



# 12

## Opportunities and Implications Related to Future Mobile Communications

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Life is short,  
Art long,  
Opportunity fleeting,  
Experiment dangerous,  
Judgment difficult.

(Hippocrates)

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## Toward Forward-Looking Multidisciplinarity

Digitalization has dramatically changed the role of technologies in communications and information sharing. Over and above this, the ecosystems and value networks that used to be dominant are no longer in

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charge of technology evolution. At the center of all this are the customers, users, and developers and their unique needs and specific requirements. Most of the existing digitalization literature explores what is technologically possible or viable, and how future technologies will evolve. This technology push approach typically focuses on new technical developments that the technologists want to see, not what users need. Taking a step further, this book adopted a multidisciplinary and forward-looking approach to make sense of digitalization, especially in the context of future mobile communications, seeing technology as an enabler, regulation as a conditioning and limiting factor, and business as something that will emerge between technology and regulation. From the technological perspective, the chapters presented an outlook for the capabilities needed for various envisioned services enabled by future 5G and 6G. From the regulatory perspective, the chapters discussed the increasingly complex regulatory domain emerging for future mobile communications and presented some solutions for dealing with the complexities of anticipatory regulation. From the business perspective, the chapters provided an outlook on value creation and capture with novel services and business models, discussing the platform-based and ecosystemic features of future 5G and 6G. Finally, the chapters discussed the social and societal context for future 5G and 6G as they concern individuals, businesses, markets, societies, and geopolitics. What remains to be discussed are the implications and opportunities arising from the presented analysis and discussion.

This chapter will discuss the implications for research, management, and policymaking stemming from the preceding chapters. The idea is not to wrap up the chapters; rather, the aim is to identify and map *opportunities* and *implications* for further action for researchers, managers making decisions in the mobile communications context, and policymakers and the authorities.

## Opportunities and Implications for Research

This section will identify opportunities and implications from business, regulation, and technology perspectives for researchers interested in

future mobile communications-related topics, regardless of their discipline or domain. The following research methodology and research theme-related opportunities and implications are presented for the future:

- *Apply cross-disciplinarity and future research methods.* Understanding and exploring mobile communications as a research domain requires knowledge from several disciplines, ranging from engineering, business, economy, law, international relations, sociology, and psychology to mention only some. The current and emerging phenomena around 5G and 6G call for a combination of scientific knowledge and approaches from several fields that warrant a cross-disciplinary approach and a forward-looking methodology, specifically with qualitative research but also with various multi-method combinations. This also requires the involvement of various stakeholders to open the door for non-dominant voices to be heard when designing the future.
  - What does cross-disciplinarity mean in the future mobile communications context?
  - What theories and approaches are suitable for explaining the phenomena around future 5G and 6G?
  - What are the new cross-disciplinary design criteria for future mobile communications systems and services?
- *Emphasize the triple bottom line of sustainability and sustainable development goals.* Sustainability has emerged as a new design criterion for future 5G and specifically 6G. Green radios with lower energy consumption have long been a research topic, along with how to minimize electromagnetic fields in mobile communications. Yet the triple bottom line of sustainability, covering environmental, economic, and social perspectives, and especially what it means, how it can be reached, and what its measurable impacts are, remain interesting research questions. In addition, different notions of social and societal sustainability in different cultures and government systems provide impetus and importance for research into what social and societal sustainability means, and how it can be achieved. Questions

concerning how ethnicity, inclusivity, and human-centricity can be embedded in the development of mobile communications arise.

- What are the new sustainability-driven performance and value-related requirements for 6G and beyond?
  - How can 6G and beyond technologies and services contribute to solving sustainability challenges?
  - How can ethical principles be introduced to future mobile communications?
- *Examine general-purpose technologies and innovation.* Technologies define the opportunities available for business and society. 6G and artificial intelligence are becoming tethered together, giving rise to a new type of general-purpose technology domain that will have far-reaching impacts on everyday life. However, the outcomes and impacts and the mechanisms behind them, specifically related to this combination of technologies, on individuals, organizations, businesses, markets, and societies, are poorly understood and present opportunities for future research.
    - How will 5G, 6G, and artificial intelligence change societies and human life?
    - What mechanisms can be used to explain and understand innovation behavior and the benefit for firms and societies?
  - *Explore platformization and ‘ecosystemization’ of businesses.* On the consumer side, platforms have become the mainstream of global business. However, platformization and its related emergence of ecosystems—with traditional business incumbents becoming platform-based—are entering every business field, making multiplatform ecosystems the dominant type of business, represented by owners and complementors. However, theories that capture and explain strategies within such a new platform or ecosystem economy are still in their infancy.
    - What kind of strategies emerge in multiplatform ecosystems?
    - Will vertical-specific multiplatform ecosystems differ from those of consumer markets?

