

# 5G for the Future of Telecommunications: How Innovation Platforms Redefine the Mobile Network Operators' Role

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**Keywords:** Mobile Network Operators (MNOs), Innovation Platform, 5G, Platform Governance, Digital Transformation, Business Model.

**Abstract:** The paper addresses the transition process that Mobile Network Operators (MNOs) can undertake after the advent of 5G technology and the unique opportunities it introduces. It focuses on how seeing 5G as an innovation platform can support the strategic repositioning of these actors, enabling them to regain influence in the market, especially in the enterprise market. Therefore, an exploratory study of 8 cases was conducted, including different players of the 5G Italian telecommunication industry. Results show that industrial 5G has many common points with innovation platforms, being a promising technology that enables additional services and applications on top of it. The associations between 5G and innovation platforms offers a new perspective on the challenges and the ongoing dynamics for MNOs, highlighting the platform consolidation complexity and outlining potential future scenarios. The MNO is identified as a potential candidate to orchestrate the ecosystem, although this remains a prospective view. Finally, a framework is presented to picture the 5G landscape, offering strategic insights to maximize MNOs' competitive advantage.

## 1 INTRODUCTION

Mobile Network Operators (MNO)'s situation is not the most prosperous due to the economic difficulties afflicting the whole industry. Moreover, several emerging technologies are rising and evolving very rapidly. Among these, 5G is particularly interesting, given its enormous potential with respect to the previous connectivity generations (Gooderham et al., 2022). 5G innovative characteristics make it more than a simple internet access, but rather a perfect foundation for building application services, especially for the enterprise sector. The 5G new opportunities are a crucial occasion for MNOs to regain power in the mobile telecommunication market, after the decline that has led them to become mere commodity providers (Cave, 2018). The Italian scenario presents a peculiar legislation, for which MNOs are the only ones able to acquire the licences to access the spectrum. This introduces another specific factor to be included in the premises on the analysis. The 5G technology has been sometimes defined as an enabling innovation platform, (Ahokangas et al., 2021) however, existing literature about platforms is still fragmented, both in terms of

definition from a managerial perspective and about the strategic challenges they may introduce. So, it could be interesting to delve the platform literature to see if this analogy could be exploited by MNOs

Hence, the paper aims at answering the following research question: "How can MNOs resume a relevant role in the mobile telecommunication ecosystem through the usage of 5G intended as an innovation platform?", combining the investigation about the MNOs transition process with innovation platforms and the definition of roles within them.

The study explores the topics through an exploratory multiple-case study with the main players of the 5G Italian industry (Eisenhardt, 1989). Data were analysed adopting the Gioia methodology (Gioia, 2013). The main findings show the 5G technology enabling nature, considering how its features are suitable for the Industry 4.0 revolution. This potential is challenged by the high infrastructural costs, the development delays and by the market unreadiness. MNOs focus is shifting from the commodity provider position, placing attention on service creation and on the ecosystem orchestration. Customization and collaboration with partners are key factors for marketing positioning, while lack in

vertical skills and effective communication remain hurdles.

The study offers a fresh perspective identifying potential scenarios in the mobile telecommunication ecosystem. It highlights the MNOs evolving role as possible ecosystem orchestrators, but without drawing definitive conclusions, given the in-progress nature of the unit of analysis. Then, practical aids for MNOs are introduced. Indeed, they should aim at becoming platform orchestrators, leveraging partnerships and open innovation. Their success will also depend on strategic branding, ecosystem management and internal reorganization.

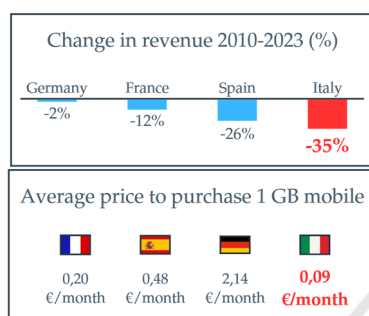


Figure 1: Change in Revenue 2010-2023.

