



Development and implementation of new startup technologies in urban mobility from a patent perspective: legal framework and challenges

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I. Introduction

A. General overview of Urban Mobility

Urban mobility refers to the movement of people and goods within cities, encompassing diverse transport modes.¹ Once centred on roads, traffic safety and transport modes, it became a cross-sectoral ecosystem, shaped by two megatrends — sustainability and digitalisation.² Landmark inventions in transport and energy, such as the steam engine (Trevithick's, 1802)³, alternating current (Tesla, late 19c) and early electric carriages (Morrison, 1890s), laid the groundwork for today's urban mobility, inspired by the Industrial Revolution⁴ and the absence of massive restrictions.

However, the current trends are shaped by the imperative for sustainability and digitalisation under the government policy and social interest, supported and inspired by the Sustainable Development Goals (SDG 11 on Sustainable Cities and Communities; SDG 9 on Industry, Innovation and Infrastructure)⁵, European Climate Law⁶ and European Green Deal⁷, and specific sectors policies, such as the Sustainable and Smart Mobility Strategy⁸ and the New EU Urban Mobility Framework,⁹ which identifies European cities as "living laboratories" to become places where science, new ideas, entrepreneurship and green technologies are tested and employed.¹⁰

The shift towards sustainability is especially seen in electric vehicle technologies. Interestingly, while electrification primarily contributes to sustainability, it does not, on its own, fundamentally restructure urban mobility systems.¹¹ Massive pollution and congestion are the result of the dominance of car-based infrastructure, founded on deliberate regulatory and policy choices that historically prioritised automobiles over other forms of mobility.¹² While recent scholarly efforts increasingly explore the potential for a meaningful shift towards alternative modes of transport, cars continue to constitute the primary mode of movement in most urban and suburban contexts.¹³ Critics argue that electric vehicles and smart applications may reproduce unsustainable patterns unless

¹ A Green Deal Industrial Plan for the Net-Zero Age, COM(2023) 62 final, 1 February 2023, pp. 7–8; see also Annex 2 on Net-Zero Technologies.

² Eurocities Pulse Mayors Survey 2024, accessed June 4, 2025, <https://monitor.eurocities.eu/eurocities-pulse-mayors-survey>

³ Patenting of the High-Pressure Steam Engine", EBSCO Research Starters, <https://www.ebsco.com/research-starters/history/patenting-high-pressure-steam-engine>.

⁴ "Invention City," Tomorrow.City, accessed July 25, 2025, <https://www.tomorrow.city/invention-city/>.

⁵ United Nations, Sustainable Development Goals, accessed 9 August 2025, <https://sdgs.un.org/goals>.

⁶ Regulation (EU) 2021/1119, the "European Climate Law"

⁷ Communication from the Commission—The European Green Deal, COM(2019) 640 final

⁸ Sustainable and Smart Mobility Strategy (COM/2020/789 final), 9 December 2020.

⁹ The New EU Urban Mobility Framework, COM(2021) 811 final;

¹⁰ Eurocities Pulse Mayors Survey 2024, <https://monitor.eurocities.eu/eurocities-pulse-mayors-survey> (accessed June 4, 2025)

¹¹ Haobo Yang et al., "Electric Vehicle Sharing Systems: Opportunities and Challenges", The Open Transportation Journal 19 (2024)

¹² Ülkü Tanriverdi, Wouter Verheyen, and Esther van Zimmeren, "Enhancing the Regulatory Framework for Platform-Based Mobility Services: Facilitating the Transition from Cars in Urban Mobility," Transportation Research Procedia 82 (2025): 1534

¹³ *Ibid*, 1534

embedded within broader systemic sustainable change.¹⁴ Therefore, the shift in current infrastructure to green technologies has to be made faster and deliberately, with attention to the process, chains and future implications.

This transformation creates both opportunities and challenges for startups. On one hand, increasingly, cities leverage pilot projects through public procurement to encourage and support startup participation. In this environment, intellectual property — especially patents — becomes a strategic asset. Patents influence whether and how technologies scale, particularly in interconnected urban mobility systems such as smart charging, connected vehicles, and integrated platforms. On the other hand, the procurement processes often introduce legal and strategic uncertainty, particularly concerning intellectual property, where approaches to ownership, licensing, and commercialisation differ significantly between the private and public sectors. The new EU's Startup and Scaleup Strategy confirms that procurement hinders the scalability of disruptive projects.¹⁵ As a result, Europe is currently experiencing the so-called “European Paradox”, whereby substantial scientific and research investments are channelled into startups, yet these efforts rarely translate into successful large-scale deployment.¹⁶

Despite EU support through Horizon Europe¹⁷, the European Innovation Council (EIC)¹⁸, and EIT Urban Mobility¹⁹, structural disadvantages persist. Litigation is costly, procurement rules are complex, and most startups lack the legal capacity to negotiate IP terms effectively. Many disputes remain invisible and untested in case law.

In light of this context, the present research examines the legal and strategic challenges associated with intellectual property and technology transfer that startups face when entering the urban mobility market, with a particular focus on hardware technologies, such as EV-charging infrastructure. Special attention is given to patents in the context of public procurement and the position of startups within Europe's urban mobility ecosystem. The study identifies legal gaps, maps current practices, and discusses pathways for enabling startups to scale while actively contributing to the green and digital transformation of urban mobility.

B. State of the Art

Urban mobility systems risk “city lock-in” due to reliance on proprietary infrastructure, which limits scalability and adaptability. While patents foster innovation and provide

¹⁴ Caroline Mullen, “Governing a Risky Relationship Between Sustainability and Smart Mobility,” in *Smart Urban Mobility: Law, Regulation, and Policy*, eds. Michèle Finck et al., MPI Studies on Intellectual Property and Competition Law 29 (Berlin: Springer, 2020), p. 28-29

¹⁵ The EU Startup and Scaleup Strategy, COM(2025) 270 final, p. 4–5.

¹⁶ Schuurman, Dimitri, Bastiaan Baccarne, and others. “Living Labs as open innovation systems for knowledge exchange: solutions for sustainable innovation development” (2016); The New EU Urban Mobility Framework, COM(2021) 811, para. 62.

¹⁷ Horizon Europe, accessed August 10, 2025, https://research-and-innovation.ec.europa.eu/funding/funding-opportunities/funding-programmes-and-open-calls/horizon-europe_en (accessed August 10, 2025)

¹⁸ European Innovation Council (EIC), https://eic.ec.europa.eu/index_en (accessed August 10, 2025)

¹⁹ EIT Urban Mobility, European Institute of Innovation and Technology (EIT) Urban Mobility, <https://www.eiturbanmobility.eu/> (accessed August 10, 2025)

commercial leverage, they can also create barriers through patent thickets and concentrated ownership.²⁰ In high-tech green sectors, patents create R&D incentives but can slow sustainability transitions.²¹ Early-stage innovators often adopt closed IP strategies to secure funding and market position, and licensing is getting more broadly adopted after achieving commercial success to balance investment recovery with decarbonisation objectives.²²

Patent protection in urban mobility is evolving under the pressures of massive digitalisation, with certain domains emerging as “IP negative spaces.” In such contexts, stakeholders prioritise interoperability and innovation over strict enforcement, reflecting a sectoral shift towards openness rather than exclusivity as a driver of technological progress.²³ While urban mobility startups benefit from collaborative opportunities, they remain disadvantaged by restricted access to competitor data and the high costs of IP enforcement. This limits their ability to safeguard innovations, even when driven by strong societal and environmental goals.²⁴

A key challenge in innovation procurement, particularly Pre-commercial procurement, is the lack of clear guidelines for valuing IPRs retained by suppliers. This absence, combined with patenting and overlapping rights, risks disputes and can deter participation. The lack of clear mechanisms for resolving IPR conflicts across different PCP phases and potential competition law issues further restricts fair market access and the exploitation of innovations.²⁵

As an example, the EU's EV charging sector faces significant hurdles from fragmented licensing rules and inconsistent national procurement, which leads to market distortions by the reliance on Standard Essential Patents (SEPs) — FRAND licenses are difficult, and the concentration of rights risks entrenching market dominance.²⁶

Some scholars warn that collaboration in smart mobility must not devolve into ceding control to private actors. Without strong governance, municipalities risk allowing patent-holding startups or platforms to dictate system design and operation, undermining transparency, accountability, and public-interest goals. Such arrangements can fragment mobility ecosystems, prioritising corporate objectives over climate resilience, accessibility, and equitable infrastructure.²⁷

²⁰ Natasha Tusikov, “Greener Cities: Intellectual Property and Data in Sustainable Smart Cities,” in *The Elgar Companion to Intellectual Property and the Sustainable Development Goals*, ed. Bitu Amani, Caroline Ncube, and Matthew Rimmer (Cheltenham, UK: Edward Elgar, 2024), 383–84, 390–93.

²¹ *Ibid.*, 25–26.

²² *Ibid.*, 18–19.

²³ Giulia Priora and Caterina Sganga, *Smart Urban Mobility: A Positive or Negative IP Space? A Case Study to Test the Role of IP in Fostering Digital Data-Driven Innovation*, in *Smart Urban Mobility*, ed. M. Finck et al. (Springer, 2020), p. 156–57.

²⁴ Priora and Sganga(2020), p. 156–57.

²⁵ Nicola Dimitri, “Intellectual Property Rights in the EU Pre-Commercial Procurement for Innovation,” *Journal of Strategic Contracting and Negotiation* 4, no. 3 (2018).

²⁶ Vasco Guedes Ferreira, *Charging Ahead: The Future of Electric Vehicle Infrastructure in the EU* (Scientific Foresight [STOA], European Parliament, 2025), April 2.

²⁷ Caroline Mullen, “Governing a Risky Relationship Between Sustainability and Smart Mobility,” in *Smart Urban Mobility: Law, Regulation, and Policy*, eds. Michèle Finck et al., MPI Studies on Intellectual Property and Competition Law 29 (Berlin: Springer, 2020), 42.

C. Methodology and Objectives

This study employs a two-layered analytical framework to investigate legal challenges for startups in the European urban mobility sector, focusing on patents across both horizontal and vertical dimensions, inspired by G.V. Overwalle and E.V. Zimmereren's (2009) work.²⁸

The horizontal dimension examines interactions among private actors, analysing how patents shape licensing mechanisms and technology transfer. The vertical dimension explores the relationship between startups and public procurement, viewing it as the primary channel for diffusing innovation and highlighting the structured, hierarchical interactions with public authorities.

The research begins with a systematic literature review to identify startups as independent subjects of the EU urban mobility market, trends and problems from an IP perspective, including patents' role in urban mobility and startups' unique operational characteristics and IP use. The analysis examines different IP spaces and strategies in urban mobility, inspired by works of G. Priora and C. Sganga (2020) and A. Gorbatyuk, G. V. Overwalle, and E. V. Zimmereren (2016).

The study then applies a doctrinal legal analysis of EU statutes, case law, and innovation policies to assess the legal environment startups face. It maps the scope of patent rights, identifies the complexity of the urban mobility framework, and examines the influence of standards and infrastructure. The analysis examines traditional procurement models, which are characterised by rigid rules and risk aversion, with the innovation procurement model, in particular accent is made on Pre-Contractual Procurement, designed to facilitate the entry of new technologies; however, significantly influenced by the EU Horizon policy. It specifically addresses the challenges of IPR allocation and other structural barriers that limit startup scalability.

The literature review draws on peer-reviewed scholarship and official policy documents, prioritising sources from Springer, ScienceDirect, HeinOnline, IEEE Xplore, ResearchGate, Scopus, Google Scholar, and the University of Antwerp Library. Keyword queries combine core terms — Urban Mobility, European Union legislation, Patents, Startups, Open Innovation, IP Strategies, Procurement, Allocation of IP Rights — with legal challenge qualifiers (e.g., “Green” AND “Sustainable” AND “EU” AND “Patent” AND “Urban Mobility” AND “Challenge” AND “EU Law”). Sources are selected if they address patents, startups, or urban mobility at their intersection in the EU context.

The doctrinal analysis follows a top-down approach, beginning with high-level EU legal instruments and policy communications that establish sustainability and innovation objectives, before narrowing to sector-specific rules on urban mobility. As an applied example, the study examines EU rules on electric vehicle charging infrastructure, illustrating the convergence of sectoral objectives and technical standards. While direct case law involving startups in the urban mobility sector, related to patents and

²⁸ Geertrui Van Overwalle and Esther van Zimmereren, “Functions and Limits of Patent Law,” in *Facing the Limits of the Law*, eds. Eva Claes, Wouter Devroe, and Bert Keirsbilck (Berlin–Heidelberg: Springer, 2009).

procurement disputes, is limited, relevant jurisprudence is identified by keywords in the literature search.

Several issues were excluded from the analysis, for example, liability in procurement procedures, the purity of rights, as well as joint ownership.. The research also does not address the consequences of post-tender IP transfers or the allocation of rights in tenders divided into lots. Given the narrowed scope, patent-related issues are treated only in brief, focusing on illustrating the general sector's complexity and dependence on standards. This study is constrained by the scarcity of published disputes involving startups in procurement-related IP conflicts and by restricted access to unpublished procurement contracts. The study does not provide an examination of the effect of the European Patent with Unitary Effect. Additionally, the study examines only the EU-level legal framework and only occasionally observes national law as examples. Future research should include real-world examples, procurement agreements, and empirical studies involving startups. It should also feature a comparative analysis of best practices and the transposition of the Procurement Directive norms.

D. Relevance and Research Questions

Urban mobility increasingly relies on innovations from startups. The role of patents, however, is seen in a dual light: they are a driver of innovation through disclosure and commercialisation, but they can also act as a barrier due to their monopolistic and exclusive nature. Startups, as the most vulnerable market actors, face distinct barriers when navigating complex IP regimes, especially in the complexity of the rigid legal framework in procurement, licensing obligations, and compliance requirements.

The research questions:

- 1) What are the legal challenges and limitations that might be foreseen by startups from patent perspectives, and which legal aspects are still vague?
- 2) How can those challenges be overcome with the existing legal instruments, and if not, what other ways?

The findings will benefit startups, corporations, local authorities, and industrial property owners by clarifying the chain of rights in technology use, anticipating legal risks, and informing procurement and collaboration strategies.

II. IP and Urban Mobility: Co-Shaping the Innovation Landscapes

A. Intellectual Property in Urban Mobility

1. Redefining Exclusive Rights in Intellectual Property

Patent Law structures vertical relations — on one side, public authorities and on the other side, companies and individuals — by granting and enforcing exclusive rights, while shaping horizontal relations among companies and individuals through mechanisms for

licensing, transferring, and exploiting intellectual property rights (IPRs).²⁹ Patent law balances societal values and economic needs to serve the public interest and innovators.³⁰ However, IP law does not exist in isolation. Sustainable policy goals³¹, market trends and interactions between actors in urban mobility significantly influence how IPRs are exercised. Understanding the core functions of patents clarifies their strategic value for startups and supports their entry into the urban mobility market.

EU patent law, as a branch of intellectual property law, provides a stable framework for protecting technical inventions through a combination of international treaties, regional and national laws.³² European patents take effect similarly to national ones,³³ while unitary patents offer uniform protection across participating countries.³⁴ International treaties establish minimum standards for IP protection; however, states can provide stronger protection and adopt additional exceptions in situations involving public interest, national emergencies, the prevention of IP right abuse, and government use.³⁵

Therefore, while patents confer exclusive rights — including the ability to prevent others from using or commercialising an invention, as well as the ability to license or transfer those rights (horizontal dimension) — these rights are subject to statutory limitations (vertical dimension), such as private, non-commercial, experimental use, interoperability, etc.³⁶

Apart from those established by law, adjustments and exceptions may arise from industry practices, sector-specific requirements, other legal sectors or broader technological and policy developments. For example, standard-essential patents (SEPs) reflect the influence of competition law and interoperability requirements in urban mobility and telecom sectors. Meanwhile, public health demand coupled with the pharmaceutical industry interest (horizontal need) could reshape even the law system. For instance, while the standard patent term is 20 years, EU law allows an additional five years through supplementary protection certificates compensating for delays in obtaining regulatory approval (a vertical adjustment).³⁷

Compulsory licensing, an ongoing subject of debate, allows the use of a patented invention without the holder's consent in specific circumstances such as public health emergencies or market failure.³⁸ While compulsory licensing may be established under

²⁹ Geertrui Van Overwalle and Esther van Zimmeren, "Functions and Limits of Patent Law," in *Facing the Limits of the Law*, eds. Eva Claes, Wouter Devroe, and Bert Keirbilck (Berlin–Heidelberg: Springer, 2009), p. 422

³⁰ *Ibid*, p. 430 with reference to G. Van Overwalle, *l.c.*, 2008e.

³¹ United Nations, Sustainable Development Goals, accessed 9 August 2025, <https://sdgs.un.org/goals>.

³² Such as Paris Convention, TRIPS Agreement (1994), and, in the EU, the European Patent Convention (1973), the Unitary Patent system, and Directive 2004/48/EC.

³³ EPC Article 64

³⁴ Regulation (EU) No 1257/2012 of the European Parliament and of the Council of 17 December 2012, Articles 3, 5 (UPR)

³⁵ TRIPS, Article 1(1) 8, 30 and 31; UPR Recital 10; Article 7,

³⁶ Agreement on a Unified Patent Court, signed 19 February 2013, OJ C175/1 (2013) (UPCA), Article 27

³⁷ EPC, Art. 63; SPC Regulation (Reg. 469/2009/EC), Art. 13.

³⁸ TRIPS, Arts. 8, 31; Paris Convention, Art. 5A.

national laws on a case-by-case basis and subject to strict conditions,³⁹ no unified mechanism exists within the Unitary Patent System — a gap that undermines harmonisation across the EU.⁴⁰ A key trend in urban mobility is the recognition of environmental concern as an "overriding public interest" justifying compulsory licensing for green technologies.⁴¹ So far, the proposed EU Regulation establishes a balanced, last-resort mechanism for addressing crises affecting public welfare, with non-exclusive, time-limited licenses, fair compensation for rights holders, and judicial oversight.⁴² Notwithstanding, global challenges and sustainability policies have already influenced the patent system through the emergence of new, non-legally defined mechanisms such as "green patents", which have developed organically through market practice and policy initiatives rather than formal legal recognition.

Green patents have been incorporated in classification systems of the World Intellectual Property Organisation (WIPO) and the European Patent Office (EPO), using specific codes to identify and track inventions related to sustainability.⁴³ However, this categorisation lacks harmonised classification (e.g. Y02, Y04S v ENV-TECH), which affects statistical consistency.⁴⁴ Concerns have been raised about the representativeness of the metrics, as many innovations are either misclassified or fall outside the narrow definitions⁴⁵ and valuation methods used in current systems.¹³ Widely recognised as key actors in driving environmental and sustainability transitions,⁴⁶ startups could — with greater transparency and clarity — be better positioned to access funding and public procurement for green technologies using green patents.

The IP system is based on a reciprocal bargain: inventors get temporary exclusive rights and financial returns in exchange for disclosing their innovations, enabling others to build on once protection expires, improve or create alternatives.⁴⁷ However, while patents serve both as a driver and a measurable indicator of innovation activity, some studies question whether patents are essential to boosting innovation or whether alternative mechanisms

³⁹ Duncan Matthews, Esther van Zimmeren, and Timo Minssen, "Using compulsory licences as a governance tool: The need for greater effectiveness and policy coherence," in *Improving Intellectual Property* (Edward Elgar, 2024), p. 72.

⁴⁰ Matthews, van Zimmeren, and Minssen (2024), p. 65-66, 71

⁴¹ AIPPI, Summary Report on "Compulsory Licensing" (SQ293), 25 July 2025, <https://www.aippi.org/news/summary-report-on-compulsory-licensing-sq293>, accessed 3 August 2025, with reference to Articles 31 and 31bis of the TRIPS Agreement.