- What theories can help develop our understanding of strategies employed in multiplatform ecosystems?
- *Explain novel ecosystemic business models for value creation and capture.* The business model has become the contemporary tool for describing and designing businesses in the digital era, with value creation and capture at the heart of the discussion. Related to platforms, ecosystems, and general-purpose technologies, novel business models, and business model conceptions are expected to arise for public and private organizations, but also due to the increasing human-centricity of digitalization for individuals.
  - Will there be specific business models for new services such as network slicing, artificial intelligence, or metaverses in the future?
  - How can we use business model theory to explain firms' strategies and behavior?
  - To what extent can business model theory be used to foresee future strategies?
- *Explore human experience and services. In the future,* empowering experiential citizens as knowledge producers, developers and users will contribute to a process of human-centered democratizing innovation stemming from pluralism and diversity. With the expected emergence of new human–machine interfaces, holographic communications, haptic communications, and metaverses, human experience and empowerment are expected to expand to new heights. Data-intensive, human experience-enhancing services, especially if ubiquitously available, are technically and regulatorily challenging.
  - How should human experience be researched in the context of the metaverse or human–machine interaction?
  - How will human–machine interaction and metaverses change human needs, servitization, *markets, and the consumption of services?*
- *Ensure privacy, security, resilience, strategic autonomy, and sovereignty.* Future mobile communications must be understood and designed to ensure privacy, national and personal security, the availability and integrity of communications and data, and respect for the fundamental rights of the individual and for countries' self-determination.

These principles and procedures must meet the legitimate expectations set by the stakeholders in future mobile communications, but they may also produce differing implications in different contexts, as they may be of concern for nations regarding strategic autonomy, democracy, and sovereignty.

- How can 6G technology and governance be designed and societal acceptance be supported so that they evolve fruitfully together?
- How can we collaborate internationally to reap the full benefits of a global 6G and to avoid a backlash by concerns about sovereignty or fundamental rights?
- *Explore regulatory antecedents and outcomes to develop anticipatory regulation.* The increasingly complex regulatory environment surrounding mobile communications-enabled businesses is becoming challenging to comply with, and in different markets and countries, the regulatory domains may have contradictory requirements, leading sometimes to unwanted or unexpected outcomes. Anticipatory regulation has been seen as an opportunity to develop future regulation, but new knowledge is needed for how to understand and approach it.
  - What is the minimum that needs to be regulated?
  - How can we examine and anticipate the outcomes and impacts of regulation?
  - How can we avoid the negative outcomes and impacts of regulation?
- *Benefiting from innovation and transformative innovation policies.* Like the regulatory domain, the policy domain needs a holistic understanding of how firms and societies can benefit from innovation. As innovation policies should holistically consider innovation activities, their lifecycle, and commercialization efforts, transformative innovation policies should also have predefined and measurable outcomes and impacts. However, theories that explain the benefits of innovation and transformative innovations are yet to be combined.
  - What kind of innovations policies should there be for future mobile communications?
  - The systemic and complex converging 6G platform and ecosystem provide an exciting research context to study how to profit from

- innovation, particularly in relation to the open architecture and open source adopted in 6G.
- How do globalization or global strategies and innovations policies interact within mobile communications?
  - Risks, threats, and negative impacts of platformization and digitalization. 5G and 6G are typically associated with progress and development. However, they can be seen as enablers of harmful and even criminal developments in society.
    - What could the downsides be of progressing digitalization and advancing mobile communications, and how can we deal with or solve them?