## 2 LITERATURE REVIEW

### 2.1 The Evolution of MNOs Through Time

Three different phases can be distinguished in the mobile telecommunication industry advancement (Gooderham et al., 2022) and in the MNOs role evolution. The first phase (1990-2010), the 2G-3G era, started with MNOs as main players, that being the only ones to offer voice and SMS services, managed to become very profitable. However, by the 2000s, internal operators' competition became critical (Ghezzi et al., 2013, 2015) ending in a price war that drastically lowered margins. Also, new opportunities emerged, shifting the market focus on web, media and ICT services, introducing turbulence and shaking the industry equilibrium (Ghezzi, 2012; 2013). The second phase, or 4G era (2010-2020), encapsulates the decline of MNOs, that completely lost their competitive advantage due to their inability to adapt to external changes, not entering the multimedia content segment (Lehr et al., 2021), instead continuing to provide only connectivity. In contrast, other players such as Mobile Virtual Network Operators (MVNOs) and Over The Top (OTT) companies realized the new potential, entering

the competition (Cave, 2018) and further lowering the MNOs value (Gooderham et al., 2022).

The third phase, beginning in 2021 and called 5G era, comes with the fifth connectivity generation and its great opportunities, especially in B2B, to remodel MNOs business model and regain competitiveness, after the failure in 4G capitalization (Lehr et al., 2021).

### 2.2 Platform

Platforms businesses disrupted many industries, and five different typologies can be distinguished in the literature, namely internal platforms, or a collection of tools and resources used to create a modular framework to develop derivative products (Gawer & Cusumano, 2014); supply chain platforms, that act as tools to facilitate resource management, improving efficiency (Gawer, 2014); multi-sided platforms, interfaces that facilitate connection between different user groups affected by network externalities (Trabucchi & Buganza, 2021); innovation platforms, basis for the development of complementary products or technologies by external parties, thanks to the adoption of standards as modular building blocks that facilitate the creation of an ecosystem of developers (Gawer, 2021); and hybrid platforms, seeking synergies by integrating different aspects (Jacobides et al., 2024). Platforms generate value through network effects, that increase user appeal as participation grows, driving economies of scale and efficiency. Their technological nature further allows scalability and extendibility of businesses, maintaining centralised the value capturing (Gawer, 2021). Transaction platforms facilitate exchanges by easily connecting users (Jacobides et al., 2024), thus reducing market friction (Bonina et al., 2021). Innovation platforms incentivize third parties to innovate, triggering collaboration among different actors (Gawer & Cusumano, 2014), who are interdependent (Rietveld et al., 2019).

In innovation platforms many actors are involved in final offer creation, that is enhanced by all the complementarities added by the external developers. It is the orchestrator job to balance value capturing among actors based on the generated value proportion (Jacobides et al., 2024).

The literature recognizes various players involved in platform models with different roles. Innovation platforms see on the one hand the end users, namely the final offers beneficiaries (Gawer, 2014), and the complementors or developers on the other. These are important for the generation of a complete proposition, since they develop complementary

products/services to enhance the initial platform offering (Cennamo, 2018). Platform owners are instead central players who must govern the platform dynamics. Governing a platform implies assuming its control and engaging in strategic decisions aimed at maximizing the platform success. An orchestrator should address four main aspects: the firm scope, or the selection of elements to produce in-house (Gawer & Cusumano, 2014). The technology design, balancing openness and control of technological standards to attract innovators, while ensuring enough quality and stability (Jacobides et al., 2024). Also, the timing of opening the platform is also delicate, and should be based on the readiness of external contributors (Parker & Van Alstyne, 2018). The external relations with complementors and the set up of rules that affect developers (Singh & Kapoor, 2024). Lastly, the internal organization, the creation of specific internal processes to manage critical situations (Gawer & Cusumano, 2014). Platform success is more dependent on resource orchestration than their control (M. Van Alstyne & Parker, 2017), thus, leadership skills and attitude are fundamental for platform owners, fostering inclusion and cooperation (Parker & Van Alstyne, 2018), activating network effects to build mutually beneficial relationships and to align all participants' interests for shared value creation (Jacobides et al., 2018).