⁴² COM(2023)224 - Proposal for a regulation of the European Parliament and of the Council on compulsory licensing for crisis management and amending Regulation (EC) 816/2006

⁴³ European Patent Office, Updates to CPC Schemes Y02 and Y04S – Classification for Green Technologies, accessed July 25, 2025, <https://www.epo.org/en/news-events/in-focus/classification/classification/updatesY02andY04S>.

⁴⁴ Marinella Favot et al., "Green Patents and Green Codes," *Resources, Conservation & Recycling Advances* 18 (2023).

⁴⁵ Yasmin Lambert, "Green Patents Slow as Net Zero Deadlines Edge Closer," *Financial Times*, June 16, 2022. Comment by Christopher Hamer.

⁴⁶ Klaus Fichter et al., "Sustainability Impact Assessment of New Ventures: An Emerging Field of Research," *Journal of Cleaner Production* 384 (2023)

⁴⁷ EIT Urban Mobility, Intellectual Property Strategy: Why and How to Use It, slide 13, <https://www.eiturbanmobility.eu/wp-content/uploads/2025/07/Intellectual-property-strategy.pdf>

may be more effective in protecting and promoting technologies.⁴⁸ Chapter 2 examines the role of patents, exploring how the interplay between patents and urban mobility shapes interactions among stakeholders and, in turn, impacts startups.

2. Role of Patents in Urban Mobility

Urban and smart city elements often embody intangible ideas, combining digital and physical components. These concepts are articulated in documents before being materialised into tangible goods or services. Even when embodied in physical form, the value of such products often lies in the underlying intangible idea. Consequently, legal protection is typically sought through mechanisms designed to safeguard ideas, solutions, and inventions — namely, patent law.⁴⁹

Patents constitute an important component of urban mobility. First, patents confer legal validity on novel technologies, providing credibility through their technical specifications, claims, and expert valuation. Second, given major investments in urban mobility, patents financially secure rightholders with exclusive control over foundational technologies.⁵⁰ Third, patents providing full disclosure drive further innovation among other parties, including competitors, academics and inventors. They encourage third parties to investigate, experiment, seek collaborations, or explore alternative solutions. Therefore, despite their monopolistic nature, patents also stimulate further innovation. Fourth, the last decades have seen a rapid increase in patent filings related to transport and information and communication technologies (ICT) focused on sustainability. Since the 2000s, patents in sustainable transport have grown at nearly triple the annual rate of those in traditional transport technologies.⁵¹ Statistics reveal significant patenting activity in intelligent transport systems, zero-emission vehicles, and fuel technologies, covering both digital solutions and hardware innovations.⁵² Interestingly, the most valuable patented innovations in urban mobility are often developed by firms outside the traditional transport sector.⁵³ This reflects the deep intersection of the UM domain with transport, energy, ICT, data systems, finance, sustainability, infrastructure, public governance, and other domains.

Studies show that successful urban innovation relies on effective patent transfer, including cross-border licensing and technology trading.⁵⁴ Meanwhile, other scholars

⁴⁸ Julien Penin and Daniel Neicu, “Patents and Open Innovation: Bad Fences Do Not Make Good Neighbors,” *Journal of Innovation Economics & Management* 25, no. 1 (2018), with references to Levin et al., 1987; Cohen et al., 2000; Sakakibara, Branstetter, 2001; Arundel, 2001; Bessen, Meurer, 2008, for a survey; Lerner, 2009.

⁴⁹ Tomasz Szewc and Szymon Rubisz, “Intellectual Property Issues in Managing a Smart City,” in *Intellectual Property Issues in Managing a Smart City* (Silesian University of Technology, 2023), 3-4

⁵⁰ Tusikov, Natasha. “Greener Cities: Intellectual Property and Data in Sustainable Smart Cities,” in *The Elgar Companion to Intellectual Property and the Sustainable Development Goals*, eds. Bitu Amani, Caroline Ncube, and Matthew Rimmer, 382. Cheltenham: Edward Elgar, 2024.

⁵¹ WIPO Technology Trends Report 2025: The Future of Transportation, p. 12, <https://www.wipo.int/web-publications/wipo-technology-trends-future-of-transportation/en/index.html>

⁵² Jyoti Prajapati, Arijit Paul, and Rupert J. Baumgartner, “A Patent Landscape of Sustainable Mobility Innovations in Land Transportation,” *World Patent Information* 78 (2024), Section 4.1.

⁵³ Prajapati et al, Section 6.

⁵⁴ P. Jin, S. Kumar Mangla, M Song, The power of innovation diffusion: How patent transfer affects urban innovation quality, *Journal of Business Research*, Volume 145, 2022, p. 423-424,

highlight that patents enable dominant firms to extract disproportionate economic value and create barriers to the diffusion of technologies.⁵⁵ Additionally, urban mobility innovation tends toward a more open and less proprietary approach to IP driven by digitalisation and accelerated R&D⁵⁶ However, it remains questionable whether this trend enhances innovation performance — particularly for startups.

As cities evolve due to sustainability and digital transformation — reflected in growing patent filing activity — IPRs help structure how new technologies emerge, compete, and spread. However, the cross-sectoral nature of urban mobility raises new questions about how best to manage intellectual property. While patents can foster growth and collaboration, they may also limit access or create barriers for new entrants. As the sector continues to evolve, the role of patents will remain important but must be balanced with the core principles of openness and inclusivity, while also serving broader public interests and ensuring equitable returns on investment.

B. Specific Features of the Urban Mobility Sector from a Patent Perspective

1. The Role of Startups and the Use of Patents

Startups are key players in driving environmental and sustainability transitions.⁵⁷ Much of the innovation in urban mobility originates from young, high-tech companies with significant growth potential.⁵⁸ These startups deliver innovative solutions in niche markets through disruptive innovation, while also stimulating advancement in larger firms via collaboration, competition, and acquisition.⁵⁹ Their agility enables them to respond quickly to changing urban demands.⁶⁰ EIT Urban Mobility, an initiative of the European Institute of Innovation and Technology, highlights the critical role of startups in accelerating the transition to sustainable and smart cities and retaining their innovation potential within the European Union.⁶¹

With the rise of startups as a global trend, many cities are actively seeking to build strong and supportive environments for them.⁶² Scholars emphasise that radical innovations should be protected and enabled to scale through development, testing, and distribution while installation and operational costs are simultaneously reduced.⁶³

⁵⁵ Tusikov (2024), pp. 383–397.

⁵⁶ Priora and Sganga (2020), Section 5.

⁵⁷ Klaus Fichter et al., “Sustainability Impact Assessment of New Ventures: An Emerging Field of Research,” *Journal of Cleaner Production* 384 (2023)

⁵⁸ Ernesto Cassetta et al., *Emerging Technological Trajectories and New Mobility Solutions*, Transportation Research Part A 106 (2017), p. 3.

⁵⁹ European Commission, *The EU Startup and Scaleup Strategy*, COM(2025) 270 final, 28 May 2025, p.1.

⁶⁰ Agnieszka Skala, “Sustainable Transport and Mobility—Oriented Innovative Startups and Business Models,” *Sustainability* 14, no. 9 (2022), p. 12–15

⁶¹ EIT Urban Mobility, *Impact Report 2024* (2024), p. 5–6, 13.

⁶² Baran and Zhumabaeva (2018), p. 68. with reference to A. Sosnowska et al. (2000).

⁶³ Konstantinos Gkoumas et al., “Towards Climate-Neutral Cities: Resilient, Environmentally Friendly and Energy-Efficient Urban Transport”, in *European Research and Innovation in Support for Sustainable and Smart Urban Mobility*, conference paper, *Transport Transitions: Advancing Sustainable and Inclusive Mobility* (2025), p 427

The EU's startup strategy raises critical questions concerning scalability; however, it predominantly emphasises EU funding mechanisms and academic collaboration, rather than recognising startups as distinct legal and economic entities. This institutional framing raises a fundamental question: are startups just small firms with valuable IP assets, or are they a distinct type of formation that relies on the Mertonian norms of sharing value?⁶⁴ Clarifying this distinction is essential for understanding the legal and structural challenges startups face within the European Union.

Interestingly, there is currently no single, harmonised EU-level definition for startups, scaleups, or innovative companies at the EU level.⁶⁵ The General Block Exemption Regulation (GBER) defines an “innovative enterprise” as a company that meets at least one of the following criteria: it develops substantially new or improved products, services, or processes; spends at least 10% of its operating costs on research and development (R&D); or it has received funding from a recognized EU innovation program.⁶⁶ Studies, however, identify startups as typically small in size, established within the past 5 years, employing between one and ten individuals, and often lacking with limited capital.⁶⁷

In the EU, startups are established at the national level using general legal entity forms (sole proprietorships, limited liability companies),⁶⁸ as there is no unified EU-wide dedicated registration category specifically designated for “startups. Therefore, the legal formation of a startup is, in principle, no different from that of any other company engaging in economic activity. While strong ties to innovation ecosystems, such as university spin-outs, incubators, or public funding programs, can enhance access to resources, their absence, or in other words, organisational independence, should not inherently impede market entry or potential for success.

In recent years, concerns regarding the weak position of startups have become more pronounced. In a Financial Times article, Ann Mettler highlighted Europe's chronic inability to scale startups, describing it as a major threat to economic sovereignty. Mettler criticises the European Commission's startup strategy as inadequate, particularly due to its reliance on traditional top-down political interventions, which she views as counterproductive. She argues that the core problem is a fundamental misunderstanding by public officials of how innovation works, treating startups and large companies as separate entities. Mettler advocates for a private sector-led approach, emphasising stronger connections and cross-fertilisation between startups and established industries, rather than with government.⁶⁹ Startups must be competitive in the market; their survival depends on it. As this paper will demonstrate, IPRs are one of the main instruments enabling startups to achieve this competitiveness.

⁶⁴ Christopher Jon Sprigman, “Are Negative Spaces Likely to Be Fragile?” in *Improving Intellectual Property*, ed. Rochelle Dreyfuss (Edward Elgar, 2024), p. 25, with reference to Merton (1973) Cohen and Walsh (2007).

⁶⁵ European Commission, *The EU Startup and Scaleup Strategy*, COM(2025) 270 final, p. 17.

⁶⁶ Commission Regulation (EU) No 651/2014 (GBER), as amended by Regulation (EU) 2023/1315, article 2.

⁶⁷ Ying Lowrey, *Startup Business Characteristics and Dynamics: A Data Analysis of the Kauffman Firm Survey* (Washington, DC: U.S. Small Business Administration, Office of Advocacy, August 2009), 10–15.

⁶⁸ *Ibid.*, p. 10–15.

⁶⁹ Ann Mettler, “Europe’s Inability to Scale Start-Ups Could Be Disastrous,” *Financial Times*, June 11, 2025, <https://www.ft.com/content/cb86d8aa-03bc-4918-938f-28dbde5d2b5e>, accessed June 12, 2025.

Startups are increasingly perceived as attractive investment targets for foreign investors.⁷⁰ There is a trend of non-EU companies acquiring European startups, with more than six out of ten buyouts involving foreign firms.⁷¹ Which explicitly outline their interest in gaining profit, and not sharing freely the knowledge. Not being able to distribute technologies in the EU, they tend to use mergers and acquisitions as exit strategies to gain profit. Could this be the result of their inability to scale up independently in the EU?

It is widely acknowledged that startups face regulatory complexity and infrastructure gaps.⁷² Many encounter a “first valley of death” when innovations fail to transition from prototype to market-ready products, and a “second valley of death” when companies struggle to scale.⁷³ Despite their high dependence on external funds, startups have limited access.⁷⁴ At the same time, they are often unable to fully exercise the possibility of using IP as collateral.⁷⁵

Horizontally, startups face complex negotiations over IP ownership in collaborations, particularly in co-development or licensing arrangements.⁷⁶ Vertically, limited commercialisation opportunities outside funded innovation clusters, coupled with risk-averse public procurement practices, constrain access to public contracts and scalability for startups.⁷⁷ Fragmented IP management agreements are widely recognised as a major barrier preventing startups from accessing research and technology facilities.⁷⁸

One in four startups in Urban Mobility holds patents (i.e. 25%), which indicates that patenting remains a selective yet critical tool for market positioning, investor attraction, and enhancing post-launch acquisition value.⁷⁹ The main reasons startups secure patents are to gain supply chain control over the supply chain and achieve a competitive edge, allowing them to lead in the development of new technologies and drive more sustainable, decentralised innovation models.⁸⁰ Being an integral part of the innovative economy, startups often leverage intellectual capital and innovations to gain a competitive advantage and to legally safeguard their intangible assets.⁸¹

Startups with more IP assets are more likely to exit successfully: they were 10 times more likely to secure early-stage investment in comparison with startups that did not use robust

⁷⁰ European Commission, The EU Startup and Scaleup Strategy, COM(2025) 270 final, p. 8

⁷¹ *Ibid.*

⁷² EIT Urban Mobility, Impact Report (2024), 5–6, 13, <https://www.eiturbanmobility.eu/knowledge-hub/highlights-report-2024/>

⁷³ European Commission, The EU Startup and Scaleup Strategy, COM(2025) 270 final, p. 3

⁷⁴ *Ibid.*, p. 7-8.

⁷⁵ European Commission, The EU Startup and Scaleup Strategy, COM(2025) 270 final, p. 7-8.

⁷⁶ Priora and Sganga (2025), p. 13-14.

⁷⁷ *Ibid.* p.11.

⁷⁸ Priora and Sganga (2025), p.17.

⁷⁹ Agnieszka Skala, “Sustainable Transport and Mobility—Oriented Innovative Startups and Business Models,” *Sustainability* 14, no. 6 (2022), p. 13.

⁸⁰ Chenyi Liao et al., “Sustainable Future Flight Business Models: Motivations and Barriers,” in *TRAconference 2024, LNMOB*, ed. C. McNally et al. (Springer, 2025), pp. 363–369, https://doi.org/10.1007/978-3-031-85578-8_46.

⁸¹ Agnieszka Baran and Asel Zhumabaeva, “Intellectual Property Management in Startups — Problematic Issues,” *Engineering Management in Production and Services* 10, no. 2 (2018), p. 67.

IP management,⁸² — even with a single patent.⁸³ This shows that IPRs are playing one of the key roles in increasing their value as companies and pursuing profit goals.

Intellectual property rights serve as key economic assets, akin to a product or service, and can be deployed competitively in the marketplace. A patent is a document around which commercial activity can be structured: it has a form of technical specification that serves as a “product passport” or verifies that an idea is established and is unique. Patents are governed by a well-defined regulatory framework under the IP law, which enables the negotiation of contracts, pricing terms, collaboration, alliances, and competition — essential mechanisms for fostering a dynamic and innovative market environment. While having a complicated technical nature, patents are convenient for use in trade matters, transfers, use, etc. They have all elements to carry out commercial transactions and scale.

Therefore, despite their recognised role in driving innovation and sustainability in the UM sector, startups risk being treated as peripheral actors, valued for their ideas but not fully integrated as independent economic entities. They are frequently positioned as knowledge providers for incubators and academia, or as recipients for governmental funding, rather than as self-standing businesses capable of shaping markets. In collaborations with larger companies, they are also seen as donors, rather than partners. This systemic underestimation is exacerbated by fragmented legal definitions, regulatory hurdles, and limited access to capital. In this sense, IP plays a crucial role in startup survival and identification — acting not only as a protective tool but also as a commercial asset, it shows startups' independence, legitimacy, and viability. If startups are to thrive, EU policy should shift from merely funding innovation to recognising startups as equal economic actors, empowered by IP to compete, grow, and lead Europe's technological future.

2. IP Strategies for Startups

As awareness of IP as a development tool grows, startups have begun to pay greater attention to it. While occupying unique niches and creating disruptive solutions, they rely on IP at an early stage as a primary asset and survival strategy.⁸⁴ Competitors, particularly larger companies, can easily copy their ideas. Therefore, IP serves as a strategic tool for protection.⁸⁵ Despite the high costs and legal complexity, IP remains the most effective way to secure technological advances.⁸⁶

Profound IP management demonstrates professionalism and preparedness. It includes monitoring market trends, observing competitors' activities, and adjusting the R&D process through Freedom to Operate (FTO), especially in the early stages.⁸⁷ For example,

⁸² EIT Urban Mobility, Intellectual Property Strategy: Why and How to Use It (2025), 6, <https://www.eiturbanmobility.eu/wp-content/uploads/2025/07/Intellectual-property-strategy.pdf>

⁸³ Hady M. Khawand et al., Intellectual Property and Exit Strategies among SMEs: A Scoping Review and Framework, *World Patent Information* 79 (2024), p. 3–7.

⁸⁴ Baran and Zhumabaeva (2018), p. 68–70.

⁸⁵ Baran and Zhumabaeva (2018), 70–72.

⁸⁶ Baran and Zhumabaeva (2018), 70–72.

⁸⁷ EIT Urban Mobility, Intellectual Property Strategy: Why and How to Use It (2025), 9, <https://www.eiturbanmobility.eu/wp-content/uploads/2025/07/Intellectual-property-strategy.pdf>, slides 28–29.

it may help to change the product to avoid infringing existing third-party IP rights, seek licensing of the IPR owner, or challenge rival patents.

For startups, IP management typically takes the form of a defensive, impromptu or collaborative strategy.

A defensive IP strategy aims to prevent imitation and protect proprietary knowledge, prioritising control over patents rather than revenue generation. This strategy, often associated with closed innovation, frequently employs offensive patenting to secure future value and is prevalent among large R&D-intensive firms and established innovative SMEs in specialised fields.⁸⁸ This strategy is often adopted when a startup has a solid idea and a clear understanding that it will be in demand, making IP protection the main instrument for structured commercialisation.⁸⁹

Impromptu IP strategies typically involve filing patents without a clear plan. This approach reflects a limited focus on IP due to a lack of knowledge and understanding of how IP works. This is the most common strategy among startups.⁹⁰

Collaborative IP strategies leverage patents to build partnerships and generate revenue, often through licensing, and are often associated with open innovation.⁹¹

While SMEs mostly gravitate towards impromptu practices due to resource limitations or lack of awareness, the research findings show that collaborative IP strategies result in better performance and greater investment attractiveness for startups.⁹² However, other research shows that collaborative strategies are less actively used than those with defensive ones in transferring knowledge from the company to its partners.⁹³ This brings to a conclusion that defensive strategies are the most favourable, which is confirmed by the other study, where closed and semi-open IP strategies, especially non-exclusive licensing, are the preferred approaches for green innovations, with preferences varying across different technology domains.⁹⁴

Evolving companies likely use a combination of innovation strategies. Because business in the knowledge economy requires interaction, all firms must capture sufficient value through their patents to be incentivised to collaborate.⁹⁵

There are also other strategies, such as an open strategy, which involves the deliberate voluntary disclosure and free sharing of knowledge, more commonly adopted by digital startups. For example, companies working with open-source software, such as Linux

⁸⁸ Michele Grimaldi, Marco Greco, and Livio Cricelli, "A framework of intellectual property protection strategies and open innovation," *Journal of Business Research* 123 (2021): p. 158-159, 161;

Greco et al., "Unveiling the Relationships among Intellectual Property Strategies, Protection Mechanisms and Outbound Open Innovation," *Creativity and Innovation Management* 31, no. 2 (2022), p. 8; Hady M. Khawand et al., *Intellectual Property and Exit Strategies among SMEs: A Scoping Review and Framework*, *World Patent Information* 79 (2024): 102318, 4–5.

⁸⁹ Grimaldi, Greco, and Cricelli (2021); Greco et al. (2022); Khawand et al. (2024)

⁹⁰ Grimaldi, Greco, and Cricelli (2021); Greco et al. (2022); Khawand et al. (2024)

⁹¹ Grimaldi, Greco, and Cricelli (2021); Greco et al. (2022); Khawand et al. (2024)

⁹² Khawand et al. (2024), p. 5-6.