## Managerial Opportunities and Implications

The 6G era is characterized by a completely new kind of convergence and complementarities as a multiplatform ecosystem with a central role of general-purpose technologies, which generates new kinds of needs to understand how value is created, delivered, shared, and captured. For business managers, the discussion in the book chapters gives rise to the following observations regarding business opportunities and implications:

- Value appropriation (capture) outcomes may not only be about the immediate profits from innovation, but the benefits may be quite varied, from private to social returns, and they may accrue over time. This gives rise to the following implications for management:
  - Innovators may monetize their innovations by paying attention to the appropriability regime covering legal instruments, especially intellectual property rights (IPRs), tacit, hard-to-imitate technologies, and complementary assets like algorithms, data, interfaces, and ready-made components.
  - Attention should be paid to the instruments, processes, and outcomes of value appropriation in different areas/markets of future 6G.



- For incumbent firms, the changing role of innovation and ecosystems will entail the need to develop new ecosystem-embracing strategies and business models in their existing markets. The question is about choices:
  - Identify emerging new ecosystems and business verticals in the intersection of different technological domains.
  - Develop hybrid business models that extend from connectivity toward product-service models building on higher 4C layers like context and commerce.
  - Considering the organizational perspective, organize activities outside the focal enterprise to implement new business models, and design and implement the business process across the ecosystem.
  - Bring human-centricity to business model innovation.
- The decoupling of technology platforms will lower the market entry barrier, allowing multiple entities to contribute to the innovations envisaged for 6G. For startups and small and medium-sized enterprises, the exploration of growth opportunities with complementary services will become essential.
  - Adopt complementor strategies for quick market entry.
  - Develop new business models for slicing, secure zones, sensing, and sustainability.
  - Privacy regulation will be strongly linked to the rising trends of the platform data economy, sharing economy, intelligent assistants, connected living in smart cities, transhumanism, and digital twins' reality.
  - Attention should be paid to the value appropriation outcomes of business activities at the ecosystem level.
- In the emerging new ecosystems, understanding management and the organizational models needed for specific business models becomes central for business model implementation and competitiveness. New

kinds of governance and organizing logics are needed for the cooperative context, where collaboration and competition take place on both sides of platforms. This raises several implications:

- Identify the real needs in various vertical and industrial contexts to develop a strong role for 6G.
  - Identify the decision-making logic in the ecosystem.
  - Identify the fundamental role/position choices that need to be made regarding how to do business in the new ecosystems.
  - Avoid siloed thinking in multiplatform ecosystem contexts.
  - Prepare for two-sided competition.
  - Build alternative governance structures for multiplatform ecosystems.
- It is not enough for platform owners and complementors that technical, service, and business infrastructures will exist and be available in the future 6G era. It is essential to consider whether users have real access to these services—that they have the required devices, and that they also know how to use them, as well as the other adjacent/complementary services. The role of developers has been emphasized in emerging 6G (general-purpose) technology contexts. Moreover, openness can benefit original innovators later even if they release (or lose) the technological innovations to the surrounding environment where others exploit it. A deeper understanding of technology in the form of design and development skills such as programming or digital fabrication may also further enhance users' opportunities to play an active role in the ecosystem and make and shape technologies for their personal needs. This also assists users in evaluating and reflecting on the technologies and their role in the user's own life, as well as more widely in society.
    - Identify and explore the spillovers and social returns that could become a new source of private returns for the initial innovator.
    - Examine non-users and understand the reasons for their exclusion: Is it by their own choice or for another reason?
    - Identify who benefits from technology or service use, and how.
    - Who experiences value?

- What is the real price of services, and is it worth paying?
- Organize and balance value-related processes to achieve diverse triple bottom line sustainability goals.
- Integrate social and environmental goals into business models.
- Decentralized platform cooperatives will become counterforces to winner-takes-all platform monopolies.
- There will be traditional stakeholders in the future mobile communications ecosystem like mobile network operators, mobile virtual network operators, mobile communications technology providers, and mobile communications equipment providers, as well as different new ones like resource and asset providers, matching and bridging service providers and a variety of new types of service users.
  - Benchmark best newcomer strategies to enter the mobile communications domain internationally.
  - Build customized user experiences with user-centric resource orchestration.
  - Identify new sources of value creation in metaverse variants.
  - New societal models for future service provisioning will emerge, building on community-driven networks and public–private partnerships.
  - Learn the regulations that apply in mobile communications ecosystems.
- It may be expected that with new generations of mobile communications, the commercialization and standardization lifecycle will get more complicated due to the need to integrate/converge new technologies like security-enhancing ones or artificial intelligence to 5G and 6G. This raises at least the following for consideration:
  - Make a clear strategy for contributing to the definition, standardization, and deployment/use of a technology generation.
  - Develop corporate responsibility around future 6G and share best practices.