### 2.3 Research Gap

To define the most appropriate research question, the two streams of the literature have been critically analysed to highlight the gaps to be addresses. From the platform literature emerged a certain entropy in the definition of roles and responsibilities within the platform itself. Indeed, papers assumed roles as already established, neglecting the dynamics behind their affirmation (Gawer, 2021), (Bonina et al., 2021). In particular, the authority that should govern the platform is often taken for granted as central, not clarifying the reason why this centralization is necessary (Jacobides et al., 2024). Moreover, recent trends in open innovation emphasize decentralization and interoperability, making roles' boundaries even more blurred. This is the case of MNOs, where there is not yet a clear central role for managing the B2B offers. Thus, 5G lays the groundwork for regaining influence in the market, but this process will not be free of challenges (Lehr et al., 2021). In fact, MNOs do not have the necessary specific expertise to develop industrial application and to diffuse awareness about an emerging technology. The matter, hence, is understanding how those actors can successfully overcome those barriers.

The resulting research question is “How can MNOs resume a relevant role in the mobile telecommunication ecosystem through the usage of 5G intended as an innovation platform?”

## 3 METHODOLOGY

A qualitative analysis was deemed appropriate for exploring the dynamics of the study (Heath, A. W., 1997), and the exploratory case study (Yin, 1984) research method was adopted, given the limitations in formulating a priori hypotheses to be tested, and the most likely scenario in that theoretical propositions will emerge from the data collected. The study can be considered relevant both because it addresses gaps emerged from the existing literature, and since its findings can be useful for MNOs that are facing the transition and that need to be aware of their limits and opportunities. The unit of analysis is the transition process of MNOs during the 5G era, so the investigation will be dependent on it, and the study refers to the Italian context, given the legislation that allows only the MNOs to access the spectrum. Specifically, the paper will explore how innovation platform perspective, applied to 5G, can an enabling tool for MNO's repositioning process. Indeed, industrial 5G has many similarities with the elements of innovation platforms and some peculiar conditions that make it a suitable environment for addressing the gaps: the technology is still at an early validation phase, where roles and responsibilities have yet to settle, even more so considering how disparate the resources and skills needed for different industrial applications may be. After identifying the most suitable Italian MNOs to be included in the sample (MNO A, MNO B, MNO C), other actors were also included aiming at gathering more perspectives to observe the unit of analysis. In fact, one of the main difficulties for MNOs when it comes to 5G industrial applications is their poor knowledge of the specific field the services are addressed to. It is still unclear then how these applications will be constructed and established in the market. This is why other figures besides operators can add crucial insights to this investigation, for example IT system integrators (SIs). Those actors are closer to the vertical industries that could need the applications, but being IT consultants, they can work as a bridge for MNOs to approach those markets. Thus, in addition to three MNOs, the final sample also includes one MVNO (MVNO A), three SIs (SI A, SI B, SI C), and one real 5G use case (Use Case A). Data were collected through semi-structured interviews to leave enough

space to respondents for capturing a higher amount of information (Yin, 1984). The 11 interviews obtained from the 8 cases represents the primary source of evidence, since they directly address the research question. Nevertheless, the sample was expanded with 1 podcast, 11 YouTube videos, 9 news articles, 9 reports, and 5 company websites, triangulating the interviews also with secondary sources of information that increases reliability. After that, all the data were processed using the inductive Gioia methodology for coding (Gioia et al., 2013), that allowed to theoretically process information, while staying rooted to the empirical nature of data.

## 4 FINDINGS

The coding process highlighted aspects arisen from data, that have been categorized under three overarching dimensions regarding innovation platforms, barriers and opportunities for MNOs, and enabling characteristics of 5G.