⁹³ Khawand et al. (2024), p. 4–5; Grimaldi, Greco, and Cricelli (2021), p. 158-161.

⁹⁴ Pratheeba Vimalnath et al., *IP Strategies for Green Innovations – An Analysis of European Inventor Awards*, Centre for Technology Management Working Paper No. 2020/01 (2020).

⁹⁵ *Ibid*, p. 4.

intentionally releases code without access restrictions to encourage external development, leading to shared value creation and technological diffusion.⁹⁶ Given the relatively low cost of software development compared to other sectors, such collaborative innovation becomes feasible. Nonetheless, even in open-source contexts, firms frequently protect commercializable components — especially when open-source technology is integrated into physical or hardware products.⁹⁷ However, an open strategy is more often perceived as an IP environment or ecosystem, in which companies collaborate and interact, which will be covered in the following chapter.

Therefore, IP management is a key aspect of the general R&D startups,⁹⁸ and often depends on the main strategic objectives — whether a startup is aiming to scale and dominate a niche, go public, prepare for an acquisition, or secure sustainable IP returns. For example, WiTricity Corporation — a globally recognised manufacturer of electric vehicle charging equipment was founded in 2007 as a spin-off startup based on a novel wireless power transfer technology patented by a MIT team.⁹⁹ Later, the company structured their operations around IPRs, entering into licensing agreements with companies including Toyota and TDK.¹⁰⁰ Some of their patents are part of the international standards.

Scholars emphasise the need to pay greater attention to exit strategies. As it was said above, startups tend to go for M&A deals and the possibility of profit. Therefore, exit IP strategies should be considered early on to enable the creation of a robust IP portfolio that enhances a startup's valuation. Common exit types include: (1) financial harvest, such as M&As for profit, driven by a strong IP portfolio; (2) stewardship, where focus is on continuity rather than financial gain; and (3) voluntary cessation involving the planned closure after achieving business objectives.¹⁰¹ While financial harvest strategies are typically driven by market value maximisation, stewardship emphasises long-term stability, and voluntary cessation reflects strategic withdrawal, each presenting distinct implications for IP management and the preservation or monetisation of intangible assets.¹⁰²

Bringing technology to market typically involves three key steps: creating awareness and attracting the first customer or investor; securing a deal; and negotiating agreements that convert IP into value.¹⁰³ It means that patents serve a broader strategic function: beyond legal protection, they help formalise R&D, support business development and negotiations, and enable successful commercialisation.

⁹⁶ *Ibid.*, p. 4–5, with reference to Jeyakodi and Ros, 2019

⁹⁷ *Ibid.*, p. 4–5 with reference to Strobel, 2013

⁹⁸ Baran and Zhumabaeva (2018): 71, citing: S. Truskolaski (2014).

⁹⁹ WiTricity, “Company,” accessed August 2, 2025, <https://witricity.com/company>.

¹⁰⁰ WiTricity Corporation, “WiTricity Files Patent Infringement Suit Against Momentum Dynamics; Seeks to Halt Sales of Unlicensed Products and Monetary Damages for Past Use,” WiTricity, December 10, 2020, <https://witricity.com/media/press-releases/witricity-files-patent-infringement-suit-momentum-dynamics-seeks-halt-sales-unlicensed-products-monetary-damages-past-use>.

¹⁰¹ Khawand et al. (2024), p. 4–6, with reference to DeTienne et al (2015) and Cefis (2022)

¹⁰² *Ibid.*

¹⁰³ EIT Urban Mobility, Intellectual Property Strategy: Why and How to Use It, slide 33, last accessed 27 July, 2025 <https://www.eiturbanmobility.eu/wp-content/uploads/2025/07/Intellectual-property-strategy.pdf>

3. Licensing Mechanisms

The UM sector is characterised by the complexity of technology exchange and rapid evolution, driven by diverse actors and their strategies, and by industries and their trends. This makes licensing a core mechanism in innovation contexts involving knowledge sharing, collaboration, and open innovation, as it can “*promote both knowledge sharing and protection*”.¹⁰⁴ Large corporations — and their patent strategies in particular — have played a key role in shaping licensing mechanisms, influencing market dynamics and, specifically, startups. On the one hand, licensing allows startups to transfer technologies without relinquishing ownership, while generating ongoing revenue. On the other hand, it allows them to access essential technologies at minimal cost compared to purchasing IPRs or conducting independent research. However, due to the high amount of patents and stakeholders in the UM sector, individual licensing agreements are rarely used;¹⁰⁵ therefore, analysing dominant licensing mechanisms to understand their characteristics and challenges is essential.

In the context of R&D collaborations, various licensing approaches are used to manage the sharing and protection of intellectual property:

(a) Cross-Licensing

Cross-licensing, often used in patent pools, enables collaborating parties to grant each other rights to use patented technologies. This can involve remuneration-based sharing, which simplifies licensing and reduces administrative costs, or royalty-free licensing arrangements.¹⁰⁶ Patent pools can be managed by a special organisation.¹⁰⁷ They are widely used in the ICT and urban mobility sectors. As an example, Avanci has developed specialised licensing platforms, including the 5G Vehicle program targeting the automotive industry.¹⁰⁸ Such patent pools are reported to reduce transaction costs, provide access via a “one-stop shop” model, and offer assurance through verification by independent experts.¹⁰⁹ This is particularly valuable for startups, which, as new market entrants, typically have limited knowledge of licensing mechanisms. Therefore, such collaboration helps companies balance the IP rights and avoid litigation,¹¹⁰ particularly by mitigating the risk of patent thickets and monopolies.¹¹¹

¹⁰⁴ Bogers (2011), p. 109

¹⁰⁵ Bogers (2011), p. 109

¹⁰⁶ Bogers (2011), p. 109–110.

¹⁰⁷ Goddar, Heinz, Melanie Müller, and Jonathan Porath, Creation and Sharing of Innovations: The Role of Opening Mechanisms Provided by Patent Law, in A Modern Guide to Patents (Edward Elgar, 2025), pp. 324–325p. 337.

¹⁰⁸ Avanci, “5G Vehicle,” *Avanci*, accessed August 6, 2025, <https://www.avanci.com/vehicle/5gvehicle/>; Fidelice Opany, The Search for an Optimal Framework for Licensing Standard-Essential Patents: Is Collective Licensing a Solution? (2025), p. 5.

¹⁰⁹ Fidelice Opany, The Search for an Optimal Framework for Licensing Standard-Essential Patents: Is Collective Licensing a Solution? (2025), pp. 4–5

¹¹⁰ Heinz Goddar, Melanie Müller, and Jonathan Porath, Creation and Sharing of Innovations: The Role of Opening Mechanisms Provided by Patent Law, in A Modern Guide to Patents (Edward Elgar, 2025), p. 324–325.

¹¹¹ Goddar, Müller, and Porath (2025), p. 324–325.

However, this approach can also lead to mutual dependency among licensees and "lock-in".¹¹² Additionally, it may raise antitrust concerns by enabling collusion or price fixing among members.¹¹³ For example, the Avanci patent pool centralises licensing of 4G and 5G SEPs and sub-licenses them to major implementers, with 80–85% of connected cars reportedly covered by its licences. While it simplifies access, this concentration raises concerns about potential anticompetitive effects.¹¹⁴ Moreover, empirical data show that only a small fraction of declared SEPs are licensed through pools, more related to the ICT sector;¹¹⁵ however is still a part of the UM system. Scholars broadly support the idea that a public collective licensing agency — modelled in part on collective rights organisations in copyright — could offer an effective solution for facilitating FRAND licensing.¹¹⁶ Therefore, patent pools for cross-licensing are not panaceas. It is highly important for startups operating in the urban mobility sector to include all critical aspects of possible advantages and disadvantages, while operating with such a licensing mechanism.

(b) Royalty-free licenses

In royalty-free licenses, users do not pay ongoing fees for exploiting IPRs. Such licenses are commonly used within open innovation contexts, or to promote the widespread dissemination of a technology to establish it as a new standard.¹¹⁷ While some examples of royalty-free licensing models have proven successful (e.g. Tesla pledges, Linux), others illustrate their limitations. The Eco-Patent Commons (2008-2016) initiative ultimately failed despite its ambitious goals, highlighting that open access alone does not guarantee effective technology transfer or innovation uptake. Key reasons include the absence of a system to track patent usage, a lack of effective technology transfer mechanisms, and inadequate digital infrastructure.¹¹⁸ Additionally, firms bore the full cost of patent maintenance while providing their IP to competitors on a royalty-free basis.¹¹⁹

Royalty-free licenses can be part of cross-licensing among multiple parties or can be derived from a single company. Despite their philanthropic nature, such licenses can contain restrictions that may later hinder a licensee's market expansion. For instance, Renault grants under its Patent License Agreement¹²⁰ royalty-free use of its patents related to EV firefighter access. In exchange, licensees must make any patented improvements derived from the licensed technology available to third parties on similar royalty-free terms. The license is also non-transferable.¹²¹ This case creates uncertainty over patent scope and IP chain of title, leaving the intellectual property status unresolved

¹¹² Goddar, Müller, and Porath (2025), p. 324–325.

¹¹³ Opany (2025), p. 5

¹¹⁴ Goddar, Müller, and Porath (2025), p. 337.

¹¹⁵ Opany (2025), p. 5

¹¹⁶ Opany (2025), p. 5.; Expert Group on Licensing and Valuation of Standard Essential Patents, Contribution to the Debate on SEPs (European Commission, 2021), Proposal 74.

¹¹⁷ *Ibid*.

¹¹⁸ Vimalnath et al. (2020), pp. 9–10. with reference to Bowman, 2009, Contreras et al., 2018

¹¹⁹ Contreras et al., IP Strategies for Green Innovations – An Analysis of European Inventor Awards, Centre for Technology Management Working Paper No. 2020/01 (2020), p. 10.

¹²⁰ Renault Group, Patent Licence Agreement – Fireman Access Program, 2024, <https://cdn.group.renault.com/ren/master/renault-new-cars/editorial/discover-renault/safety/unpatent/universalpatent-contrat.pdf.asset.pdf/40ebd7ad70.pdf> (accessed August 6, 2025)

¹²¹ Renault Group, PLA, Articles 3–4, 2024

and limiting its commercialisation potential. Additionally, Renault's licensing agreement requires licensees to acknowledge the company's name and trademark¹²², which may create obstacles in future partnerships with competing firms. Moreover, Renault will not provide any further technological support or documentation to licensees beyond the granted patents,¹²³ which may result in limited technical support and maintenance of the technology. Furthermore, when operating under royalty-free licensing, startups must scrutinise contractual terms to ensure they can commercialise their innovations without being locked into specific technological platforms.

(c) FRAND Licensing

FRAND licenses are voluntary pledges by patent holders to offer standard-essential patents (SEPs) on fair, reasonable, and non-discriminatory terms.¹²⁴ They are governed by the principles of fair, reasonable, and non-discriminatory (FRAND) licensing, limiting exclusivity to ensure broader access and foster innovation. These conditions, though not established by law, were developed by practices, market demand, and competition principles and have been affirmed in case law and administrative decisions — notably the CJEU's *Huawei v ZTE* ruling¹²⁵ and the European Commission's antitrust decisions in the Motorola and Samsung cases.¹²⁶

The CJEU's *Huawei v ZTE* case¹²⁷ defined SEPs as patents whose use is indispensable for compliance with a technical standard. SEPs, while vital for enabling sustainable mobility and energy systems, especially via interoperability standards,¹²⁸ have become central to numerous disputes, bringing uncertainties due to their controversial nature and lack of regulation. According to critics, the 2023 SEP Regulation Proposal, which was withdrawn in 2025, risked undermining the IP positions of SMEs and startups, while lobbying the interests of large technology firms through industry associations.¹²⁹ Therefore, they are governed by contract agreements in the horizontal dimension, which creates uncertainty for startups regarding how the licensing process will vary from one SEP holder to another. For example, there is a legal distinction between permissible experimentation to verify a patent's integrity and typical R&D activities, where companies design or test products based on standards. Using standardised, patented technology without a license — even in the context of R&D — may infringe a SEP if it exceeds the scope of experimental use. For example, ETSI's policy states that "*the only way to avoid the violation of this IPR in respect*

¹²² Renault Group, PLA, Article 8

¹²³ Renault Group, PLA, Article 3

¹²⁴ Srividhya Ragavan, Brendan Murphy, and Raj Davé, "FRAND v. Compulsory Licensing: The Lesser of the Two Evils," *Duke Law & Technology Review* 14, no. 1 (2017), p. 91–92

¹²⁵ Case C-170/13 *Huawei Technologies Co. Ltd v ZTE Corp.* [2015] ECLI:EU:C:2015:477.

¹²⁶ European Commission, Summary of Commission Decision of 29 April 2014 relating to a proceeding under Article 102 of the Treaty on the Functioning of the European Union and Article 54 of the EEA Agreement (Case AT.39985 — Motorola — Enforcement of GPRS Standard Essential Patents), 2014/C 344/06, OJ C 344, October 2, 2014

¹²⁷ Case C-170/13 *Huawei v ZTE*

¹²⁸ Enrico Bonadio, Nicola Lucchi, and Dyuti Pandya, "Can Standard Essential Patents Accelerate Ecological Transition?," *Kluwer Patent Blog*, January 25, 2024

¹²⁹ Damien Geradin, *Anatomy of a Car Crash: The European Commission's Decision to Withdraw its Big Tech Friendly Proposed SEP Regulation* (2025), pp. 4–5, 16–17

*of the implementation of the standard is therefore to request a license from the owner."*¹³⁰

In this case, the provision of explicit permission regarding the use of standardised technology models in construction software could be a solution. However, the following risks may arise: SEP holders can require disclosure, e.g. details on how the standard is used, product architecture, design drawings, source code fragments, revenue models or user base, which can compromise the integrity of inventions. Based on this example, it's evident that the industry, rather than regulation, shapes and governs IP relationships among its actors.

(d) Compulsory Licensing

There is also a type of license that is different from others due to its statutory nature (Paris Agreement, TRIPS, national law) — compulsory licensing (CL). It is a governance tool used to safeguard access to technologies, facilitate fair pricing negotiations and enhance access to essential innovations.¹³¹ It refers to involuntary, state-imposed contracts that compel patent holders to license their invention in the interest of public benefit and access to essential technologies, particularly in critical sectors such as energy, thereby limiting the patent holder's exclusive rights.¹³² Although compulsory licensing limits patentees' control, some scholars argue that broader market reach can offset potential losses, and that globalisation may help preserve innovation incentives through fixed royalty arrangements, thereby avoiding costly disputes.¹³³

Governments may adjust IP rights in vital sectors to serve the public interest and prevent abuse¹³⁴. Patent exceptions are permitted under TRIPS¹³⁵, provided that such exceptions do not unreasonably prejudice the patent holder's interests. For a European Patent with Unitary Effect (EPUE), applicable exceptions include private non-commercial acts, experimental use, and lawful decompilation of software, as well as other exceptions related to pharmaceuticals and transport.¹³⁶ "Other use" of a patent can also refer to government use,¹³⁷ for which adequate remuneration is provided, as determined by a court or a minister.¹³⁸ It can also be used to prevent an initial patent from blocking "follow-on" innovation¹³⁹. CL can provide secondary innovators with the legal certainty needed to commercialise their improvements. In exchange, the initial innovator's interests are protected by giving them the right to a cross-license.¹⁴⁰

¹³⁰ European Telecommunications Standards Institute. Guide on Intellectual Property Rights (IPRs). Version adopted by Board #133, 10 June 2021. Last updated 12 December 2022. Accessed August 3, 2025. <https://www.etsi.org/images/files/IPR/etsi-guide-on-ipr.pdf>.

¹³¹ Duncan Matthews, Esther van Zimmeren, and Timo Minssen, "Using compulsory licences as a governance tool: The need for greater effectiveness and policy coherence," in *Research Handbook on Intellectual Property and Access to Medicines* (Edward Elgar, forthcoming), (2023), p. 62

¹³² Srividhya Ragavan, Brendan Murphy, and Raj Davé, "FRAND v. Compulsory Licensing: The Lesser of the Two Evils," *Duke Law & Technology Review* 14, no. 1 (2017), p. 109

¹³³ Ragavan (2017), p.109–112

¹³⁴ Paris Agreement Article 5a, TRIPS Article 8

¹³⁵ TRIPS Article 30

¹³⁶ UPCA Article 27

¹³⁷ Matthews, van Zimmeren, and Minssen (2024) p. 62, p. 64.

¹³⁸ *Ibid*, p. 65-66.

¹³⁹ Goddar, Müller, and Porath (2025), p. 337

¹⁴⁰ *Ibid*

Some scholars emphasise, on hand, compulsory cross-licensing helps SMEs access innovation-driven markets like 5G and AI, reducing dependence on dominant patent holders. On another hand, while it promotes fair competition and legal access, legal uncertainty remains due to courts' discretion in setting royalty rates and the requirement of prior failed negotiations before a license is granted.¹⁴¹

Compulsory licensing has gained renewed attention in recent years in the context of international harmonisation. While historically associated with public health, CL now has potential application in other areas of significant public interest, such as green technologies, climate solutions, and clean infrastructure.¹⁴² The recent opinion of the International Court of Justice (ICJ) underscores that states have a duty under international law to limit emissions, both collectively and individually. This can reinforce the legal basis for compulsory licensing of green technologies, where the withholding of patented climate solutions would conflict with a state's duty to prevent environmental harm and fulfil its international climate obligations.¹⁴³

(e) Other Licensing Mechanisms

Startups should also be aware of other licensing options. It is important to note that different licensing mechanisms can coexist and intersect.

An umbrella agreement refers to a less formal licensing arrangement that broadly outlines terms for knowledge sharing within a collaboration without specifying every individual transfer.¹⁴⁴

A grant-back license requires the licensee to grant the licensor rights to any improvements they develop in relation to the licensed technology, and may include provisions regarding exclusivity or sub-licensing rights.¹⁴⁵

(f) Challenges in Licensing Mechanisms

Licensing faces key challenges, notably the disclosure dilemma — revealing knowledge to demonstrate value risks unintended knowledge transfer.¹⁴⁶ For startups, this results in high transaction costs and a closed-loop problem: they must secure funding for validation or seek support while protecting their core knowledge.

While SEPs offer FRAND licensing terms and established dispute resolution paths, restrictive licensing remains a key issue in sectors such as urban mobility, where interoperability is essential. This highlights how gaps in patent law's regulation of horizontal relationships between market actors can hinder access to critical services.¹⁴⁷

¹⁴¹ Goddar, Müller, and Porath (2025), p. 324–328

¹⁴² AIPPI. Summary Report on Compulsory Licensing (SQ293). 2023. Available at: <https://www.aippi.org/news/summary-report-on-compulsory-licensing-sq293> (accessed 6 August 2025).

¹⁴³ International Court of Justice, Obligations of States in Respect of Climate Change, Advisory Opinion, Summary 2025/1, July 23, 2025; United Nations, "States have legal obligation to act on climate change: UN court," UN News, July 24, 2025, <https://news.un.org/en/story/2025/07/1165475> (accessed August 6, 2025)

¹⁴⁴ Bogers (2011), p. 109–110.

¹⁴⁵ *Ibid*

¹⁴⁶ Bogers (2011), p. 96

¹⁴⁷ Van Overwalle and Van Zimmeren (2009), p. 426

Patent thickets and royalty stacking, where overlapping IP rights require multiple, costly licenses, can impede innovation and block access to key technologies.¹⁴⁸ Although originally observed in healthcare, these barriers also hinder innovation and access in urban mobility. Collaborative models like patent pools aim to reduce costs and improve access, yet structural licensing barriers persist despite ongoing standardization efforts.¹⁴⁹ Wireless EV charging exemplifies a patent thicket, with overlapping rights held by firms such as WiTricity and Qualcomm, creating licensing complexities and hindering interoperability in smart mobility.

