of cognitive legitimacy stemming from the business environment/ecosystem. The regulatory approach, also within the EECC, does not directly consider any kind of business model approach, but it can be understood as giving the grounds for moral legitimacy and procedural fairness in the ecosystem via the regulation. This kind of approach creates a “white area” where regulation and business are not fully reconciled. This may further hinder the development of future businesses.

Combining legitimation and business approaches enables prioritizing a regulatory perspective with respect to the stakeholders’ needs for local mobile communications business. The regulatory architecture may become a milestone for legitimizing businesses within their immediate business ecosystem when exploring prospects with high degrees of technology or market novelty. This research offers a complementary framework to conventional explanations of regulatory approaches and suggests theoretical avenues for future research on contending theories.

5.2. Recommendations for regulation and business

A review of the current state of the European telecommunication framework in the EECC (Directive (EU) 2018/19,729) indicates a need to ensure and further promote European values through regulation. As the cross-cutting impact of digital innovation in the telecommunication sector has removed old sector boundaries, the adopted EECC has brought about new regulation-related legitimacy challenges for future local mobile communication network businesses. The essential elements refer to the legal developments, amendments or new regulatory provisions related to the EECC, and converging the regulatory approach towards raising efficiency by ensuring sustainable competition, security, personal data confidentiality, and proper management of the spectrum. The EECC needs to be updated via amendments or new legal instruments that will cover the loopholes and will adjust the regulatory provisions toward the identified challenges to enable the deployment of local 5G/6G network businesses.

First, regulatory measures need to consider adjusting non-uniform terminology that is not adapted for local 5G and 6G networks’ characteristics and needs to be aligned with the relevant EECC provisions better to enable the implementation of local mobile

communication networks. Second, the provisions of the EECC covering spectrum management, authorization, and licensing also need to consider the characteristics of local networks that different stakeholders deploy. As an implication, new spectrum awarding mechanisms in 5G and 6G are needed, covering both valuation and pricing. Third, the access regulation and interconnection provisions of the EECC need to be expanded to ensure that the provisions apply to uniform adopted terminology that extends to local networks. Moreover, an effective network connection architecture needs to be established building on the elaborated definition of the local networks. Fourth, the security, privacy, and personal data provisions of the EECC must be developed to manage and ensure the confidentiality of data, including confidential company data, data ownership, and exploitation of confidential personal data. Clear provisions must be elaborated, which will impose detailed rights and obligations on the local 6G network and service providers regarding every aspect of their operations, from the network architecture to remediation and recovery. The multi-stakeholder ecosystem of local 6G networks needs clear regulation. Fifth, competition, price control, and cost provisions need to be developed to provide clear rules alongside monitoring measures for ensuring competition for local 6G networks to serve vertical-specific needs in specific locations. Competition provisions have limited effectiveness against structural market issues, including those that involve the mere existence of a monopoly or oligopoly, exploitative behavior, or issues that require ongoing implementation or monitoring.

Continuing to observe and track 5G and upcoming 6G advancements can strengthen our understanding of the complex connections between public and private governance regarding local mobile communication networks. The decision of the deployment is left to the national level, where approaches taken by countries vary significantly. Suggestions for regulatory improvements were presented to better promote European competitiveness in implementing the EECC. The future consideration of the proposed themes for development will spur the legitimacy of local 5G and 6G networks. With clear regulations on terminology, spectrum management, access, interconnection, security, privacy, and competition the local 5G and 6G networks deployed by different types of stakeholders can become accepted and legitimate in the mobile ecosystem in the near future.