### 4.1 Innovation Platform

The informants confirmed that 5G is more than simple connectivity, as it represents a “horizontal enabler with edge data centres” (MVNO A), so the fundament to “support a wide range of applications”, “innovative solutions” and “business-critical services” (MNO C), as also Use Case A corroborates. However, these promises are threatened by the delayed technology development (MNO A) (SI A), and by the market immaturity, not yet ready to embrace 5G applications (Pietro Labriola). The hardware expenditures to enable the generational transition are significant, while the capacity that MNOs will have to return these investments is still uncertain: “it is an entirely new network, and the investments that need to be made are significant” says Giovanni Miragliotta. Also, from the analysed use case, that is not placed in Italy, it emerged that 5G spectrum liberalization accelerated the development by enabling low-cost, flexible testing for private entities (Use Case A). 5G is built as a modular layered structure, based on standardized elements that provide the system with flexibility and expandability (MNO A), allowing “to respond in a multidimensional way to multidimensional service needs” (MNO C). Use Case A assert that “there will be basic components that might fit all”, providing standard pieces that optimize replicability. Indeed, its “whitebox”, open-source hardware is generic and programmable through the provision of Application

Programming Interfaces (APIs) (Tommaso Melodia). These work in an open logic, serving external development by increasing accessibility allowing a more flexible innovation process, letting third parties develop their own contribution (Francesco Sortino). The interfaces openness can also make riskier and more vulnerable the network, potentially reducing the solutions’ quality. So, MNOs usually stress their selection process to individuate the right partners basing on their credibility and trustability. To fully harness 5G advantages, the technology “requires the creation of new ecosystems of actors who will have the skills to harness its capabilities”, claims Giovanni Miragliotta and that together possess the specific skills to generate the final offer (SI B), becoming “life cycle partners” (Use Case A). Consequently, cooperation and interoperation become crucial (SI A), and relying on partnerships is fundamental to supply the most complete and innovative solutions, maximizing benefits. Anyway, collaboration face barriers, particularly in communication between different parties (SI C).

### 4.2 MNO Challenges and Opportunities

From data connectivity is perceived as a commodity, hence the 5G monetization for consumers is hard, and this segment generates low margins: “no one is willing to pay a significant price” (SI C). “The margin that the operator is able to make from the content is exactly the same regardless of its value”, comment Alessandro Colonna, referring to the commodity providers’ role assumed by MNOs after their failure of the 4G era. “The operator has fundamentally lost its positioning”, mainly following the advent of OTT and the iPhone (SI C), that exploited MNOs as pipelines to run their business using the connectivity without paying for it (MNO A). Another challenge for MNOs is the inability to communicate 5G potential to customers, who do not justify investments without tangible demonstrations. This highlights the need to implement real cases, “helping these companies understand what they can do with these platforms” (MNO C). Here, MNOs are in a “moment of great redefinition” (SI B), trying to pose themselves as coordinators between the various roles “ (MNO B), aiming at offering an “end-to-end service management”, supervising the entire value chain, “from requirements to implementation” (MNO C). With this resources orchestration, MNOs seek to become the primary reference entity in 5G projects (MNO A), providing the most comprehensive offer (MNO C). As expected, MNOs lack vertical expertise



needed to address every industrial sector (SI A), and this “cause them knowledge gaps in their understanding of use cases” (Use Case A). So, beside leaning on specialized partners, they started to organize by verticals, training and qualifying internal staff to acquire additional competencies. This restructuring confers MNOs a more consultant-like emphasis (MNO A), with pre-sales skills, that will help them in effectively communicating 5G applications value. The 5G applications development is driven by market requirement, as these solutions needs to be functional to the needs (MNO B). Hence, the “scouting” phase is crucial to get knowledge of market trends and potential positioning areas (MNO C). Moreover, searching for “external sources of ideas” (MNO C) can be decisive, as it could allow to capture innovative insights “as soon as they emerge” (Alessandro Colonna).