Co-owned patents present licensing challenges,¹⁵⁰ particularly in coupled open innovation settings. Mandatory co-owner consent — required in jurisdictions such as France, even for non-exclusive licenses — can reduce flexibility and discourage the use of IP.¹⁵¹ Unclear ownership in patent registries also undermines third-party confidence and hinders licensing transactions.¹⁵²

Since licensing is based on a contractual agreement between parties, obligations may persist even after a change of status of the underlying IP rights, including even in cases of revocation. The CJEU's decision in *Genentech v. Hoechst*¹⁵³ established that a licensee may still be obligated to pay royalties on a revoked patent if the licensing agreement does not contain specific termination clauses. This highlights that while contract terms govern enforceability, they do not affect the validity of a patent after revocation. Therefore, licensees must include appropriate safeguards in their licensing agreements, particularly for SEP portfolios.

Studies also reveal that licensing in UM, in light of ubiquitous digitalisation, does not have fertile ground for spreading. Software and data tools are integral to UM innovation; however, as they are often developed within collaborative or publicly funded frameworks, they tend to be highly context-specific and difficult to license beyond the original project.

¹⁵⁴

Moreover, stakeholders often view IP costs as disproportionate compared to potential returns making licensing less attractive. Startups may lack resources, while public actors prefer openness. As a result, the sector prioritises standardisation and interoperability over exclusivity, making urban mobility more of an IP-negative space.¹⁵⁵ This creates gatekeeping through social and reputational norms and continuous technological upgrades. As Sprigman noted, reliance on reputation rather than formal rights can still restrict access for startups.¹⁵⁶ If open-access becomes the new market norm, startups

¹⁴⁸ *Ibid.*, p. 425

¹⁴⁹ *Ibid.*, p. 432

¹⁵⁰ Bogers (2011), p. 109

¹⁵¹ Arina Gorbatyuk, Geertrui Van Overwalle, and Esther van Zimmeren, Intellectual Property Ownership in Coupled Open Innovation Processes, IIC 47 (2016), p. 276–278

¹⁵² Gorbatyuk et al (2016), p. 291

¹⁵³ *Genentech, Inc. v. Hoechst GmbH*, Case T-91/07, Judgment of the General Court (Seventh Chamber), 12 December 2014, ECLI:EU:T:2014:1039.

¹⁵⁴ Priora and Sganga(2020), p. 156-160.

¹⁵⁵ Priora and Sganga(2020), p. 156-160.

¹⁵⁶ Sprigman (2024), 24–27, with reference to Robert K. Merton (1973), Wesley Cohen & John P. Walsh (2007), and Dotan Oliar & Christopher Sprigman (2008).

relying on traditional, proprietary innovation models could face significant barriers. They risk being excluded from collaborations, lacking IPRs as strategic tools for survival, or being perceived as illegitimate if they fail to conform to the established environment. This issue is particularly salient in urban mobility, where open access to platforms and data is becoming an essential component of innovation ecosystems. Scholars argue that relaxing intellectual property rights may reduce innovation incentives and the potential for rewards, especially in dynamic sectors such as UM and renewable energy.¹⁵⁷

The existence of open knowledge-sharing practices and "negative IP spaces" can help explain why some studies find no significant correlation between the number of green patents and the emergence of green startups (see Colombelli et al. (2025)).¹⁵⁸ In short, the rise of negative IP spaces can both challenge and replicate traditional IP forms. For startups in urban mobility, survival may increasingly depend not solely on licensing strategy, but also on their ability to navigate and conform to the normative ecosystems shaped by these IP spaces.

C. Preliminary Conclusions

For startups operating in the urban mobility sector, licensing is not merely a tool for accessing or monetising innovation—it is a strategic necessity shaped by complex ecosystems dominated by larger actors and evolving regulatory standards. When developing their IP strategies, startups must consider key factors such as the types of licensing mechanisms available (e.g. cross-licensing, FRAND terms, royalty-free models, and compulsory licensing), the potential presence of patent thickets or SEP-related obligations, and their position within the value chain. They must also evaluate how to retain sufficient control over their IP while enabling collaboration and compatibility, particularly when entering public-private partnerships or integrating standardised solutions. Critical decisions include whether to engage in open licensing, how to structure exclusivity provisions, and how to manage improvements and grant-back clauses. A lack of clarity regarding IP ownership, co-owned patents, or poorly negotiated licenses may hinder a startup's growth, restrict access to future funding, or create dependencies on dominant firms. Therefore, an informed, flexible, and context-aware IP strategy is essential for startups to survive and thrive in the innovation-driven yet structurally constrained UM sector. Obligations may remain binding even after patent revocation, underscoring the need for startups to negotiate robust contractual safeguards. Meanwhile, the rise of open, shared ecosystems — where interoperability, open platforms, and software tools are prioritised — poses an identity challenge: startups that rely on proprietary models may find themselves marginalised if they fail to conform to reputational and access-based norms. So far, effective IP strategies for startups must be both legally sound and ecosystem-aware, enabling them to navigate the complex landscape of gaps, pit stops, and hurdles inherent in urban mobility .

¹⁵⁷ Pratheeba Vimalnath et al., *IP Strategies for Green Innovations – An Analysis of European Inventor Awards*, Centre for Technology Management Working Paper No. 2020/01 (2020), p. 5 with reference to Beldiman, D. (2018); Percival, R.V. & Miller, A. (2011), 20.

¹⁵⁸ Alessandra Colombelli et al., "Knowledge Spillovers, Green Entrepreneurship and the Demand for Sustainability," *Journal of Technology Transfer* (2025) 25–26

The following chapter examines the main horizontal IP spaces to explore how IPRs are used in practice and how they shape urban mobility, and identifies challenges that extend beyond the operational and strategic level of the startup.

III. Navigating IP spaces in Urban Mobility

Understanding the innovation transfer in urban mobility means looking at diverse actors and their interactions. For startups, it is especially important to observe how robust IP strategies of large key players are shaping the market, business relations, and using their patents as a "knowledge-based capital".¹⁵⁹ Large corporations leverage IP and data ownership to exert market power in smart cities. They use tactics like creating 'patent thickets' to block competitors and capture a disproportionate share of value, creating their economic dominance over key technologies.¹⁶⁰

Examining these approaches will help identify systemic asymmetries and barriers that arise in horizontal relationships, enabling startups to adjust their IP strategies to effectively position themselves within the complex dynamics of the urban mobility sector.

A. Patent Fences and Thickets

Patent fences and patent thickets are related concepts in IP strategy. In a patent fence, a firm blocks competitors by filing multiple related patents around a core invention. A patent thicket, however, is a bunch of overlapping patents held by different entities, making commercialisation difficult, and can appear in complex telecom or urban mobility sectors (e.g., 5G, ITS), often without intention.

"Patent fences" often are built by companies like Tesla and WiTricity that file patents to build to secure their innovations and market position. Tesla has more than 4000 patents in total.¹⁶¹ WiTricity has a portfolio exceeding 1,000 global patents.¹⁶² Chinese company BYD has a portfolio of 20,000 global patents spanning critical EV sub-technologies, such as battery chemistries, energy recovery, and drive systems, which gives the company more assets to leverage in litigation, licensing, and cross-licensing negotiations, and more protection across diverse jurisdictions.¹⁶³

However, not only can the quantity of patents cause potential challenges, but also the quality of patents, articulated in their vague claims, sometimes intentionally, can block

¹⁵⁹ OECD/Eurostat, Oslo Manual 2018: Guidelines for Collecting, Reporting and Using Data on Innovation, 4th ed. (Paris/Luxembourg: OECD Publishing/Eurostat, 2018), p. 85–92.

¹⁶⁰ Tusikov (2024), p. 390.

¹⁶¹ Greyb, "Tesla Patents – Every Patent Filed by Tesla [Updated 2023]," GreyB Insights, accessed July 31, 2025, <https://insights.greyb.com/tesla-patents/>.

¹⁶² WiTricity Corporation, "WiTricity Files Patent Infringement Suit Against Momentum Dynamics; Seeks to Halt Sales of Unlicensed Products and Monetary Damages for Past Use," WiTricity, December 10, 2020, <https://witracity.com/media/press-releases/witracity-files-patent-infringement-suit-momentum-dynamics-seeks-halt-sales-unlicensed-products-monetary-damages-past-use;>

WiTricity Corporation, "IP Portfolio," accessed August 8, 2025, <https://witracity.com/innovation/ip-portfolio#:~:text=Licensing,to%20discuss%20potential%20licensing%20agreements.>

¹⁶³ 20,000 patents spanning critical battery chemistries, energy recovery, and drive systems

market access and deter commercialisation.¹⁶⁴ The so-called “bad patent fences”, which have unclear claims, vague ownership and indexing, create lots of confusion and uncertainty.¹⁶⁵ Scholars mentioned that the massive expansion of patents has triggered growing concern over the *quality* of granted patents. Critics argue that the overwhelming volume of applications has, in some cases, resulted in a proliferation of low-quality or overly broad patents, potentially undermining the system’s legitimacy and hindering innovation.¹⁶⁶ Scholars have cautioned that exclusive property rights may, in certain cases, obstruct the effective use of assets when overlapping private rights prevent efficient resource integration.¹⁶⁷ Today, this situation is increasingly visible in innovation-heavy sectors such as biotech, ICT, and urban mobility, e.g. the battery EV management systems, including Standard Essential Patents (SEPs), creating “bottlenecks”.¹⁶⁸

All situations can end up in ‘hold-up’ scenarios, where startups are unexpectedly accused of infringement after they have made sufficient financial and timing investments.¹⁶⁹ A patent holder can demand excessive royalties due to the threat of an injunction, leading to a “royalty stacking” situation.¹⁷⁰ Besides costly disputes, startups can face the risk of termination of existence, debts, or forced sale. Such tension in the IP arena in UM leads to high costs for Freedom to Operate (FTO) analyses.¹⁷¹

Patent with vague claims a patent can be revoked due to a lack of patentability: in *ChargePoint v. SemaConnect (2019)*¹⁷² case the Federal Circuit dismissed ChargePoint's patent infringement suit, ruling its EV charging station patent's claims were merely an abstract idea of network communication to control electricity,¹⁷³ lacking any inventive concept beyond applying generic components to a known domain.¹⁷⁴ The same happened in *WiTricity Corp. v. Momentum Dynamics Corp. (2021)*.¹⁷⁵ However, such occasions can be turned into a deliberate strategy — the 2024 settlement between Compleo Charging Solutions and S.A.F.E. e.V. revealed a tactical move: Compleo gave up enforcement of its

¹⁶⁴ Van Overwalle & van Zimmeren 2009, 424; with reference to Hall et al. 2003, 2–3

¹⁶⁵ Penin and Neicu (2018), p. 60–64.

¹⁶⁶ Van Overwalle & van Zimmeren (2009), with references to Eisenberg 1996; McManis and Noh 2006; Adelman 2005; EPO 2007; Doern 2009

¹⁶⁷ Van Overwalle and van Zimmeren, “Functions and Limits of Patent Law,” (2009), p. 418, with reference to Heller and Eisenberg 1998;

¹⁶⁸ Xiaotao Li and Xiaodong Yuan, “The Diversity and Coincidence of Patent Thickets: A Case of Battery Electric Vehicle Technology,” *Technology Analysis & Strategic Management* 35, no. 7 (July 2023)

¹⁶⁹ Penin and Neicu (2018), p. 72.

¹⁷⁰ Mark A. Lemley and Carl Shapiro, “Patent Hold-Up and Royalty Stacking,” UC Berkeley, January 10, 2007, p. 2.

¹⁷¹ Penin and Neicu (2018), p. 66–73.

¹⁷² *Case ChargePoint, Inc. v. SemaConnect, Inc.*, No. 18-1739 (Fed. Cir. 2019)

¹⁷³ Charging Ahead or Slowing Progress? The Patent Battles Shaping EV Infrastructure,” NL Patent, accessed July 25, 2025, <https://www.nlpatent.com/post/charging-ahead-or-slowing-progress-the-patent-battles-shaping-ev-infrastructure#:~:text=ChargePoint%20filed%20a%20lawsuit%20against,Appeals%20for%20the%20Federal%20Circuit.>

¹⁷⁴ The Mayo/Alice two-step framework assesses patent eligibility under 35 U.S.C. § 101. Step one asks whether the claim is directed to a patent-ineligible concept (e.g., an abstract idea or law of nature). If so, step two evaluates whether the claim contains an “inventive concept” that transforms it into a patent-eligible application beyond conventional or generic implementation.

¹⁷⁵ U.S. District Court for the District of Delaware, *WiTricity Corporation et al v. Momentum Dynamics Corporation*, Case No. 1:20-cv-01671, https://www.govinfo.gov/app/details/USCOURTS-ded-1_20-cv-01671.

patents to avoid legal risks posed by S.A.F.E.'s validity challenge.¹⁷⁶ It is an assumption that a company may use this action, showing collaborative intention, thereby improving its public and regulatory image, while saving IP assets.

As scholars point out, low-quality patents, characterised by a lack of novelty, inventive step, or clear claims, undermine patent law's core objective of promoting innovation and R&D, as it can slow the pace of new technologies and investment in their commercialisation by creating uncertainty for inventors.¹⁷⁷

B. Open Innovation and Collaborations in Urban Mobility

Local municipalities serve as the main intermediary between private companies and end-users, or citizens. Both cities and residents are equally interested in lower prices and high-quality, innovative products and services, while simultaneously demanding a shift towards sustainability. This presents a complex challenge, but the market has responded by forming unique ecosystems where technologies are exchanged to reduce development costs, enhance quality, and keep pace with trends to stay ahead of competitors. This dynamic creates a dual incentive: a pursuit of the common good on one hand, and a push for competitive innovation on the other. This is close to the concept of open innovation (OI). Patents also fully disclose an invention, allowing society to stay informed of trends; however, they still preserve a monopoly and the right to remuneration. OI includes various forms of knowledge exchange, with an award and free royalties. By examining different modes of OI, it is possible to analyse how this situation has influenced the formation of intellectual property spaces, what benefits startups can gain, and what pitfalls they should be wary of.

Collaboration and knowledge sharing are fundamental ideas of OI. Within the UM sector, replicating successful “living labs” and “lighthouse projects” is a widespread principle, where collective problem-solving is prioritised over exclusive rights.¹⁷⁸ In addition, traditional private companies, which are not focused by nature on innovation and disruptive technologies, are also willing to integrate innovative technologies into their supply chains to stay competitive in the rapidly changing UM sector.¹⁷⁹ Both public and private sectors are interested in standardising the innovation to make it easier and cheaper to scale. Therefore, free knowledge sharing and complementarity a key in collaborations, since the ultimate goal is to create a ubiquitous standard.¹⁸⁰ In response to the limitations of the traditional closed IP model, Chesbrough proposed open innovation in 2003. This concept involves organisations collectively sharing knowledge, technologies, and intellectual property through networks and platforms to drive innovation and growth.

¹⁷⁶ Compleo Charging Solutions AG, “SAFE: The New Secure Communication Standard for EV Charging,” Press Release, March 22, 2022, https://www.compleo-charging.com/en/company/press/pressdetail?tx_news_pi1%5Baction%5D=detail&tx_news_pi1%5Bcontroller%5D=News&tx_news_pi1%5Bnews%5D=512&cHash=19c8569bc1ea30fcfe67e472cdb372d9 (accessed July 26, 2025).

¹⁷⁷ Van Overwalle and Van Zimmeren (2009), 425.

¹⁷⁸ Priora and Sganga(2020), p.161–162

¹⁷⁹ Cassetta et al., p. 9–10, referencing Dilk et al. (2008); Dodourova and Bevis (2014); Karlsson and Sköld (2013).

¹⁸⁰ Marcel Bogers, “The Open Innovation Paradox: Knowledge Sharing and Protection in R&D Collaborations,” *European Journal of Innovation Management* 14, no. 1 (2011), p. 101

This includes sharing best practices and strategies, moving beyond restrictive IP practices.¹⁸¹

Patent monopoly is seen as the reward that society pays for an invention to be publicly disclosed and comprises, by nature, a “closed model” of cooperation.¹⁸² As a result, IP rights generally make inventions more expensive and less accessible.¹⁸³ Studies show that firms tend to favour formal IP agreements over just simple, broad disclosure and free sharing of information.¹⁸⁴ Additionally, IP signals a firm's expertise and draws in potential collaborators.¹⁸⁵

However, a startup can slow down its activity with a “no patent, no talk” syndrome, which prevents any engagement with external entities that might jeopardise technology without protection.¹⁸⁶ Formal IP protection can result in prolonged and expensive negotiations, potentially restricting partners from utilising each other's technology and delaying technology deployment.¹⁸⁷ Additionally, startups tend to resist external ideas (“not invented here” or NIH) or are hesitant to share their own (“not sold here” or NSH), which can leave technology unused. These syndromes stem from fears of losing competitive advantage, legal disputes, or IP leakage.¹⁸⁸ Researchers suppose that establishing both formal (e.g., patenting, contracts, NDAs) and informal (e.g., trust-building routines) structures will reduce fears of knowledge and intellectual property misuse, loss of ownership, or reputational harm.¹⁸⁹ Therefore, the IP strategy of Startup shall include clarifying boundaries of ownership, protecting contributors, and creating trust partnerships over time.¹⁹⁰ However, even with alignment of goals, the reward and recognition aspects (NIH/NSH) remain, as otherwise, companies would move to an open-free-sharing model.

Another problem for a startup can arise when the costs of enforcing intellectual property are so high, and the benefits of a monopoly so low, that a competitor copying the invention does not cause significant economic damage.¹⁹¹ When patenting negatively impacts a firm's turnover due to high costs, long procedures, and a reluctance to engage in costly legal disputes and creates inefficiency in the fast-changing UM industry, startups can end

¹⁸¹ Henry Chesbrough, *Open Innovation: The New Imperative for Creating and Profiting from Technology* (Boston: Harvard Business School Press, 2003); Fernando Almeida, “Causes of Failure of Open Innovation Practices in Small- and Medium-Sized Enterprises,” *Administrative Sciences* 14, no. 3 (2024): 9–13, <https://doi.org/10.3390/admsci14030050>; Priora and Sganga (2020), p. 159-160

¹⁸² Nicola Dimitri, “Intellectual Property Rights in the EU Pre-Commercial Procurement for Innovation,” *Journal of Strategic Contracting and Negotiation* 4, no. 3 (2020): 186–199, p.187

¹⁸³ Priora and Sganga (2020), Section 3.

¹⁸⁴ Grimaldi et al. (2021), p. 157, with references to Hsu & Ziedonis, 201; Alexy et al., 2009; Hagedoorn and Zobel (2015);

¹⁸⁵ Ellen Enkel, Henry Chesbrough, and Oliver Gassmann. “Open R&D and Open Innovation: Exploring the Phenomenon.” *R&D Management* 39, no. 4 (2009)

¹⁸⁶ Grimaldi et al. (2021), p. 157 with reference to Alexy et al. (2009)

¹⁸⁷ *Ibid*

¹⁸⁸ Marie Amann et al., *Mitigating Not-Invented-Here and Not-Sold-Here Problems: The Role of Corporate Innovation Hubs*, *Technovation* 111 (2022): 102377, 2-4, with reference to Chesbrough; Fernando Almeida, “Causes of Failure of Open Innovation Practices in Small- and Medium-Sized Enterprises,” *Administrative Sciences* 14, no. 3 (2024), p. 9

¹⁸⁹ Amann et al. (2022), p. 12–13.