- Local-demand–supply–consumption models will become prominent in an already globalized world, with opportunities in localized spatial circular economies.
- From the environmental perspective, 6G is seen as a provider of services to help steer communities and countries toward reaching the UN SDGs. However, the UN SDGs should have been achieved by the time 6G enters the market. 6G will offer opportunities for monitoring and steering the circular economy and understanding the big picture of the sustainable data economy. It is also expected that companies will shift the focus, developing products and technologies that innovate to zero, including zero-waste and zero-emission technologies bringing social innovation to the fore.

## Implications for Policymaking

The traditional questions for policymakers with a new mobile communications generation at hand have been about how to deal with new spectrum bands. The challenge of finding more spectrum for mobile communications is a fundamental problem for which the solution space differs by the stakeholder. The only way out of this challenge is sharing-based spectrum access, which allows different radio systems to share the spectrum under predefined rules and conditions. The technology for this is already mature; now, it is time to introduce these principles to mobile communications, which has traditionally relied on exclusive long-term spectrum licenses over wide areas.

However, policymaking is not only about spectrum management. How to address the emergence of a large number of local 6G networks deployed by different stakeholders for different types of use faces not only the spectrum challenge but also competition, openness, regulatory, and technology, and innovation policy challenges. These themes extend the discussion to the global scale, requiring harmonization in several fields. Among the most important are: spectrum-related policies and principles; standardization across different technology areas and industries; international trade and fair competition; data ownership, governance,

and platforms; privacy, security, and user/consumer rights; innovation policies and international collaboration; and artificial intelligence.

Moreover, digital technologies have become the basis for global competitiveness and geopolitical rivalry. They are becoming the source of geopolitical tension and are being weaponized. One consequence is the fragmentation of regulations. Apart from the increasingly complex regulations, there is now also a geopolitical motivation to turn away from global interoperability and open interconnection. The ‘splinternet’ is already a fact today. Industrial and innovation policies are becoming more compartmentalized and are driven by geopolitics as much as by national competitiveness and company interests. Trade impediments, data colonialism, and increasing concerns about strategic autonomy and sovereignty all risk contributing to the globalization backlash, creating a real possibility that we will never see a truly global 6G.

However, there are also forces that require global 6G and beyond mobile communications. The most pronounced of these are global grand challenges, notably climate change and the need to achieve environmental sustainability at a global level, global health scares (pandemics), and rampant worldwide cybercrime. Environmental sustainability has emerged as a new design principle for future mobile communications. However, we argue that social and societal sustainability, inclusivity, human-centricity, and human rights should also be considered, as indicated and measured by the United Nation’s seventeen social development goals, the UN SDGs. In current discussions, the concept of trustworthy and resilient networks or communications has been related to the privacy, security, safety, and resilience of communications, but the concept could also be seen in a wider context. This gives rise to the following implications for policymaking:

- Despite geopolitical tension, promote open, global, and full 6G as a political vision.
- Collaborate as policymaking communities with researchers, academia, and business to advance common global good use of 6G, addressing global challenges in particular.
- Avoid regulatory and standardization fragmentation by enabling global collaboration on legal and technical matters.

- Develop integrated policy for 6G to achieve economic, social, and democratic progress, respecting human-centricity and human rights and addressing security concerns by design.
- Collaborate internationally to anticipate the future of technologies and their economic and social appropriation, notably on
  - The combination of electronic communications with cybersecurity, quantum computing, cyber-physical systems, and artificial intelligence, as well as on
  - The evolution of platformization and its effects in terms of competition, global inequality, and equity.

Finally, we emphasize that sustainability will be a game changer for beyond 6G. The ways and criteria for how countries are evaluated as pioneers in mobile communications will change drastically. The total amount of consumed mobile data is far from sustainability thinking. Telecommunications policymakers face the challenge of defining new rules and requirements for something that is outside their traditional competence area.

- Develop new metrics and methods to assess environmental, social, and economic sustainability of 6G and beyond (footprint), as well as the use of mobile communications in other sectors to make a positive impact (handprint) on the environment (see, for example, the recent discussions on nature positive strategies by the World Economic Forum) and societies at large.
- Provide visibility for end users about the sustainability impact of their decisions on ICTs.
- Establish the research community's role as the provider of unbiased research results that are the foundations for future policymaking.

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