### 4.3 5G as an Enabling Technology

5G introduces promising features for the enterprise space, thus, the real revolution of this technology will be expressed in the B2B arena Giovanni Miragliotta. Thanks to low-latency, high reliability and capacity to connect thousands of devices (MNO B), 5G become a performant and secure network, perfect to support services that require speed, high capacity and a precise process control (MNO C). Key potential sectors for 5G business growth include manufacturing, healthcare, tourism, energy, transportation, and smart cities, where the combination of 5G with other technologies such as IoT and AI can drive Industry 4.0. Additionally, 5G efficiency consents to reduce the overall maintenance and operational expenses. Hence, it is evident that the real 5G value added is constituted by on-top application services: the technology opens new business model opportunities as answers market needs (MNO A). 5G flexibility also give a chance of personalization. This further increases value for end users, since vertical sectors addressable are different and can have divergent requirements. So, the possibility to build ad-hoc, tailored projects enhance their appeal (SI B).

## 5 DISCUSSION

### 5.1 Framework: Mobile Telecommunication Ecosystem

Given the research goals and the similarities between the findings and innovation platforms, a framework

was developed to encapsulate information on 5G and the mobile telecommunications ecosystem, reworked using innovation platform theory as a lens. In this way, the concepts have been associated to the theoretical elements characterizing the innovation platform model, producing a structure that will be the starting point for the generation of new theoretical support. The framework is articulated in six interconnected levels. The first level concern the 5G infrastructure, that constitutes the platform foundation element on that all the structure leans (Gawer & Cusumano, 2014) (Jacobides et al., 2024). The crucial modifications introduced by 5G make it more innovative, but even if it consents to improve the business and production activities of companies (Gooderham et al., 2022) (Cave, 2018), it is also more expensive in terms of hardware. The three enhancing elements of 5G are its capacity to connect a huge number of devices, the very low latency and the ultra-high reliability, that together with network slicing and edge computing functions make this network suitable for the realization of industrial applications. Moreover, 5G presents a great flexibility allowed by the modular architecture (Singh & Kapoor, 2024) implied by the adoption of standards and whitebox hardware. The block layering logic identifies and isolates the basic components as the building blocks (Cusumano et al., 2019) of the infrastructure, reducing the dependability of the system. Due to these properties, 5G stands as the basic horizontal platform from that to innovate and build complementary components. Indeed, the use of shared APIs (Bonina et al., 2021) and open-source software incentivize the development of innovative features and functionalities attracting different entities in the creation of components. So it has the positive effect given by the increment of accessibility (Gawer & Cusumano, 2014) and external collaboration, but on the other side there is the higher vulnerability of an open network. Hence, it is important for Italian MNOs to rely on trusted and selected partners, that can assure high quality final results. As shown in the second level, the architecture openness generates a fruitful environment for the creation of an ecosystem of different actors who provide the various components, and that necessarily have to interoperate and cooperate to synergistically produce the outputs. Therefore, players with different expertise enter the system, making up a chain of “complementors” partnerships dependent upon each other (Gawer, 2021). In this ecosystem, a particular entity tries to undertake an intermediary role, setting up as a single point of contact between the final client and the underlying network of players (De Silva et al., 2018).

In this scenario, this entity becomes the main reference for clients, who do not have to interface with all the complementors, but that only see a figure that act as a final collector of the parts, managing end-to-end the service. Hence, it supports the companies in all the phases of the project, relying on the competencies and contributions of third parties aiming at offering a complete service. In Italy, MNOs are trying to take this function, since an intermediary position could be suitable for them (Gooderham et al., 2022). Indeed, it is unrealistic for MNOs to develop comprehensive expertise across all domains within every industry, and the many collaborations that MNOs are generating focus on the overall improvement of the solutions they offer, so they are trying to manage a number of different actors who could add value to the end result that they would not be able to bring. Besides, posing as mediators could reduce communication barriers providing a common high-level language among all participants. Another redefinition of MNOs concerns their attempt to get closer to the final application areas, and fill their skills lacunes by developing internal specialized sections, training their salesforce and organizing it by verticals (Gooderham et al., 2022). This rearrangement would not be enough to make them independent from