¹⁹⁰ *Ibid*

¹⁹¹ Priora and Sganga (2020), Section 3.

up in the "Negative IP Space" and the "knockoff economy".¹⁹² This concept refers to space, where participants are driven by a culture of "productive infringement" (mutual copying), recognition and community contribution, rather than exclusive rights.¹⁹³

Startups may benefit from reduced costs related to acquiring and enforcing IP rights, allowing them to focus only on research and innovation,¹⁹⁴ imitation, and improvement.¹⁹⁵ In network collaborations, free use can boost adoption, leading to profits from complementary services.¹⁹⁶ Additionally, this Negative IP Space model can work in hard-to-replicate technologies — startups can rely on being first to market rather than on IP exclusivity.¹⁹⁷ Additionally, the sector is changing so fast that the time of patent protection within twenty years may not always be relevant for some technologies. On top of that, a patent backlog limits green mobility innovation by delaying deployment of critical technologies.¹⁹⁸

While many studies focus on digital mobility, it should be taken into account that the hardware part is more complex and fundamental, and needs more resources. Hardware-based startups (vehicles, charging infrastructure), while being fully integrated with software, face significant funding gaps due to high costs and slow profitability, despite offering greater environmental benefits. Conversely, solely digital service startups achieve profitability more easily through their intangible development process.¹⁹⁹ Therefore, in the case of hardware inventions, a startup might not be interested in sharing the technology based on the Negative IP approach.

According to studies, open innovation alone does not significantly enhance SMEs' performance unless they appropriately use IP protection mechanisms;²⁰⁰ meanwhile, SMEs often neglect using patents.²⁰¹ In Open innovations, IPRs are shared through licensing, co-ownership, or partnership R&D agreements.²⁰² For startups, exclusive rights provide significant bargaining power, allowing them to safeguard their interests while limiting access to powerful competitors.²⁰³ Therefore, IP protection mechanisms play a crucial role in managing the tension between safeguarding innovations and enabling knowledge exchange.²⁰⁴

Therefore, it shall be pointed out that, in open innovations, startups don't have to choose between mandatory sharing of all their knowledge or maintaining full legal control over

¹⁹² Alexander Brem, Petra A. Nylund, and Emma L. Hitchen, *Open Innovation and Intellectual Property Rights: How Do SMEs Benefit from Patents, Industrial Designs, Trademarks and Copyrights?*, Management Decision 55, no. 6 (2017), p.12; Priora and Sganga (2020), Section 3

¹⁹³ Priora and Sganga (2020), Section 3.

¹⁹⁴ *Ibid.*, 154, 156

¹⁹⁵ *Ibid.*, 147.

¹⁹⁶ *Ibid.*, 150.

¹⁹⁷ *Ibid.*, 150.

¹⁹⁸ Prajapati et al (2024),. Section 5.

¹⁹⁹ Baran and Zhumabaeva (2018), p. 16

²⁰⁰ Brem, Nylund, and Hitchen (2017), p. 11

²⁰¹ *Ibid.*, p. 4-6

²⁰² Chesbrough (2003); Penin and Neicu(2018), p. 61-62

²⁰³ *Ibid.*

²⁰⁴ Greco et al. (2022), p. 377, citing Aquilani et al. (2017), p. 376, Bogers (2011); Gretsche et al. (2020); Hagedoorn & Zobel (2015); Veer et al. (2016); Wikhamn (2013).

it. Instead, they should be selective, deciding when and how to give up control or to defend their interests, being guided by the startup's overall strategy.²⁰⁵

The main modes in Open Innovation, such as inside out (outband), outside in (inbound), are presented in the Urban Mobility sector. An inside-out mode for one party is, by definition, an outside-in mode for the other; organisations may also combine these approaches in a 'coupled' open innovation process.²⁰⁶

1. 'Inside-out' (outbound)

'Inside-out' (outbound) innovation focuses on making an organisation's internal knowledge available to others for profit. This strategy helps protect against free-riding and signals the value of the technology to potential licensees.²⁰⁷ Such outbound innovation activities may include free revealing, licensing out, or transferring IP rights through sale.²⁰⁸

In urban mobility, large companies often use an "inside-out" strategy by openly licensing their proprietary technologies and patents, a practice known as a "patent pledge". For example, in 2014, Tesla made an irrevocable pledge not to sue anyone using its EV technology in "good faith" to accelerate the sustainable transition.²⁰⁹ Another example is Renault, which in 2024 introduced the UN.patent initiative, offering royalty-free and non-exclusive licences for its patented EV battery safety mechanism designed for rapid fire suppression.²¹⁰

Patent pledges can lower entry barriers, provide access to newer and higher-quality technologies, and create a system for further innovation and interoperability. This can also increase a startup's visibility, signalling innovation to investors.²¹¹

However, legal analysis conducted by scholars revealed that companies using Tesla's patents must waive their rights to litigate against Tesla for any IP infringement, including non-patent rights, and must extend that waiver globally, not just towards Tesla. Moreover, firms are prohibited from holding any "financial stake" in challenges against Tesla's IP, potentially deterring competitors and limiting genuine open access.²¹²

For dominant players like Tesla, such strategies can be deliberate market interventions rather than simple technology diffusion, consolidate the company's technological position and establish its solutions as de facto standards — as of September 2024, one of their most important patented technologies, NACS, is recognised as the SAE J3400 standard.²¹³

²⁰⁵ Grimaldi, Greco, and Cricelli (2021), p. 157 with reference to Brunswicker & Chesbrough, 2018.

²⁰⁶ Gorbatyuk et al, (2013).

²⁰⁷ Gorbatyuk et al, (2013), Section 1.2.

²⁰⁸ Greco et al. (2022), 377, citing Aquilani et al. (2017).

²⁰⁹ Tesla, Inc., "Patent Pledge," accessed July 24, 2025, <https://www.tesla.com/legal/additional-resources#patent-pledge>.

²¹⁰ Adobo Magazine, "Renault's UN Patent Initiative Shares EV Safety Innovations Globally, Starting with Fireman Access," Adobo Magazine, February 2024, <https://www.adobomagazine.com/campaign-spotlight/renaults-un-patent-initiative-shares-ev-safety-innovations-globally-starting-with-fireman-access/> (accessed July 18, 2025).

²¹¹ Yeongsu (Anthony) Kim, "A critical appraisal of IBM'S patent pledge model: The impact of patent quality on open source software START-UP'S market entry decision," World Patent Information 62 (2020), p. 1.

²¹² Pratheeba Vimalnath et al., IP Strategies for Green Innovations – An Analysis of European Inventor Awards, Centre for Technology Management Working Paper No. 2020/01 (2020), pp. 8–9.

²¹³ SAE International, J3400: North American Charging Standard (NACS) Electric Vehicle Coupler, revised September 2024, accessed July 24, 2025, https://www.sae.org/standards/content/j3400_202409/.

Additionally, in the news, it was said that Tesla opened its Supercharger network patents and related standard technology to non-Tesla EVs to obtain credits in qualification for federal funding.²¹⁴ This strategy is also known as “revealing”, fully or selectively disclosing internal knowledge without immediate financial return to attract partners, signal innovation capabilities, or participate in standard-setting initiatives.²¹⁵

However, another point of view includes an analysis of the current global economic situation. Tesla’s open-source patent policy allowed competitors to freely use its patents to accelerate EV adoption. While visionary in 2014, this model now poses a strategic liability in an era of trade wars and protectionism, reducing Tesla’s ability to block rivals through IP enforcement. A Chinese company, BYD, by contrast, follows a closed, protectionist innovation model, maximising exclusivity and defensive capabilities. With the tariff war on Chinese EVs, Chinese automakers are aggressively filing patents in the U.S. and Europe to secure market positions.²¹⁶

In this sense, the IP strategy of a startup should be adjusted depending on which role, position in the value chain, startups occupy in the UM sector in outbound mode, and which future implications their technology will bring.

On one hand, if a startup integrates technologies from a patent pledge, this can create barriers for future collaborations and distribution of the product.. That being said, that patent pledge facilitates open sharing, while its conditions create significant uncertainty and potential commercialisation hurdles for licensees. Another negative aspect is that market entry is selective, not universal; startups only benefit from pledges involving high-quality, relevant patents. Outdated or low-quality patents have limited impact and can even be risky, potentially hindering investment. Ultimately, the effectiveness of a patent pledge is driven by the quality and relevance of the patents, not by their availability alone.²¹⁷

On another hand, as many startups follow an *impromptu* intellectual property strategy, their activity in open innovation is based primarily on trust, lacking formal rules, because they do not treat IP as a revenue-generating asset, but rather adopt a reactive approach to knowledge sharing.²¹⁸ Therefore, if a startup is entering into an outbound mode as a provider of IPRs, a defensive IP strategy is most effective when it relies on formal protection.²¹⁹ While this may seem restrictive, it helps create structured governance for partners and doesn't necessarily mean a closed innovation mindset.²²⁰ It provides significant control, which studies show is a significant concern for startups. A startup can

²¹⁴ Consumer Reports, “Tesla Superchargers Are Opening to Other EVs. Here’s What to Know,” accessed July 24, 2025, <https://www.consumerreports.org/cars/hybrids-evs/tesla-superchargers-open-to-other-evs-what-to-know-a9262067544/#why-is-tesla-opening-up-its-superchargers-to-other-brands>.

²¹⁵ Grimaldi et al. (2021), p. 157–158

²¹⁶ Lumenci Team, “How Patents Are Shaping the EV Power Struggle Between China and the U.S.,” Lumenci, May 1, 2025, <https://lumenci.com/blogs/ev-patent-war-china-us/>.

²¹⁷ Kim (2020), 1-3

²¹⁸ *Ibid*, p. 8-9

²¹⁹ Greco et al. (2022), p. 9

²²⁰ *Ibid*, p. 10-11

use a “selling” strategy by commercialising its inventions through licensing agreements, thereby generating direct revenue.²²¹

2. ‘Outside-in’ (inbound)

‘Outside-in’ (inbound) mode involves acquiring external knowledge to enrich internal capabilities (e.g. in-licensing, acquisition of external know-how).²²² It can take the form of the Commercial Innovation Hub (CIH), creating the Living Labs, which reflects a predominantly outside-in model of open innovation, including real-world experimentation and feedback.²²³ As an example, the BMW Startup Garage explicitly declares that it does not seek to invest in or acquire IP rights, but instead aims to collaborate with startups by acting as their first industrial customer to integrate their solutions into BMW's value chain, thereby supporting innovation without ownership transfer.²²⁴

Interoperability is one of the significant challenges for startups, which requires startups to navigate complex technical environments and ensure their solutions can communicate with varied existing infrastructures.²²⁵ Therefore, when a startup participates in such a hub, providing its technologies to the parent body, there is a risk it will face the NSH syndrome - by a defensive position against sharing internal knowledge, fuelled by a ‘fear of giving without receiving’ and a strong desire to monetise intellectual property assets. Scholars explain it due to the lack of confidentiality awareness and a pervasive fear of not being credited or compensated for valuable technology. For startups, whose IP often constitutes their very core asset, this translates into a strong reluctance to share without robust legal safeguards, fearing misuse or unintended transfer. This creates an IP ‘tug-of-war’: the tension and struggle over who owns the technology, who can use it, and who gets credit during the collaboration, ending up in legal disputes over pre-existing (background), sideground or co-created (foreground) knowledge.²²⁶

Additionally, patent registers are essential for outside-in open innovation, as they enable third parties to identify patent owners and initiate licensing negotiations. However, since ownership changes after grant are often not recorded or enforced effectively, third parties may lack accurate information — undermining trust and impeding outside-in collaboration.²²⁷ This also creates some uncertainty in situations related to the purity of the IPRs chain, e.g. in layered supply or public procurement, divided on stages or lots.

²²¹ Grimaldi et al (2021). p. 157-160

²²² Gorbatyuk et al.(2016), Section 1.2.

²²³ Dimitri Schuurman, Lieven De Marez, and Pieter Ballon, “The Impact of Living Lab Methodology on Open Innovation Contributions and Outcomes,” *Technology Innovation Management Review* 6, no. 1 (2016).

²²⁴ BMW Startup Garage, “FAQ,” BMW Startup Garage, accessed July 26, 2025, <https://www.bmwstartupgarage.com/faq/#:~:text=The%20BMW%20Startup%20Garage%20is,Become%20our%20partner.>

²²⁵ Justyna Berniak-Woźny, Piotr Sliż, and Jędrzej Siciński, "Empowering Smart Cities Through Start-Ups: A Sustainability Framework for Incubator-City Collaboration," *Systems* 13, no. 4 (2025), p. 3

²²⁶ Marie Amann et al., "Mitigating not-invented-here and not-sold-here problems: The role of corporate innovation hubs," *Technovation* 111 (2022): 10-11

²²⁷ Gorbatyuk et al. (2016), p. 291.

3. ‘Coupled’

Coupled open innovation inherently involves co-creation.²²⁸ This mode combines both inside-out and outside-in approaches and centres on R&D partnerships where organisations mutually exchange pre-existing knowledge and jointly develop innovations.²²⁹ Such R&D partnerships give companies access to vital resources and help shorten R&D timelines, a practice that fits well with the rapid pace of urban mobility.²³⁰ The concept of coupled OI is used by companies individually, collectively, and also within EU sectoral initiative platforms, such as EU Horizon, supporting startups and SMEs.²³¹ For example, smart UM interfaces are built through peer-production mechanisms based on participation in a project.²³² However, openness, which encourages co-creation, reduces exclusivity. Therefore, startups are challenged to establish defensible IP positions.²³³ Moreover, a tendency towards interoperability and a variety of standards, fragmentation, overloading with contractual practices and licensing policies, inconsistent expert guidance and a lack of monetisation foresight can hinder strategic IP decisions for startups.²³⁴ Strong enforcement of exclusive IP rights is seen as detrimental to innovation, especially when technological developments require cooperation and are boosted by network effects²³⁵. Such a kind of collaboration aligns with the concept of IP negative spaces, where value is generated even without exclusive IP rights being enforced. As a result, while the collaborative infrastructure of such projects is beneficial for early-stage innovation, startups must balance openness with selective IP protection if they aim to scale sustainably and attract investment through these ecosystems.

While ‘Coupled’ mode combines both inside-out and outside-in approaches, it includes the tensions that were described in previous sections. R&D partnerships face challenges in managing risks like loss of control, misconduct, and unauthorised disclosure, which require strict contract terms on allocation and use of IPRs, and an understanding of the whole IP chain.²³⁶ For third parties, transparency is crucial to verify ownership and legitimacy, as a lack of clear disclosure can undermine trust in inside-out innovation models.²³⁷

Diverging national laws complicate the exploitation of co-owned patents in coupled open innovation. While some jurisdictions allow co-owners to act independently, others require consent (USA, France).²³⁸ This poses a challenge for startups in cross-border

²²⁸ *Ibid*, p. 264.

²²⁹ *Ibid*, Section 1.2.

²³⁰ *Ibid*, p. 264.

²³¹ European Commission, “Open Innovation Resources,” European Commission – Research and Innovation, accessed July 27, 2025, https://research-and-innovation.ec.europa.eu/strategy/past-research-and-innovation-policy-goals/open-innovation-resources_en.

²³² Priora and Sganga (2020), p. 156

²³³ *Ibid*, p. 160-161

²³⁴ *Ibid*

²³⁵ Priora and Sganga (2020), p. 155

²³⁶ *Ibid*, Section 1.3.

²³⁷ Gorbatyuk, Van Overwalle, and van Zimmeren (2016), p. 289.

²³⁸ *Ibid*, p. 276, 279–280.

collaborations, as the rules for joint patents depend on the jurisdiction where protection is sought.

C. Preliminary Conclusions

In the urban mobility sector, private actors established effective mechanisms for interaction that integrate all possible actors -- cross-licensing, patent pledges and pools, R&D collaborations, free-sharing, and others. As a result, patents and licensing became strategic assets for companies, helping them secure funding, negotiate partnerships, and enter the market. These instruments and ecosystems can provide startups with access to cutting-edge technologies, visibility, and real-world testing.

However, these mechanisms also present significant challenges. Large players can use patent fences, thickets, and selective licensing to consolidate power and create entry barriers. Startups face further risks from restrictive contractual terms, legal uncertainty over co-owned patents, and misaligned IP strategies that can lead to IP leakage or stalled deployment.

Ultimately, startups must approach patents and licensing as integral parts of their commercial strategy. By balancing openness with targeted exclusivity and implementing clear contractual safeguards, they can maximise the benefits of participating in these innovation ecosystems while mitigating the risks of dependency, IP leakage, and a loss of competitive advantage.

IV. Unlocking Innovation: Analysis of Urban Mobility and Public Procurement Framework

A. Challenges in the diffusion of innovations in Urban Mobility

Sustainability goals deadlines are accelerating the shift to green innovation; as a result, the public sector is increasingly focused on attracting and creating new products to achieve its goal. As a result, the concept of open innovation, which originated in the private sector, has been successfully applied to the public sector,²³⁹ shaping vertical relations related to IPR matters.

The New EU Urban Mobility Framework states that authorities should prioritise public procurement (PP) procedures that favour innovative solutions through 'living city labs'.²⁴⁰ It is a "playground" or "sandbox" for testing new solutions and further replication,²⁴¹ e.g. the AMS Institute's Urban Living Labs situated in Amsterdam.²⁴² Scholars say that such an approach is a response to the so-called 'European Paradox', grounded in extensive

²³⁹ S.M. Lee, T. Hwang, and D. Choi, "Open Innovation in the Public Sector of Leading Countries," *Management Decision* 50, no. 1 (2012): 147–162.

²⁴⁰ European Commission, *The New EU Urban Mobility Framework*, COM(2021) 811 final, 14 December 2021, paras. 30, 32, 37, 66.

²⁴¹ Schuurman, De Marez, and Ballon (2016), p. 7–16; Communication from the Commission, *The New EU Urban Mobility Framework*, COM(2021) 811, para. 62.

²⁴² AMS Institute, "Our Living Labs," Amsterdam Institute for Advanced Metropolitan Solutions, accessed August 2, 2025, <https://www.ams-institute.org/how-we-work/ull/our-living-labs/>.

research and the lack of further successful commercialisation.²⁴³ Discovering different reasons for such failure, the new EU's Startup and Scaleup Strategy highlights that procurement hinders the scalability of disruptive projects, and also emphasises the solution through regulatory sandboxes.²⁴⁴

Studies identify main challenges in innovation procurement: conflicting interests (e.g. regarding the value of IPRs), the failure of pilot projects to become standard practice, and IPR issues concerning risks, benefit sharing, and competition. Especially in innovation procurement, which focuses on the R&D process.²⁴⁵

EU policy promotes startups to retain IP ownership to justify their innovation investment and facilitate scaling beyond the contract;²⁴⁶ however, in cases where the EU is funding an innovation project, ²⁴⁷ it leaves a certain footprint on the scope of IPRs.

B. Collaboration with Public Authorities

1. Distinctive features of vertical relations

Cities mainly use the “inbound” mode to attract new technologies from outside in. However, during the actual interaction between parties, the mode can shift to “coupled”. However, collaboration with public organisations differs from private ones. These differences can affect the diffusion of technologies.

Firstly, public authorities are not involved in competition, which reduces their incentive to innovate. It leads to limited absorptive capacity to leverage new technologies.²⁴⁸ They are also not interested in profit, which goes in contrast with the nature of patents, which is commercialisation.

Secondly, the decision-making process in public areas is often constrained by rigid bureaucratic procedures and governed by strict rules related to many different fields that have to be aligned.²⁴⁹ It includes not just competition law, technical interoperability, public interest, etc, but also other sectoral regulations, which can significantly influence the project and future use of IPR. For example, the EV charging project may include alignment of AFIR, battery regulation, NZIA, and other regulations.