Reframing regulation is a helpful instrument for the responsible creation and application of new technology and business models and it can be made easier by considering the identified priority areas for regulatory interventions. Fig. 2 presents the two priority areas for regulatory and managerial actions, which are depicted from our analysis and are brought forward in support of future regulatory implications that should be developed further to ensure the flow of the adopted legislative provisions. Primarily, we observe a need to

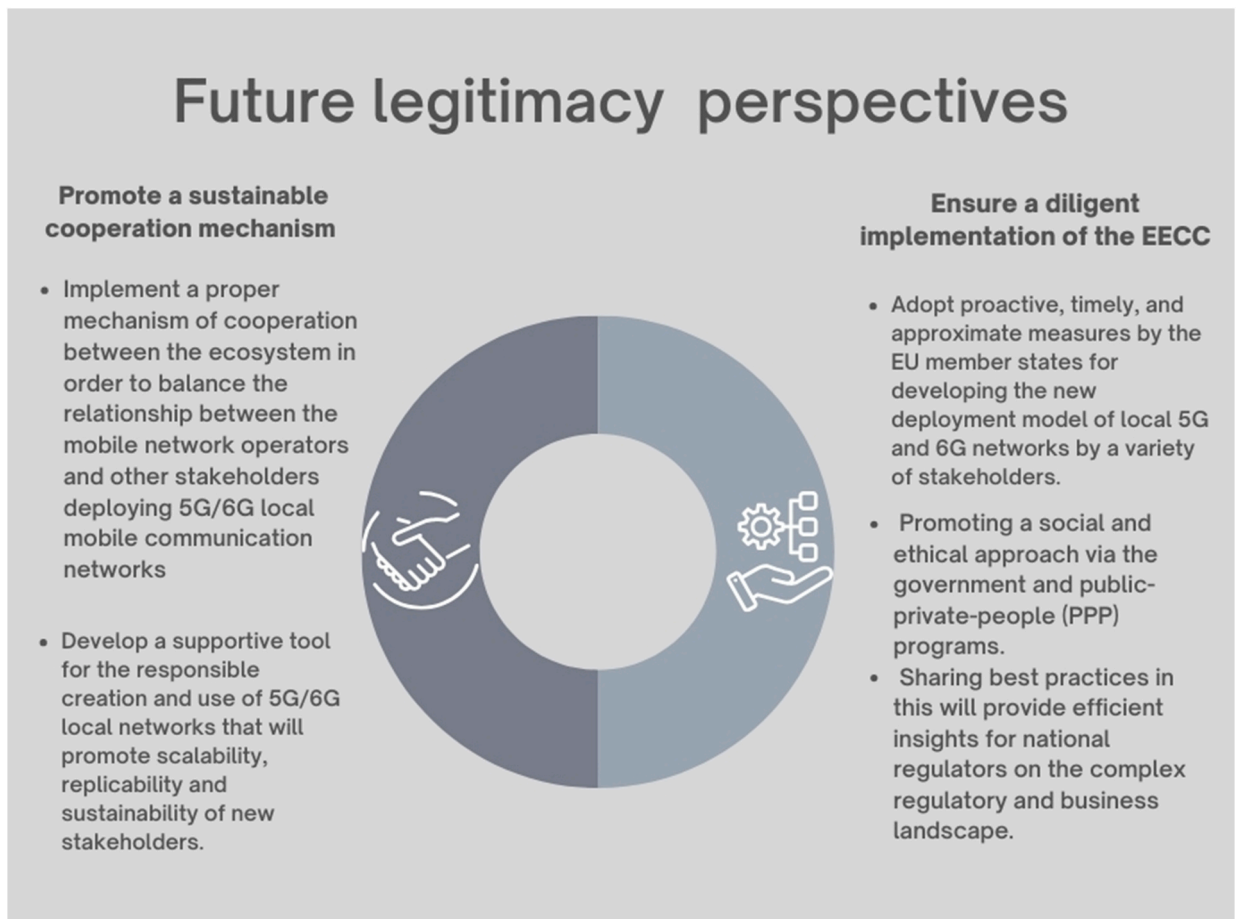


Fig. 2. Future legitimacy perspectives.

reframe regulation as a supportive tool for the responsible development and use of new technologies and business models for sustainability. The adopted regulation may assist policymakers in expanding the legal provisions at the European and national levels and better support innovation as it emerges. The need for a cooperation mechanism to balance the relationship between the mobile network operators and other stakeholders deploying local mobile communication networks will be achieved by giving due priority to the legal approximation required.