partners, but it gives them a consultative setup, helping them to properly connect with the final customer and to be able to sell the service. MNOs also needs to interface with the market. Indeed, the creation of services originates from the knowledge of the needs that came out of the it. For this, another level of the framework delves into how Italian MNOs cope with the commercial environment, considering the systematic exploration and analysis of market opportunities, also called scouting, to stay competitive introducing new offerings. This activity is performed directly by the MNOs marketing departments or using external channels to effectively exchange information and experiences, facilitating the early identification and testing of emerging needs and technological solutions. The enterprise space is represented in the 5th level, articulated in vertical sectors (Li & Malerba, 2024), that could also be very specialized segments with specific needs, so their requirements collection is another crucial aspect that the reference figure must cover. The 6th and last level represent the solution for the collected needs, that is the final 5G application service. Given the uniqueness of each potential solution, and the flexibility of 5G, the personalization level for the application is potentially high.

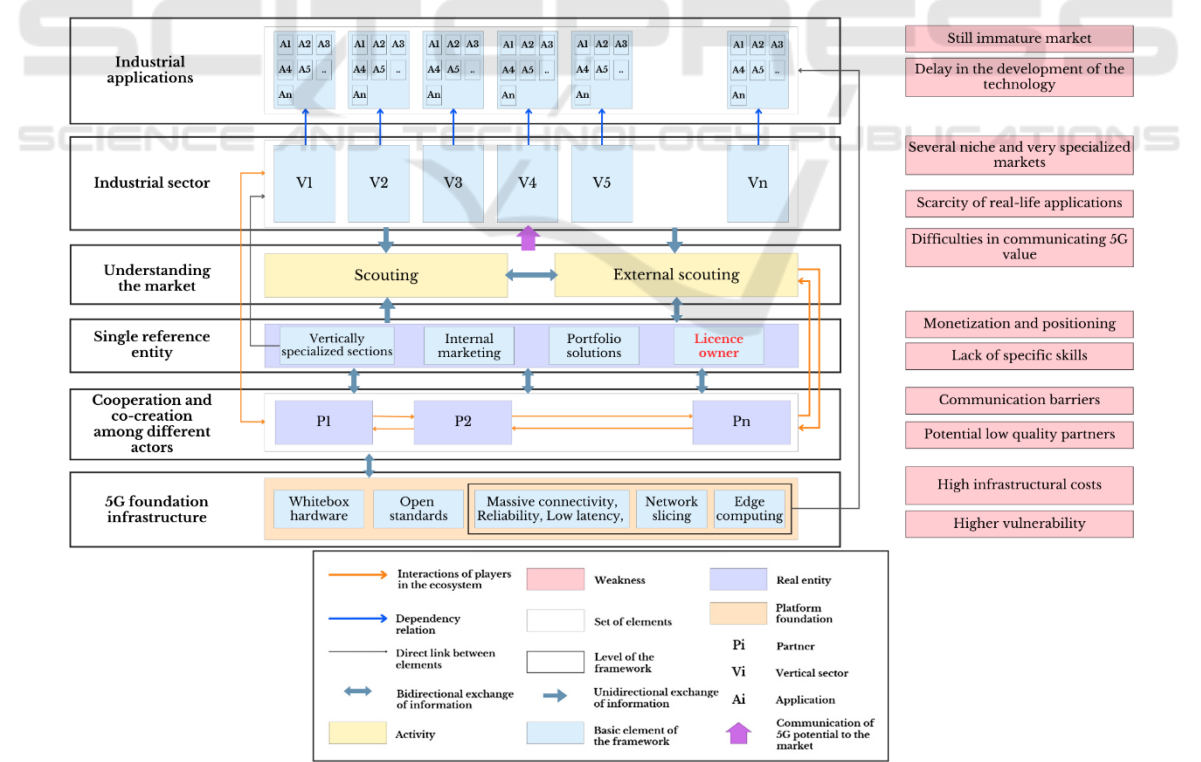


Figure 2: Framework.