Thirdly, bringing new technologies into the UM sector necessitates early-stage evaluation of their interoperability with both existing and planned infrastructure. This process must include a thorough FTO analysis, e.g. to assess whether the standards include SEPs, which are licensed on FRAND terms. Unauthorised use of SEPs constitutes patent

²⁴³ Schuurman et al. (2016), p. 7–16; The New EU Urban Mobility Framework, COM(2021) 811, para. 62.

²⁴⁴ The EU Startup and Scaleup Strategy, COM(2025) 270 final, pp. 4–5.

²⁴⁵ Edquist, Charles, Nicholas S. Vonortas, Jon Mikel Zabala-Iturriagoitia, and Jakob Edler, eds. *Public Procurement for Innovation: Good Practices and Strategies*. Cheltenham, UK: Edward Elgar Publishing, (2017), p. 71.

²⁴⁶ Edquist et al. (2017), p. 80

²⁴⁷ The European Green Deal (COM(2019) 640 final), section 2.2.3, p. 18–20.

²⁴⁸ Ferraris, A., Santoro, G., & Papa, A. (2018). The cities of the future: Hybrid alliances for open innovation projects. *Futures*, 103, p. 51 with reference to Inkpen & Beamish, 1997.; Nicola Dimitri, 'Intellectual property rights in the EU pre-commercial procurement for innovation' (2018) 4(3) *Journal of Strategic Contracting and Negotiation* 186, 186–187.

²⁴⁹ *Ibid*

infringement. Therefore, startups must adapt their technology early on to fit infrastructure and regulatory constraints, especially when transferring solutions from other sectors, requiring re-engineering for compatibility and additional investment.

Fourthly, scholars emphasise that public collaborations are based on limited-term projects instead of traditional, long-term collaboration,²⁵⁰ which is true, giving the ability to split the PP into lots, competition rules, and an advanced, fast R&D cycle. However, successful projects may subsequently lead to maintenance concessions, which are characterised as long-term contracts. Moreover, they will likely involve third parties, due to competition rules, which brings questions regarding the IPRs transfer, who will use the IPR, how long, on which terms, to whom the future licensee will be reporting on use, and how deep the sub-licensing chain shall be extended, how improvements or modifications will be governed, etc.

As a result, municipalities face the paradox of needing to deploy intelligent transport solutions amid fragmented legal and infrastructural levers. Most EU jurisdictions restrict municipal powers, hindering regulatory innovation and cities' role as just UM "laboratories."²⁵¹ This is critical for EU sustainable mobility, as startups and innovators need local access and regulatory openness to pilot technologies.²⁵² Wider local autonomy can improve the green transition, e.g with an example of London, having discretion on measures like congestion charges.²⁵³ Therefore, limited local autonomy, rigid procurement cycles, poor interoperability, and inconsistent rules hinder both innovation and long-term sustainable mobility progress.²⁵⁴

2. Open Innovation shaping Public Procurement

Horizon Europe²⁵⁵ — the main engine in the EU that promotes and supports innovation and startups — uses "open science" as a main approach to research based on open cooperative work, tools, and knowledge diffusion, closely linked to the concept of open innovation. The Programme encourages open science practices, including reciprocity in international cooperation, and benefits provision for SMEs. The open access principle requires free online access to research outputs, with beneficiaries retaining sufficient IP rights to meet these obligations. Open access applies to both publications and research data, with exceptions under the rule "as open as possible, as closed as necessary" and compliance with FAIR principles. For specific actions, including procurement, tailored provisions may be set in grant agreements, but these cannot alter open access principles.²⁵⁶

²⁵⁰ Andrés Boix Palop, "Local Leadership and Its Limits in the Deployment of Sustainable Mobility Policies," in *Smart Urban Mobility*, ed. Michèle Finck et al., MPI Studies on Intellectual Property and Competition Law 29 (Berlin: Springer, 2020)

²⁵¹ Boix Palop (2020), 91–92

²⁵² *Ibid.*, 92. "The broader lesson is that "ambitious local policies in the area of urban mobility can be game-changing... but with some caveats, especially regarding the necessity of having a previous legal framework granting local authorities the powers to act."

²⁵³ *Ibid.*, 91. The congestion charge was introduced following the Greater London Authority Act 1999 and the Greater London Congestion Charging Order 2001.

²⁵⁴ *Ibid.*, 93–95.

²⁵⁵ Horizon Europe, https://research-and-innovation.ec.europa.eu/funding/funding-opportunities/funding-programmes-and-open-calls/horizon-europe_en. (Accessed August 9, 2025).

²⁵⁶ Regulation (EU) 2021/695 of 28 April 2021 establishing Horizon Europe – the Framework Programme for Research and Innovation, and laying down its rules for participation and dissemination, Arts. 2(4)-(5), 14, 36(7), 39, 42, Annex V.

The EU's Horizon policy has significantly shaped the vertical relationship between companies and public buyers. On one hand, it brought more flexibility and helped advance stalled innovation. On the other hand, it also narrowed the path for innovation diffusion, hindering healthy competition and commercialisation.

Scholars identify in the UM sector explorative and exploitative types of interaction with public authorities. Explorative alliances emerge during the early stages as high-uncertainty projects. The risk is primarily borne by private companies, while public authorities have a limited role, just providing access to infrastructure, citizens, or local networks. For this alliance open sharing model is often used as firms are looking for mutual benefits of ideas and projects throughout the smart city ecosystem.²⁵⁷ But a recap of Chapter 3 will show that private companies collaborate in open innovation ecosystems to make their business processes more efficient and stay competitive. For that, they create special IP strategies and licensing mechanisms, they design specific infrastructure and platforms, establish separate entities that will govern their horizontal relationships, e.g. to manage collective IRRs, administrate patent-pool, organise standardisation and certification processes, etc. All this demands significant investments before they bring profit to the actors. Depending on the companies' business model, they can participate in free open license for digital projects, cross-licensing, FRAND, or other mechanisms, and it will benefit their profitability. In short, open innovations for the private sector are characterised by voluntary choices to which model the company should commit. However, when it comes to public authorities, startups participating in these types of collaboration shall be aware that it brings limitations with the use of the technologies, allocation and use of IP rights, as it is detailed in Section 4.5.

Exploitative collaborations focus on scaling up previously tested solutions or standard products, and funding from the local public authority. Companies typically use a closed approach to IPRs, as these projects are tight to the core capabilities of the company and aim to gain profit.²⁵⁸ Ideally, successful explorative alliances normally lead to exploitative ones.

These explorative and exploitative types of collaborations are reflected in the two main types of procurement: procurement of ready products/services and procurement on R&D. The first one mostly falls under General Public Procurement (GPP) rules, funded by local authorities, while the second one Innovative Public Procurement (IPP), funded mostly by EU organisations like the EU Horizon or national funds.

The IPP can be identified with a few sub-subcategories depending on the goals. Among them — Public Procurement of Innovation (PPI) and Pre-Commercial Procurement (PCP).

PPI enables the purchase of innovative solutions ready-to-market or their co-development when existing products do not meet public needs. PPI also implies further scalability and is governed by national rules in line with Directive 2014/24/EU.

²⁵⁷ Ferraris et al (2018), section 5

²⁵⁸ Ferraris et al (2018), section 5

PCP focuses on the research and development phase of solutions not yet available on the market and explicitly excludes the commercialisation (scale-up). It is governed by specific R&D exemption provisions in the Procurement Directive (rec. 47).

While innovation procurement using flexible funding models can succeed in early experimentation, the cutting-edge technologies may face issues of interoperability and conflict with existing standards. If it is successful, it will lead to the creation of new standards that shall be available for all — open sharing principle.²⁵⁹ However, projects that use general procurement laws often fail to get past the pilot stage.²⁶⁰ It follows that for a startup with a technology which does not fall under “standard”, participation in classical public procurement procedures will be challenging. In other words, startups at the early stage of development are confined to the innovation procurement pathway.

Recent studies show that sustainable and green inventions demonstrate a substantial and consistent reliance on government-supported research.²⁶¹ For example, one-third of patents in energy transformation, battery, and industrial technologies are based on public R&D, supported by federal funding.²⁶² However, these green technologies tend to consolidate and accumulate technologies rather than create new trajectories that could alter current practices.²⁶³ This brings to a conclusion that the government tends to support the project, which can be included in the layer of existing technologies, not giving chances to radical inventions.

Urban mobility aims to replicate successful projects from major metropolitan centres.²⁶⁴ However, no matter how useful and sustainable ideas and technologies may be, without a clear path for implementing innovative solutions, cities will remain mere “living laboratories”²⁶⁵ and fail to bring real advancements to society. Only 10% of startups can independently take part in procurement procedures, and 33 % are involved in B2B relationships,²⁶⁶ which shows that procurement procedures are yet to be accessible for many startups.

In conclusion, public procurement procedures, even with a tendency towards supporting innovation, have many major constraints on the scalability of urban innovation. This highlights first, an imbalance in the discretion of authorities to support innovation, placing most of the responsibility on higher-level institutions while diminishing the ability of innovative startups to compete under normal market conditions. Second, the redirection of startups solely under the public funding routes significantly narrows their exclusive rights to technologies, undermines healthy competition, technological sovereignty, commercialisation and scalability.

²⁵⁹ *Ibid*, p. 52. with reference to Bresciani, Ferraris, & Del Giudice, 2017

²⁶⁰ Ferraris et al (2018), p. 56.

²⁶¹ UK Intellectual Property Office, Fueling a Net-Zero Future: The Influence of Government-Funded Research on Climate Change Mitigation Inventions (Newport: IPO, 2024), pp. 14–15.

²⁶² UK IPO Fueling a Net-Zero (2024), pp. 14–15.

²⁶³ *Ibid*

²⁶⁴ Priora and Sganga (2020), p. 7-9

²⁶⁵ European Commission, Communication on the New EU Urban Mobility Framework, COM(2021) 811 final, 14 December 2021, para. 61-63.

²⁶⁶ Skala (2022), p. 14

C. Complexity of Urban Mobility Legal Framework

This section briefly examines the legal framework in which startups shall operate when entering the UM market. It shows how, depending on the sector, the legal framework may expand—sometimes significantly intensifying compliance requirements—and where legal norms lead to technical requirements, protected by IP rights, and thereby affecting startups' ability to develop and bring new technologies to market.

At the top of the UM framework is Regulation (EU) 2021/1119, known as the 'European Climate Law', supporting a clean, circular economy and achieving climate neutrality by 2050. It outlines that sustainable, smart mobility and transport systems as one of the priorities.²⁶⁷ The Sustainable and Smart Mobility Strategy (SSMS) aims to transform transport for climate neutrality through zero-emission mobility, infrastructure, and economic incentives, with a focus on supporting startups with pilots and validation.²⁶⁸ The New EU Urban Mobility Framework (UMF) supports this by identifying cities as "living laboratories" for new solutions and promoting public procurement as a key tool for achieving these targets.²⁶⁹

Depending on the specific field, sectoral regulations shall be applied. In the case of the EV-charging project, it can be the Regulation on the deployment of alternative fuels infrastructure (AFIR)²⁷⁰, which establishes transport electrification across the transport network (TEN-T)²⁷¹ by 2030. Under these goals, public authorities can plan tenders and budgets. Then, AFIR highlights alignment between EV charging infrastructure and rules on the internal electricity market²⁷² and on concessions.²⁷³ Additionally, the following rules can be applied:

- Radio-connected chargers (e.g. with Wi-Fi or Bluetooth) must comply with the Radio Equipment Directive to ensure safety, data protection, and secure network integration.²⁷⁴
- Energy storage — a recent survey revealed that limited grid capacity and energy access, in combination with compatibility issues, make it hard to scale up EV-charging stations.²⁷⁵ As a solution, providers started to use local battery storage,²⁷⁶ which is governed by the EU Battery Regulation²⁷⁷ and Renewable Energy Directive (RED II)²⁷⁸.

²⁶⁷ Regulation (EU) 2021/1119 ('European Climate Law'), 2021, para. 34, 35

²⁶⁸ Communication on Sustainable and Smart Mobility Strategy. COM(2020) 789 final, section 64

²⁶⁹ New EU Urban Mobility Framework, COM(2021) 811 final, sections 37 and 62

²⁷⁰ Regulation (EU) 2023/1804 on the deployment of alternative fuels infrastructure (AFIR)

²⁷¹ Regulation (EU) 2024/1258 on Union guidelines for the development of the trans-European transport network

²⁷² Directive (EU) 2019/944 on common rules for the internal market for electricity

²⁷³ Directive 2014/23/EU on the award of concession contracts

²⁷⁴ Radio Equipment Directive (RED), https://single-market-economy.ec.europa.eu/sectors/electrical-and-electronic-engineering-industries-eei/radio-equipment-directive-red_en. (accessed July 26, 2025,)

²⁷⁵ Driivz, 2025 State of EV Charging Network Operators: Challenges, Insights, and Projections (April 2025), 14, accessed August 2, 2025, <https://driivz.com>

²⁷⁶ Driivz, 2025 State of EV Charging Network Operators: Challenges, Insights, and Projections (April 2025), 14, <https://driivz.com> (accessed August 2, 2025)

²⁷⁷ Regulation (EU) 2023/1542 concerning batteries and waste batteries

²⁷⁸ Directive (EU) 2018/2001 on the promotion of the use of energy from renewable sources (recast)

- Charging communication protocols — new rules were adopted requiring all new public AC chargers to use “Plug & Charge” (ISO 15118-2) from 2026 and also support bidirectional charging (ISO 15118-20) since 2027,²⁷⁹ making these standards mandatory.

All sectors are significantly dependent on standards. And the further dive into the ISO documentation reveals how vertical relationships — regulations — incorporate horizontal relationships on IP licensing mechanisms — SEPs/FRAND — and how it affects the activity of startups.

The ISO document 15118-20 states that some parts of the standard might be patented, and the ISO organisation is not liable for listing or checking them all. If any known patents exist, they may be mentioned in the introduction or on ISO’s website.²⁸⁰ There are 2 essential patents declared to the 15118-20 standard, which belong to WiTricity and Hyundai.²⁸¹ Companies voluntarily disclose the existence of their patents. However, another company may not declare its IPRs for various reasons, leaving startups in a risky position of possibly infringing on a third party’s rights, while being forced to use standards due to the legal framework.

A declaration typically provides three commitment options: A Royalty-Free Licensing (RFL), FRAND terms, or an unwillingness to license (Refusal to license).

RFL allows the patent grant a free-of-charge licence for implementing the standard, worldwide and non-discriminatorily, under reasonable conditions. A patent holder can demand reciprocity (grant-back license — section 2.2.3.5), which means a license on SEP will be granted if the licensee agrees to license back any of its patents on similar terms. In case the licensee refuses, the SEP holder may agree to license under FRAND. For startups, this ensures free-of-charge access but can force them to share strategic patents with larger competitors, reducing exclusivity and adding legal and negotiation burdens. However, FRAND still keeps options for startups to manoeuvre.

FRAND (Fair, Reasonable, and Non-Discriminatory) licensing implies a patent owner agrees to license an essential patent to any standard implementer on equal terms, e.g. for royalties. If the patent is not included in the patent pull, it will need tailored negotiations. If reciprocity applies, startups must license back their patents, ensuring mutual access. As startups operate in unique niches, this hinders their exclusivity. Both WiTricity and Hyundai SEPs can be licensed under FRAND terms with reciprocity demand. WiTricity offers negotiations on licensing, as it is not a part of a patent pool.²⁸² As for Hyundai, precise information was not found.

²⁷⁹ Delegated Regulation (EU) 2025/656 as regards the definition of the charging communication protocol to be used for recharging electric vehicles

²⁸⁰ International Organization for Standardization, ISO 15118-20: Road Vehicles — Vehicle to Grid Communication Interface — Part 20: 2nd Generation Network and Application Protocol Requirements (Geneva: ISO, 2022), https://downloads.regulations.gov/FHWA-2022-0008-0405/attachment_3.pdf. (accessed August 8, 2025)

²⁸¹ International Organization for Standardization, “Publicly Available Resources,” ISO, <https://www.iso.org/resources/publicly-available-resources.html?t=0anPz3TMFpHPMzf5b0mZkRYtHArk-eAG7zgOrPegH2z5D7LNgLQt7ZulXvt7OSez&view=documents>. (accessed August 8, 2025)

²⁸² WiTricity Corporation, “IP Portfolio,” <https://witricity.com/innovation/ip-portfolio#:~:text=Licensing,to%20discuss%20potential%20licensing%20agreements>. (accessed August 8, 2025)

Refusal to license can happen when a patent owner declares an essential patent but refuses to license it. In this case, full compliance with the standard may be impossible without infringement. For startups, this creates a major barrier to entry, often forcing costly or inferior workarounds that compromise performance or compatibility. Proceeding without a licence carries high litigation risk, while reliance on alternative solutions can lead to a lack of interoperability. This underscores the need for a thorough FTO analysis.

When an SEP holder refuses to license under FRAND terms, startups must follow a structured legal and strategic response to preserve market access and reduce litigation risk. The CJEU in *Huawei v ZTE*²⁸³ established a negotiation framework requiring the SEP holder must notify the alleged infringer, specifying the patent and its essentiality, and make a concrete written FRAND offer. The implementer must respond promptly, showing willingness to license, and, if rejecting the offer, submit a timely FRAND counteroffer. If use of the SEP continues during negotiations, the implementer should provide appropriate security, such as payments or guarantees, to demonstrate good faith.²⁸⁴

Courts can determine FRAND rates when parties fail to agree. In *Unwired Planet v Huawei*²⁸⁵, the UK High Court set a binding global FRAND licence; therefore, FRAND is a single set of terms, not a range, and may be global if the SEP portfolio is international. The court assessed comparable, market value, and non-discrimination principles. It also confirmed that seeking an injunction is permissible if the implementer refuses a court-determined FRAND offer without a valid justification.

In *Sisvel v Haier*,²⁸⁶ the German Federal Court clarified that both SEP holders and implementers must negotiate in good faith. SEP holders must make a concrete, specific FRAND offer, while implementers must respond diligently without delay. Failure to act as a “willing licensee” can justify injunctions. The court stressed that implementers must show active engagement, such as making counteroffers, and cannot rely solely on procedural objections. This decision strengthened SEP holders’ enforcement rights while underscoring balanced obligations under the FRAND framework.

It means that startups should maintain thorough negotiation records, engage competition authorities where necessary, and resist injunctions by demonstrating willingness to license.

Additionally, in case the project uses a new type of energy, it shall also be aligned with the Net-Zero Industry Act (NZIA).²⁸⁷ Article 13 (6) on selection criteria for disruptive innovations says that Member States may refuse to recognise such a project if they cannot be a part of the general structure of their energy supply. Therefore, if a startup decides to

²⁸³ *Huawei Technologies Co. Ltd v ZTE Corp.* (C-170/13)

²⁸⁴ Article 102 TFEU

²⁸⁵ *Unwired Planet International Ltd v Huawei Technologies Co. Ltd* [2017] EWHC 711 (Pat)

²⁸⁶ *Sisvel International S.A. v Haier Deutschland GmbH* (KZR 36/17)

²⁸⁷ Regulation (EU) 2024/1735 on establishing a framework of measures for strengthening Europe’s net-zero technology manufacturing ecosystem

present a new solution for generating energy using a non-conventional method, it will face challenges and will have to take the route through the EU body.

This brief analysis highlights how both legal frameworks and infrastructure design can constrain startups to a limited range of implementation options, thereby hindering the diffusion of disruptive innovations. Intellectual Property, in the case of SEPs, is playing the role of a significant barrier to scalability.