For stakeholders, it emphasizes the next stages for joint actions, such as ecosystem efforts for a proper implementation mechanism of cooperation. It also emphasizes the development of an effective and supportive instrument for the creation and use of local 5G and 6G mobile communication networks. Additionally, it emphasizes the ecosystem impact on the adoption of adequate and approximate measures by EU regulatory authorities for developing new deployment models for local 5G and 6G mobile communication networks. It also emphasizes the ecosystem impact on the adoption of adequate and approximate measures by EU regulatory authorities for developing the new deployment models for local 5G and 6G mobile communication networks.

In our discussion of the EECC and its impact on the legitimacy of local 6G networks, we argue that national regulatory agencies (NRAs) should consider the nature of regulation and which aspects of practice are subject to regulatory enforcement. These regulations should be aligned with the context where the enforcement is sought, including the targeted stakeholders. The NRAs are suggested to abolish their “stand by attitude” and take proactive, timely, and approximate measures to be ready for the new deployment model of local 5G and 6G networks. This is needed to mitigate the risks and challenges faced by businesses in terms of policy and regulatory actions. At the EU level, policymakers should consider reframing existing regulatory provisions to widen the possibilities for the deployment of local 6G networks and foster their impact and role in the economy and society and ensure a fairer competitive business environment. Furthermore, regulators might consider initiating measures to prioritize resources for regulation alignment and implementation to reach the legal approximation required to create the future 6G business. Moreover, there is a demand to reduce the risk of internal market fragmentation and, thus, the foundations of European integration.

5.3. Limitations of the study and future research avenues

As with any other research, this study has limitations. Firstly, this research focuses on challenges for local 5G and 6G mobile communication networks and predominantly analyzes those within the recently adopted EECC. Therefore, there may be regulatory-specific legal provisions influencing the results. As the EECC is the primary telecommunication policy adopted, the outcomes of the analysis could potentially improve the focus and streamline the ecosystem efforts to the identified challenges that are not solved solely by the new framework, thereby reducing the impact on new stakeholders who aim to deploy local mobile communication networks.

The study presents an analysis of the regulation recently adopted from the local mobile communication perspective and identifies regulations that require the elaboration of comprehensive guidelines, sharing of best practices, and implementation instructions on the innovation efficiency and effectiveness for the deployment of local mobile communication networks. Despite an unregulated approach in some EU member states and the lack of a harmonized framework on local 5G and 6G mobile communication networks in EU, the attention of the regulatory measures should be directed towards support and guidance when the spectrum is made available and local mobile communication networks are deployed. The deployment of local 5G and 6G networks in vertical-specific industries entails further development. Following the United Nation’s focus which calls on states to build resilient infrastructure, promote inclusive and sustainable industrialization, and foster innovation, more effort should be dedicated to active observations and participation in driving innovation within the telecommunication projects in different sectors (Ojutkangas et al., 2022).

More research is needed to understand how the regulatory dynamics and multiple upcoming changes within the telecommunication landscape connected to the introduction of the EECC impact the 5G and 6G local mobile communication networks deployment in the European market.

Secondly, this research focusing on ecosystem legitimacy and business models provides avenues for further development in the literature. The application of legitimacy theory in telecommunication entails more research attention, notably considering the contemporary digital landscape’s emphasis on the co-creation of various services, emerging technologies, and diverse regulatory approaches. This work offers a prospective research agenda for the study of business models and ecosystem legitimacy and applications to emerging market contexts. Future studies should be complemented by an analysis of the characteristics of soft law and hard law provisions and their interplay and have a look beyond the existing boundaries for boosting the regulatory environment and ensuring the legitimacy of emerging 5G and 6G businesses.

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