## 5.2 Theoretical and Practical Implications

The associations that the framework point out between the mobile telecommunication ecosystem and the innovation platform elements have been formalized to officially recognise these links. Indeed, the technological features of 5G lay the basis for the foundation infrastructure of an innovation platform, given its modularity, standardization and scalability in the industrial environment. This acknowledges the parallelism among 5G infrastructure and the platform foundation element (Gawer, 2021). Secondly, combining 5G features with the presence of a reference figure can facilitate cooperation among the different actors, who are involved in the complementary parts development, necessary for innovation. These are the roles of complementors and of the platform owner (Gawer, 2021), which could ideally orchestrate the platform to facilitate development. Indeed, the benefits of a central actor can activate network effects, enhancing the ecosystem and the technology. The study is one of the first to link 5G with the concept of innovation platform, highlighting their intersections and offering a new point on 5G by positioning it in the platform research strand. In doing so, it reveals the existing challenges of the mobile telecommunications sector using the innovation platform lens. Because the phenomenon is still evolving, the study outlines potential scenarios rather than definitive conclusions, emphasizing the entropy surrounding roles' consolidation. The MNO idea as the central orchestrator is thus a potential outcome based on the study data and on platform theories, not a fixed conclusion. Lastly, some practical suggestions are introduced, to show how innovation platforms can be a useful tool for MNOs to implement the change. First, it is important that MNOs acquire awareness about their conditions, that are now perceived as commodity providers (Cave, 2018). So, connectivity offers are just a must-have condition, while to reach a competitive position they must build appealing services on top. Therefore, MNOs should constantly monitor the market and remain open to change for capitalizing on opportunities as soon as possible. Indeed, the occasion for MNOs now is like the one came with the media sector between the end of 2G 3G era and the beginning of the 4G era (Ghezzi, 2013), but that they did not manage to exploit (Lehr et al., 2021). Given the nature of MNOs and their lack of knowledge in specific areas (Gooderham et al., 2022), they should focus their efforts on becoming central coordinating actor for the 5G platform, becoming a

pillar for the ecosystem. Nevertheless, this position is not easy to achieve, considering both the competition they face, and the difficulty to change market perception. Hence, MNOs should actively drive the change, smartly working on their strategies to strengthen their position both internally and with respect to external actors.

## 6 CONCLUSIONS

The paper explored how MNOs can exploit 5G opportunities combined with the innovation platform perspective as a tool for regaining power in the mobile telecommunication industry. The issue was addressed through a qualitative case study approach, that comprises 8 explorative cases. Data were collected focusing on the MNO transition process, and information was processed through the Gioia methodology that generated three key theoretical dimensions about innovation platforms, MNO challenges and opportunities, and 5G as an enabling technology. The analysis of the findings produced a framework that structures data according to the characteristics of an innovation platform, highlighting the correlation between these latter and the ones of 5G and its surrounding ecosystem. This correlation provides new insights and outlines potential challenges and future scenarios. It suggests that MNOs could play a central role in orchestrating the ecosystem, without making definitive claims. Finally, some practical suggestions are formulated, that MNOs could use to exploit this research.

### 6.1 Research Limits and Future Avenues

A relevant limit comes from the qualitative nature of the research approach. Apart from the restricted data sample, interviews are biased by the personal opinions of respondents. Comparative studies could be then interesting. Moreover, the dataset is restricted also for the sensitivity of confidential information, that could not be accessed. The fast-evolving nature of 5G can make obsolete the implications of the study in a short period of time. Longer term longitudinal studies could instead monitor the MNOs real evolution over time, assessing the protracted impacts on their repositioning process. Since this study analyses the innovation platform aspects only in relation with 5G, the findings generalizability to other areas is difficult. Broader conclusions could be drawn by applying this theoretical model to different phenomena in different domains.

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