In this case, Ann Mettler in the Financial Times pointed out that Europe's fragmented Single Market, high compliance costs, and ageing infrastructure hinder growth. Policies on energy, industry, digitalisation, and budgets operate in isolated "silos". But start-ups and innovation need these areas to work together. The EU must connect them and create a system where all these policies support each other in helping businesses grow. She calls for integrated policy support to drive innovation, warning that despite the European Green Deal, the EU still lags in clean tech such as solar, EVs, and batteries, where China holds near-monopolistic dominance²⁸⁸ (see section 3.2.1). Michèle Finck confirms that the current UM legal framework is acting as both an enabler and a constraint for new transport technologies. However, a single legal framework is insufficient; a holistic, multi-level approach is needed, moving from static to flexible and experimental regulatory structures.²⁸⁹

D. Public Procurement Procedure

This section examines Directive 2014/24/EU and its intersection with IP matters, focusing on classical procurement procedures and assessing the legal challenges that startups may face regarding IPRs when participating in public tenders.

1. General Overview of the Procurement Procedure

Procurement Directive 2014/24/EU offers multiple tools to encourage SME and startup participation in public procurement, particularly for innovative and IP-driven projects. It reduces barriers for startups by allowing lot division, direct subcontractor payments (Arts. 46, Recitals 78–79), self-declarations (Art. 59), consortium participation (Art. 19(2)), and capping turnover at twice contract value (Art. 58(3)). Public authorities may consult markets to assess innovation and IP issues before tendering (Art. 40). Procedural options (Art. 26) include competitive dialogue, innovation partnerships (Art. 31), and negotiated procedures without publication for IP-protected solutions (Art. 32). Some R&D&I collaborations are excluded (Art. 14, Recital 47).

Technical specifications shall not contain patent references unless justified and accompanied by an "or equivalent" clause, enabling startups to offer alternatives. However, standards are prioritised — when criteria are based on performance or function, recognised standards cannot be rejected if compliance is proven. As specifications define the contract's subject matter, IPR terms shall be clearly defined at the start (Article 42).

²⁸⁸ Ann Mettler, "Europe's Inability to Scale Start-Ups Could Be Disastrous," Financial Times, June 11, 2025, <https://www.ft.com/content/cb86d8aa-03bc-4918-938f-28dbde5d2b5e> (accessed June 12, 2025)

²⁸⁹ Michèle Finck et al., "Smart Urban Mobility as a Regulatory Challenge," in Smart Urban Mobility, eds. Michèle Finck et al., MPI Studies on Intellectual Property and Competition Law 29 (Berlin: Springer, 2020), 9–11.

Under Article 58(4), Article 60 and Annexe XII, Part II, contracting authorities may require proof of research and innovation capacity, with patents and registered IPRs serving as one of the key evidence. In innovation partnerships under Article 31, a strong IP portfolio can signal the ability to develop and scale technologies. However, if it comes to the cross-border tender, the differences in IP national law can also create uncertainty. For example, Germany recognises national utility models as fast and affordable protection for technical inventions without substantive examination. It potentially can give local bidders an advantage in demonstrating technical ability.²⁹⁰

Article 63 allows startups to use a third party's patent to show technical capacity via licensing or other commitments. Meanwhile, procurement rules prohibit discriminatory practices and technological lock-ins, requiring that patented technologies be offered without infringing Article 18's principles of transparency, equal treatment, and non-discrimination.

Compliance with IP law is vital to avoid exclusion under Recital 101, e.g. for an IP infringement. In the German case law in the *VII-Verg 20/15*²⁹¹ The court allowed the exclusion of bidders solely on the possibility of patent infringement; however, later in the *Verg 2/19 case* court established the need for verifiable evidence of confirmed infringement amounted to serious professional misconduct.^{292 293}

Recital 107 states that substantial changes — particularly to scope, content, or IP rights — require a new procurement if they could alter the award outcome. Changes to licensing or undeclared SEPs likely exceed Article 72(2)'s de minimis rule and are related to material assessment under Article 72(4)(a). If changes affect rights, competition, or eligibility, the new procedure shall be started to uphold transparency and fairness. Overlaps with third-party IPRs can also trigger procurement cancellation, rollback of the procedure and a revision of the terms as discretionary exclusion grounds (Art. 57(4)(c)).

For example, the *Verg 2/19 case*²⁹⁴ concerned a public procurement procedure for fire protection clothing in Germany, where the technical specifications in the tender overlapped with existing industrial property rights, a utility model and related patents held by one bidder. The bidder revealed IPR rights on a later stage, which award criteria implicitly favoured a bidder's protected technical solution. The legal tension was that bidders must either meet specifications and risk IP infringement or deviate and risk disqualification, showing how patent-based specifications can block competition unless justified and revised. The court further clarified that late disclosure of a utility model does

²⁹⁰ German Patent and Trade Mark Office (DPMA), "Utility Models," last modified June 2024, https://www.dpma.de/english/utility_models/index.html. (accessed July 20, 2025),

²⁹¹ Higher Regional Court of Dusseldorf on the Relevance of Patent Infringement in Tender Proceedings (Decision of December 1, 2015 – Case VII-Verg 20/15)' <https://www.bardehle.com/en/ip-news-knowledge/ip-news/news-detail/higher-regional-court-of-dusseldorf-on-the-relevance-of-patent-infringement-in-tender-proceedings-decision-of-december-1-2015-case-vii-verg-20-15>, accessed 13 August 2026

²⁹² Federal Ministry for Economic Affairs and Energy. Regulation on the Award of Public Contracts (Vergabeverordnung - VgV). English translation. Bonn: Bundeskartellamt, 2020. https://www.bundeskartellamt.de/SharedDocs/Publikation/EN/Others/VergabeVerordnung.pdf?__blob=publicationFile&v=3 (accessed July 20, 2025), para 53 (8)

²⁹³ Oberlandesgericht München. Beschluss vom 08.07.2019 – Verg 2/19. Munich: OLG München, 2019.

²⁹⁴ Oberlandesgericht München. Beschluss vom 08.07.2019 – Verg 2/19. Munich: OLG München, 2019.

not automatically justify bid exclusion, nor does it extinguish enforceability of the right — there is no fixed moment for disclosure, though scholarly opinion suggests it must occur no later than bid submission. Bidders are not obliged to interpret procurement documents beyond the diligence of an average operator. Thus, post-award discovery of ambiguities can still be invoked. This means that if an award implicates a bidder's exclusive rights, the contracting authority must either terminate the procedure, re-tender, or amend technical specifications to permit wider participation. In this case, implicit favouring of a protected technical solution led to annulment and a return to the pre-publication stage.²⁹⁵

Overlapping with IP rights can also lead to confusion in payments, royalties and other financial questions. The German case *OLG Düsseldorf, Verg 1/20*,²⁹⁶ though connected to pharma, is still useful to examine. It concerned the responsibility of public authorities to structure procurement procedures in a manner that respects the rights of patent holders. In that case, the claimant argued that the contracting authority failed to implement a pricing and accounting model that adequately distinguished between patented and non-patented therapeutic uses. This omission exposed the patent holder to a high risk of unjustified rebate deductions for the use of a drug in a patented indication, thereby undermining the economic value of the exclusive right. According to the claimant, the contracting authority failed to take all reasonable steps to protect their constitutionally guaranteed rights as a patent holder and to limit procurement to the appropriate scope at the rebate level.²⁹⁷ The court found this risk economically unreasonable for the patent holder and ruled that such a scheme violated both the principle of fair economic calculation and the principle of good faith.²⁹⁸ The court concluded that failing to accommodate the patent holder's rights, while allowing economically advantaged generic competitors to benefit from a flawed rebate model, infringed procurement equality and rendered the framework unlawful in its current form.²⁹⁹

Therefore, the type of procedure, a startup's IP strategy, the IP chain in collaborations — all affect a startup's ability to protect future IPRs, negotiate licensing, commercialise, and secure market access. In innovation-oriented tenders, early clarity on background and foreground IP, licensing models, and exploitation rights is essential to ensure compliance with procurement law and maximise commercial benefits.

2. Variety and Equivalents in Specifications

Under Directive 2014/24/EU, technical specifications define the required characteristics of works, supplies, or services, including performance, methods, accessibility, and potential IPR transfer. They must ensure equal access, avoid unjustified competition barriers (Art. 42; Annexe VII). However, scholars point out that technical specifications

²⁹⁵ Federal Ministry for Economic Affairs and Energy. Regulation on the Award of Public Contracts (Vergabeverordnung - VgV). English translation. Bonn: Bundeskartellamt, 2020. https://www.bundeskartellamt.de/SharedDocs/Publikation/EN/Others/VergabeVerordnung.pdf?__blob=publicationFile&v=3 (accessed July 20, 2025), para 53 (8)

²⁹⁶ Oberlandesgericht Düsseldorf. Beschluss vom 21. April 2021 – Verg 1/20. OpenJur. <https://openjur.de/u/2392570.html> (accessed July 20, 2025).

²⁹⁷ Oberlandesgericht Düsseldorf. Beschluss vom 21. April 2021 – Verg 1/20. OpenJur. <https://openjur.de/u/2392570.html> (accessed July 20, 2025), para. 40, 45.

²⁹⁸ *Ibid*, para. 47–48b

²⁹⁹ *Ibid*, para. 58bb, 66c

create conflicts with radical innovations by overly detailed and rigid rules, that are built on current or past “socio-technical landscape”.³⁰⁰ This research examines this question from the perspective of the concepts of variants and equivalents, which serve as distinct but complementary tools that enable flexibility, and their relation with patents.

A variant refers to an alternative offer proposed by a bidder that deviates from the baseline requirements set by the contracting authority. Under Article 45, contracting authorities may authorise variants in procurement notices if they meet set minimum requirements and award criteria, enabling innovative solutions, such as sustainable energy options, while ensuring fair comparison with standard offers.³⁰¹ However, the European Commission’s 2024 data shows “variant use” in tenders fell from 4% to 3%, with only Switzerland, the UK, France, and Italy exceeding 10%, and many other countries at 0%. This reflects a structural underuse and rigidity in procurement design.³⁰²

Equivalents, under Article 42(3)–(4), ensure technical specifications remain open to competition. They allow alternative solutions meeting the same performance or functional requirements, preventing unjustified favouritism—e.g., ISO 15118 and IEC 61851 may qualify as equivalents if both fulfil required functionality.³⁰³ The *DYKA Plastics NV v Fluvius* case (T-452/23) confirmed that under Directive 2014/24/EU, technical specifications must avoid unjustified references to specific products, patents, or processes, which could restrict competition. As a rule, such references must include “or equivalent”, unless objectively justified by the subject matter.³⁰⁴

The concepts of equivalents and variants can be incorporated into specifications. However, depending on the type of procurement, their use may not fit the specifications themselves.

There are two types of procurement: technology-neutral and technology-specific. Technology-neutral procurement allows multiple technologies to compete in the same auction under uniform pricing.³⁰⁵ Technology-specific procurement separates auctions by technology type, assigning dedicated quantities and prices for each. Buyers set technology-specific targets in advance, without knowing future cost changes.³⁰⁶

Highly specific technical requirements can favour certain technologies or vendors, undermining fair competition and risking legal challenges.³⁰⁷ Functional or performance-based requirements, when coupled with the authorisation of variants, will stimulate

³⁰⁰ Kanerva Sunila and Ari Ekroos, “Regulating radical innovations in the EU electricity markets: time for a robust sandbox,” *Journal of Energy & Natural Resources Law* 41, no. 1 (2023), p. 7.

³⁰¹ Guidance on Innovation Procurement, C 267/01, p. 40

³⁰² European Commission, “Methodology for the Benchmarking of National Policy Frameworks for Innovation Procurement,” 2024, p. 30; Guidance on Innovation Procurement, 2021/C 267/01, pp. 40–41; EU 2024 Synthesis Report for the Benchmarking of National Policy Frameworks for Innovation Procurement, p. 102–104

³⁰³ Directive 2014/24/EU, Article 42(3)(b), OJ L 94, 28.3.2014

³⁰⁴ Case T-452/23, *DYKA Plastics NV v Fluvius System Operator CV*, General Court (Fourth Chamber), Judgment of 16 January 2025, p. 4

³⁰⁵ Natalia Fabra and Juan-Pablo Montero, “Technology-Neutral versus Technology-Specific Procurement,” *The Economic Journal* 133, no. 650 (2022), p. 671–672, 678–680

³⁰⁶ *Ibid*

³⁰⁷ Guidance on Innovation Procurement, 2021/C 267/01, p. 18–19

innovative solutions.³⁰⁸ In the *Gleisdreieck Nordbad (2018) case*,³⁰⁹ specifications referred to a patented railway switch, therefore limiting bidders. Yet the court found no breach as the wording (“should,” “desirable”) indicated preferences, but not binding requirements. The case shows that patented references are lawful if specifications allow equivalents, avoid exclusivity, and focus on non-technical award criteria. The court also confirmed that contracting authorities need not assess whether bids infringe third-party IP rights, as this lies outside procurement duties.

Therefore, for startups with patented innovations, functional or performance requirements are preferable to rigid technical specifications, as they allow proposing novel solutions without exclusion. Permitting variants and equivalents with clear minimum requirements enables fair comparison of standard and innovative options, which may foster innovation in UM projects.³¹⁰

However, while an opinion that technical specifications create conflicts with radical innovations is very strong³¹¹ — lowering technical requirements shall enable pilot-to-scale transitions — the threshold can be crossed through pre-tender dialogues with startups.³¹²

E. Innovation Procurement

1. EU Horizon

Horizon Europe is the EU’s main research and innovation programme, linking public procurement to strategic policy goals. It provides co-financing for joint projects across Member States. This funding enables cross-border collaboration and supports SMEs and startups in entering markets. Its policy priorities, aligned with the green and digital transition, Horizon Europe influences contract design, including risk sharing and conditions for IPR ownership.³¹³ Due to its strategic matter, the EU Horizon Regulation³¹⁴ was adopted, which influenced the IP allocation approach in further procurement procedures, where EU funding is involved.

The EU Horizon uses pre-commercial procurement (PCP) or public procurement of innovative solutions (PPI) under Directives 2014/24/EU as was for funding innovative projects (Article 26). In case the PCP contractor owns the IP rights to the results, the contracting authority shall retain royalty-free access for its use and the right to grant non-exclusive licenses to third parties under fair and reasonable conditions. If the contractor fails to commercially exploit the results within a given period, the contracting authority has the right to demand the transfer of ownership of the IP.

³⁰⁸ Guidance on Innovation Procurement, C 267/01, p. 40.

³⁰⁹ OLG München, Urteil vom 28.06.2018 – 29 U 2644/17 Kart, para. 91-95

³¹⁰ Guidance on Innovation Procurement, 2021/C 267/01, p. 21

³¹¹ Kanerva Sunila and Ari Ekroos, "Regulating radical innovations in the EU electricity markets: time for a robust sandbox," *Journal of Energy & Natural Resources Law* 41, no. 1 (2023), p. 7.

³¹² EIT Urban Mobility, Feedback on the EU Public Procurement Directives (2025), 5–6, <https://www.eiturbanmobility.eu/> (accessed August 1, 2025)

³¹³ European Commission, “Innovation Procurement,” New European Innovation Agenda, https://research-and-innovation.ec.europa.eu/strategy/support-policy-making/shaping-eu-research-and-innovation-policy/new-european-innovation-agenda/innovation-procurement_en. (accessed August 1, 2025)

³¹⁴ Regulation (EU) 2021/695 Horizon Europe

It emphasises ownership and exploitation of results, granting beneficiaries IP rights that must align with EU values and obligations; joint ownership requires a written agreement for shared, inseparable results (Article 38).

Article 39 mirrors the open innovation principles. It sets out beneficiaries' obligations to exploit and disseminate results from EU-funded actions. Exploitation may be direct or via licensing/transfer, with additional obligations possible under work programmes. Dissemination must be timely, public, and balanced with IP protection, security, and legitimate interests. The article embeds open access principles — scientific publications must be openly available, and research data should follow the “as open as possible, as closed as necessary” rule.

While IP protection is mandatory, open access to scientific data is set as the default term, and can be balanced by exceptions for commercial or security concerns (Article 39).

Furthermore, the Regulation outlines detailed access rights to background and results between beneficiaries and third parties, including the European Union and national authorities, under fair, reasonable, and non-commercial terms (Article 41). Beneficiaries may transfer or license their IP, including on an exclusive basis, but with the obligations and limitations outlined previously. Transfers outside the EU or associated countries may trigger objection rights by the Commission if contrary to Union interests (Article 40).

Article 42 allows specific provisions on ownership, exploitation, dissemination, transfer, licensing, and access rights for certain actions, including PCP and PPI. These provisions shall be defined in the grant agreement, but must not alter the principles and obligations of open access, to respect Horizon Europe's commitment to transparent dissemination and public availability of results.

2. Allocation of Rights in Innovation Procurement

When IPRs are involved in public collaboration, safeguards must ensure that their allocation does not confer unfair advantages in future tenders and that they are in line with both EU and national laws. Authorities may impose obligations such as fair licensing to third parties or grant themselves free internal-use licences.³¹⁵

Guidance on Innovation Procurement outlines the two basic options that exist for allocating intellectual property rights in innovation procurement. First, public buyers may require a full transfer of IPRs, e.g. when they fund 100% of an R&D project. However, this can stifle innovation by limiting the supplier's ability to commercialise the solution elsewhere. Alternatively, allowing contractors to retain IP often leads to better exploitation, lower costs for the public buyer, and higher participation from innovative firms, particularly startups.³¹⁶ Therefore, Procurement contracts must clearly define access rules for both pre-existing (background) and newly created IPRs (foreground).

³¹⁵ European Commission, Pre-commercial Procurement: Driving Innovation to Ensure Sustainable High Quality Public Services in Europe, COM(2007) 799 final (Brussels, 14 December 2007), para 5

³¹⁶ Guidance on Innovation Procurement, 2021/C 523/01, Section 4.1.7, p. 43.

Table 1 represents options in the allocation of rights in different types of innovation procurement where the tender is oriented on the R&D process, which will result in the creation of new IPRs. In this table compared General procurement and Innovation procurement. However, different options can be negotiated.

Table 1

	General procurement	Innovation Procurement
Funded	Local authority	Fund + local authority
Main Goal	Purchase commercial, market-ready goods or services	PCP - Procure R&D services to develop multiple prototypes or PPI - Buy innovative, nearly market-ready solutions.
Legal basis	Directive 2014/24/EU	PCP - Outside Directive (Art. 14 R&D exemption) PPI - Directive 2014/24/EU
EU Horizon impact	Minimal	Significant
IP Ownership by Default	In case of R&D, treated as “for hire” and given to public buyer, unless negotiated In case of selling results - with contractor + license	Both options possible but preferable - Supplier keeps IPR (explicitly)
Public Buyer’s Usage Rights	Depending on the contract	Yes, retains royalty-free rights to use & adapt or modify results
Right to License Out to Third Parties	If the buyer owns IP	Buyer retains conditional licensing rights to third parties in the public interest - FRAND

"Call-Back" Clause (transfer back if no commercialisation)	Rarely	Included
Distinction between Background and Foreground IP	Sometimes omitted; should be clarified in the contract	Clearly required
Encouragement of Innovation	Limited – focus is on predefined specifications	Very high-risk/reward shared with suppliers
Use of Patentable Results	Can be negotiated in a contract	Supplier patents; the buyer can use the results

To safeguard public interests in such cases, the public buyer will retain a broad license for its use, including the right to authorise third-party licensing or to grant a license itself if the supplier fails to commercialise the innovation within a reasonable timeframe (a "call-back" clause). The contract can include additional rights to prevent supplier lock-in and ensure future access to a competitive supply chain. This includes the buyer's right to require the contractor to grant licenses to third parties or, if they fail, to grant them themselves. To exercise these rights effectively, the buyer must have access to all relevant technical documentation and, where appropriate, be allowed to share this material with a limited group of stakeholders, such as other public administrations that require interoperability with the procured system. In all procedures, from traditional to PCP and Innovation Partnerships, the IPR arrangements must comply with State aid rules. Public buyers also need to clearly distinguish between new and pre-existing IP and may require contractors to notify them of new patent applications, ensuring the IP framework balances innovation incentives with public benefit.³¹⁷

A call-back provision raises some legal uncertainty. National law or contract shall define what is "failure to exploit". Additionally, overly rigid timeframes risk penalising sectors with inherently long development cycles, such as EV-charging and may disproportionately burden startups. Without compensation, reversion may be perceived as de facto expropriation, conflicting with IP exclusivity under TRIPS. Such uncertainty could deter investors.

Public authorities are supposed to ensure the license permits sharing results with predefined beneficiaries, like other interconnected administrations, even if it might "carve out" a portion of the future market.³¹⁸ This implies that by granting access to more public

³¹⁷ Guidance on Innovation Procurement, (2021), C 267/01 p. 43–45 (Section 4.1.7), 49–51 (Section 4.2.3.1–4.2.3.2), 54 (Innovation Partnership), and 59–60 (Annexe I, Parts I–II).

³¹⁸ Guidance on Innovation Procurement, 2021/C 267/01, Annexe I, p. 58

institutions in the contract, the original buyer is limiting the supplier's exclusive commercial opportunities in that area. For startups, it may lower the commercial value of their innovation if too much of the future market is "carved out".

In contracts *intuitu personae* (based on the contractor's unique identity or qualities) or those involving strategic autonomy and security concerns, public buyers can impose restrictions on the contractor's ability to transfer or exclusively license intellectual property (IP) rights to third parties, especially those outside the EU.³¹⁹ This measure safeguards public interest and national security by preventing sensitive technologies or trusted relationships from falling under undesirable control. Directive 2014/24/EU and Framework for State Aid for Research permit special conditions related to security and strategic interests.³²⁰

Critically, the balance between protecting public interests and incentivising supplier innovation remains delicate. On one hand, if the clauses are overly burdensome or interpreted too broadly, they may reduce the willingness of SMEs and start-ups to participate in procurement, fearing limited commercial exploitation and forced disclosure of know-how. On the other hand, failing to include such provisions may result in the public buyer being locked into proprietary technologies, with escalating maintenance costs and limited flexibility to scale or innovate.

There remains a significant gap between formal legal recognition and practical implementation of PPI across the EU. No country has adopted a national legal definition of PPI that is fully aligned with the EU framework; only several countries have included it in non-legally binding documents.³²¹ Clear legal definitions for PPI and PCP make public procurement more predictable. Startups are more likely to engage in public procurement if they understand who retains IPRs, whether partial commercialisation is allowed during or after the R&D phase, and whether their innovations can be scaled without reopening competition.³²² A key issue is the slow adoption of a default IPR, where IPR ownership remains with contractors unless justified public interest overrides, providing legal certainty for procurers on implementation, and the EU must clarify cross-border IPR aspects to prevent discrimination and foster a harmonised market for innovation.³²³

The analysis of possible limitations lead to a suggestion, that these patents created under government contract may be categorised as "public-funded patents", somehow similar to what happened with SEPs and green patents. However, the public authority let contractors retain IPRs not only for commercialisation reasons, but also for lowering costs on maintenance and future risks, related to patents. For that the contract costs much less than the contractor would transfer the exclusive rights to public authority. But if that cap in the price is enough to cover those limitations? With the list of limitations, these patents shall be treated differently as the patent, where the contractor retains full rights. Therefore, it means, the patents created under government funds differentiate from

³¹⁹ *Ibid*, Annexe I, p. 59

³²⁰ Directive 2014/24/EU on public procurement, Art. 18(2), Art. 24, and Art. 42; Framework for State Aid for Research, Development and Innovation, 2014/C 198/01.

³²¹ European Commission, Synthesis Report for the Benchmarking of National Policy Frameworks for Innovation Procurement, 2024, 24.

³²² Guidance on Innovation Procurement, 2021/C 267/01, p. 6–7.

³²³ Synthesis Report (2024), p. 99-100

normal exclusive IP rights. This is not a criticism of limitations, but is the question of balance of interests. The startups may know which outcome they are going to get.

3. State Aid and Evaluation of Patents

The EU Startup and Scaleup Strategy acknowledges that existing State Aid rules are poorly adapted to high-risk, innovation-driven firms, as traditional criteria often disqualify them from public support.³²⁴

Under the General Block Exemption Regulation (GBER), State Aid can lawfully cover administrative patent costs for SMEs.³²⁵ However, in PCP and PPI, transferring patent ownership to a private contractor without adequate compensation can be seen as unlawful State Aid under TFEU Article 107. The value of IP rights in these cases must be reflected in the price.³²⁶

Scholars propose various methods to estimate IP value, including benchmarking, revenue forecasting, and cost estimation.³²⁷ For startups and SMEs, patent valuation must adapt to high uncertainty and limited historical data.³²⁸ One option is to set a license price and a higher price for full IP transfer, or require the company to share product profits with the public administration, with payment terms and verification defined in the contract.³²⁹ However, since there are no clear guidelines for this valuation, which typically increases along the procurement procedure or decreases,³³⁰ e.g. in case of failure, or appearance of competitors, or creation of another technology,³³¹ it poses a legal challenge.

4. Green Procurement

Studies provide robust evidence that Innovative Public Procurement has a statistically significant and positive effect on firms' adoption of Environmental Innovations. And smaller firms are more likely to benefit from IPP when it comes to adopting environmental innovations.³³² The study finds that firms that win an IPP contract are significantly more likely to adopt sustainable manufacturing technologies in the next year.³³³ Article 70 of the Procurement Directive explicitly allows environmental conditions to be included in contract execution. However, local authorities face a challenge because they cannot easily

³²⁴ The EU Startup and Scaleup Strategy, COM(2025) 270 final, p. 8; Regulation (EU) No 651/2014 (GBER), Articles 2(18)–2(20).

³²⁵ Framework for State Aid for Research and Development and Innovation (2014/C 198/01), Section 5.3.3; Commission Regulation (EU) No 651/2014 (GBER), Article 28.

³²⁶ Community Framework for State Aid for Research and Development and Innovation, 2006/C 323/01 p. 3.2.1

³²⁷ Nicola Dimitri, "Intellectual Property Rights in the EU Pre-Commercial Procurement for Innovation," *Journal of Strategic Contracting and Negotiation* 4, no. 3 (2020)

³²⁸ R. Moro-Visconti, *Patent Valuation* (Cham: Springer Nature Switzerland AG, 2025), 538,

³²⁹ Guidance on Innovation Procurement, 2021/C 267/01, Annexe I

³³⁰ Dimitri (2020), p. 188

³³¹ *Ibid.*, 191-192

³³² Claudia Ghisetti, "Demand-pull and Environmental Innovations: Estimating the Effects of Innovative Public Procurement," *Technological Forecasting and Social Change* 125 (2017), p. 183; Bastian Krieger and Vera Zipperer, "Does Green Public Procurement Trigger Environmental Innovations?" *Research Policy* 51, no. 1 (2022)

³³³ Ghisetti (2017), p. 183-184

prove how innovative and green a seller truly is.³³⁴ The statistics on green patents are criticised (section 2.1.1).

Green patents are not awarded points *per se*, but they can indirectly influence the award phase through broader criteria. Under Article 67(2) of Directive 2014/24/EU, contracting authorities are permitted to evaluate tenders based on a range of qualitative, environmental, and innovative aspects, including environmental performance (a), technical merit (b), and innovative characteristics (g).³³⁵ If a patented technology demonstrably improves a product's environmental impact, such as reducing energy consumption or emissions, it may receive a higher score under these categories. Recital 92 further supports this interpretation by allowing award rules to take account of the “innovative nature of the proposal and the environmental or social characteristics.”³³⁶ Hence, while ownership of a green patent alone cannot be a scoring criterion (to preserve competition and avoid discrimination), the measurable environmental or technical benefit derived from patented solutions can be lawfully rewarded in the evaluation process.

5. Other matters to consider

The legal consequences for contracting authorities in cases of patent infringement by a tenderer remain largely unexplored in academic literature, despite their growing relevance. This intersection with open innovation ecosystems can affect both public authorities and startups, leading to significant reputational, financial, and legal repercussions.

Procurement rules do not mandate full patent ownership disclosure, but Articles 42(7), 60, and 67(2) allow contracting authorities to request proof of IP rights when technical specifications, innovation claims, or performance criteria involve proprietary technology. In such cases, authorities may require documentation verifying ownership, licensing, or freedom to operate.

F. Preliminary Conclusions

The analysis indicates that the traditional public procurement system in the EU is generally functional and supportive towards startups. Many of which base their business models on the use of patented technologies, yet impose significant complexities in the treatment of intellectual property rights. These complexities stem primarily from the persistent prioritisation of standards. As a result, startups may be compelled to obtain licences for third-party patents embedded in mandatory standards, creating a risk of dependency on rights holders. Additionally, the system exhibits a polarised approach to intellectual property: competition law prohibits certain exclusive practices, yet in practice, technical specifications may incorporate patented technologies. This overlap between technical specifications and third-party rights can place tender participants in situations of potential infringement, as evidenced by case law, requiring case-by-case solutions. Even where a company owns relevant patents, contracting authorities are obliged to ensure the availability of alternative solutions. The current procurement framework uses options on

³³⁴ Olga Chiappinelli, Leonardo M. Giuffrida, and Giancarlo Spagnolo, “Public Procurement as an Innovation Policy: Where Do We Stand?” *International Journal of Industrial Organization* 100 (2025), section 4.1.

³³⁵ Directive 2014/24/EU, art. 67(2).

³³⁶ Directive 2014/24/EU, recital 92.

variants and equivalents in rare cases, for example, in those related to the use of IPRs. While in most cases, standardised specifications hinder any attempts to attract new technologies, the design of the framework, as well as physical infrastructure, often makes it technically impossible to integrate such alternatives into existing infrastructure.

V. Conclusion

This research highlights the critical intersection between a flexible, innovative ecosystem governed through IP rights on the horizontal level and a rigid procurement system on the vertical level. It also examines how this dynamic shapes startups' ability to compete in the EU's urban mobility sector.

The study reveals systemic barriers — imbalanced IP allocation in tenders, and a preference for standardised solutions over new transformative technologies. The constraints limit scalability and undermine IP autonomy. The findings underscore the need for a legal framework and supporting infrastructure that safeguards exclusivity while enabling voluntary, innovation-driven collaboration.

RQ. 1. What are the legal challenges and limitations that might be foreseen by startups from patent and standards perspectives, and which legal aspects are still vague and unregulated?

Patents play a dual role in urban mobility. On the one hand, they provide legal certainty and commercial leverage for startups, enabling investment and collaboration. They also stimulate R&D by publicly disclosing inventions. On the other hand, the exclusivity granted by patents can create entry barriers and strengthen dominant market positions. The rise of Standard-Essential Patents (SEPs) and green patents highlights the deep interdependence between IP law and sector-specific dynamics, and how it is shaping IPRs.

Licensing models such as cross-licensing and patent pools can ease access to technologies but risk creating dependencies that limit a startup's IP autonomy. Similarly, patent pledges, while lowering entry barriers, may impose restrictive clauses that hinder further commercialisation. These issues, along with patent fences and thickets, raise FTO costs and increase exposure to litigation risks. Additionally, there is a growing need for more transparent patent pledges with independent oversight to ensure they support genuine technology diffusion without imposing hidden restraints.

Many challenges arise from prioritisation of established standards and the complex licensing mechanisms and IP strategies employed by large corporations — all of which shape the sector's innovation ecosystems. As a result, procurement processes often exclude disruptive projects that “do not fit” within existing legal and infrastructural frameworks, leading to the “European Paradox”. Procurement processes often stifle innovation through overly prescriptive technical specifications, inconsistent treatment of “equivalents” and “variants,” and fragmented interoperability standards that favour incumbent technologies, which results in higher costs and delayed adoption. Moreover, novel technologies frequently conflict with current standards, creating compatibility barriers.

Collectively, these obstacles prevent many innovations from reaching real-world implementation.

The significant barrier for startups lies in the allocation of intellectual property (IP) rights. Procurement, influenced by frameworks like Horizon, aims to safeguard public investment but imposes significant restrictions on how startups can exploit their IP. For instance, while a startup must independently acquire licenses for third-party SEPs to comply with public procurement standards, public authorities may obtain the right to sublicense the startup's technology without facing similar obligations when it comes to innovative tenders. This creates a clear asymmetry: startups effectively lose full control over their IP, yet the price of tender is significantly decreased. Innovation procurement can encourage for a new category of "public funded patents", where the title is formally retained but meaningful control is curtailed.

The lack of a harmonised EU definition for "startup" remains the subject of debate. While a new legal category could boost funding, it risks framing startups as supplementary rather than independent market players. Startups should have the right to pursue diverse development paths, including academic and research partnerships, going public and M&A, free and open sharing, or public collaborations. Therefore, the adoption of a uniform definition, which links startups with the EU innovation initiative and funds, will straight path to commercialisation through innovation procurement, which lacks from flexibility to scale up the projects. Denial of startups' independence and economic interest, and their equal position to any other corporation, leads to startups being restricted in their rights to their patented developments.

Although green patents could be seen as effective instruments for accelerating sustainability and could be used as a tool for startups to stand out in procurement, they are hindered by fragmented classification and inconsistent statistical reporting, which limits their reliability as a metric for measuring genuine impact. This ultimately undermines startups' ability to fully leverage green IP assets in competitive environments.

RQ 2. How can those challenges be overcome with the existing legal instruments, and if not, what other ways?

Addressing these structural challenges requires reforms that preserve startups' commercial autonomy while enabling participation in public innovation frameworks. Procurement specifications should prioritise functional and performance-based criteria, allowing space for patented solutions and creating a legal environment in which disruptive technologies can evolve into future standards. Local authorities could take a more active role in SEP licensing negotiations, including facilitating royalty negotiations and providing sublicenses to startups, to reduce their dependency on dominant patent holders.

A balanced allocation of IPRs in publicly funded projects is essential to ensure that startups retain effective control over the exploitation of their innovations, while safeguarding the public interest. Introducing a new category of "public funded patents" with clear, predictable limitations could establish transparent conditions for use without undermining the patent monopoly principle. The EU should support diverse development pathways by enabling academic partnerships, voluntary rights-sharing, industry

collaborations, and purely commercial routes, all underpinned by a robust legal and infrastructural framework for independent scale-up.

In parallel, contract models in public procurement must incorporate fair licensing terms, cross-border transfer possibilities, and enforceable dispute resolution mechanisms. These measures, when combined with the preservation of patent law's core exclusivity incentives, would help align the public procurement system with innovation objectives. This alignment would enable patents to fulfil their role as drivers of competitiveness, technology diffusion, and sustainable urban mobility growth.

In procurement, the EU Public Procurement Directives already permit functional and performance-based specifications, variant and equivalent offers, and innovation partnerships, but these provisions remain significantly underutilised. The forthcoming reforms under the EU Startup and Scaleup Strategy aim to lower entry barriers for smaller firms by limiting restrictive technical specifications, integrating innovation-friendly IPR clauses, and introducing SME-friendly fast-track procedures. Complementary measures include enhanced R&I funding, the strengthening of national competence centres for innovation procurement,³³⁷ and the establishment of regulatory sandboxes under the forthcoming European Innovation Act, which will give municipalities more flexibility to pilot and scale technologies.³³⁸

In the area of IP ownership and licensing, the European Commission is developing a harmonised IP valuation framework in collaboration with the EUIPO, ensuring that valuations reflect both market potential and risk exposure — enabling startups to use IP as collateral.³³⁹

In SEP licensing, the proposed on-demand public collective licensing agency under have chances to streamline FRAND-compliant licensing, promote the formation of patent pools, and reduce transaction costs, particularly for SMEs lacking negotiation leverage.³⁴⁰ Additionally, the public authority may take the role of the intermediary in licensing issues. Mirroring the situation when under the innovation procurement, a public authority obtains the right to use and sub-license a patent to other parties, in the same manner, a public authority can arrange licenses for tender participants as customer-supplied materials.

In the academic sphere, the Lab to Unicorn Initiative will support commercialisation through standardised licensing blueprints, revenue-sharing models, and capacity-building for Technology Transfer Offices.³⁴¹ Additional tools will include legal guidance on State aid compliance for IP assignments and a blueprint for licensing and spin-off creation.³⁴²

³³⁷ European Commission, The EU Startup and Scaleup Strategy, COM(2025) 270 final, 11.5

³³⁸ European Commission, The EU Startup and Scaleup Strategy, COM(2025) 270 final

³³⁹ European Commission, The EU Startup and Scaleup Strategy, COM(2025) 270 final

³⁴⁰ Z. Fidelice Opany, The Search for an Optimal Framework for Licensing Standard-Essential Patents: Is Collective Licensing a Solution? (2025), 3–22; European Commission, Contribution to the Debate on SEPs, Proposal 74 (2021).

³⁴¹ European Commission, The EU Startup and Scaleup Strategy, COM(2025) 270 final, 11.7.

³⁴² *Ibid*, 12.

For green and sustainability-linked innovation, procurement reforms will integrate SME-friendly preference criteria, resilience and sustainability requirements, and reserved quotas in crisis procurement.³⁴³ Coupled with a harmonised framework for green patent classification and sustainability assessments, these measures would enhance startups' positioning in green urban mobility projects.

Challenges such as over-reliance on public funding, Horizon Europe's open access constraints, and the lack of a harmonised EU definition for "startup" remain outside the scope of current instruments. To address these gaps, the EU could adopt a functional startup definition across its innovation legislation without tying development pathways exclusively to public funding. The startup's intellectual property portfolio, including its green patents, may be considered a defining feature. Or another way -- not to separate startups from larger corporations, but provide them with the freedom to choose their growth trajectory and remove these barriers rooted in standards and the old system. A critical challenge remains to create a pathway for truly revolutionary technologies that do not yet fit within our current infrastructure but hold the potential to deliver greater societal benefits than the existing electricity grid.

IP is crucial for startup survival, acting as a commercial asset that demonstrates their independence and viability. EU policy should shift from merely funding innovation to recognising startups as equal economic actors empowered by IP. Defensive IP strategies are shown to be the most favourable for knowledge transfer and green innovations.

The European Commission has outlined several key initiatives to strengthen IP governance for startups. Among them, the development of IP valuation frameworks to recognize it as intangible assets for financing, the creation of a blueprint for licensing and commercialization of research outputs will be created for academic institutions to encourage better use of research, the provision of legal guidance on State aid rules, and the integration of innovation-friendly IP provisions into tender documents as part of the revision of EU public procurement directives.³⁴⁴ While all initiatives are indeed targeting accessibility of startups, the problem of lack of commercialisation remains much deeper and rooted in rigid and formed for decades legal and physical frameworks.

Startups should retain the independent right to choose their development pathways — whether through public funding, private investment, strategic partnerships, or full commercialisation — without being forced into narrow, bureaucratic channels. Intellectual property, particularly patents, constitutes a core strategic asset and should remain under the startup's control unless they explicitly agree otherwise. Overly restrictive procurement frameworks and imbalanced IP allocation undermine startup autonomy, weakening both competitiveness and innovation diffusion. A supportive legal environment should safeguard startups' rights to exclusivity while enabling voluntary collaboration, ensuring that startups can leverage IP as the foundation of their market strength and sustainable growth in the urban mobility sector.

³⁴³ EIT Urban Mobility, Feedback on the EU Public Procurement Directives (March 2025), 5–6.

³⁴⁴ European Commission, The EU Startup and Scaleup Strategy, COM(2025) 270 final, p. 17.

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