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Smart urban mobility: a positive or negative IP space? A case study to test the role of IP in fostering digital data-driven innovation

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Abstract

Not all creative processes rely on IP exclusive rights to incentivize and protect innovative content. While strategic considerations on the costs and convenience of enforcing IP rules generally play an important role, in specific sectors alternative, non-IP norms and practices have proven more effective than IP rights in fostering progress by turning inclusivity into benefits, thus challenging IP protection at its core.

At a first sight, digital data-driven innovations present a twofold nature. They require remarkable investments, which likely call for strict IP rights, and, at the same time, value inclusivity, as interoperability and follow-up creation are key to the digital technological progress and, in turn, to the enhancement of services and allocation of resources. Against this background, the paper applies the conceptual framework of legal and economic theories exploring the so-called knockoff economy to investigate to what extent the innovative processes underlying the planning of smart cities, and particularly of smart urban mobility systems, rely on IP exclusive rights and how, on the contrary, the negative space of IP affects their development.

Keywords: Digital innovation, smart cities, smart urban mobility, IP law, IP negative space, knockoff economy.

1. Introduction: locating the intersection between IP, smart city and urban mobility innovation

The digital environment is under constant, rapid evolution, a fact that has great impact to our daily activities: from new features of social media communication to the emergence of digital public administration services, up to the ground-breaking impact of online market transactions. The rise of the 'digital' in our society has led to significant structural and regulatory developments aimed to reap the benefits of this new technological dimension.

The idea of **smart city** stems from the fertile soil of digital innovation. Its key components have in common a broad use of digital technologies and data collection and management systems.[1] At the same time, smart city innovation heavily relies on intellectual capital and knowledge management schemes,[2] and on high investments.[3]

Since the onset of the digital revolution, **intellectual property** (IP) law has gained centrality as regulatory backbone of digital innovation policies, due to its focus on the protection of knowledge and information, and its effectiveness in protecting investments – particularly when high and risky - and guaranteeing adequate returns. For similar reasons, IP may appear as the most appropriate regulatory framework also for smart cities innovation, particularly in light of their subject-matter overlap on investments, data and knowledge-management, which represent key features of smart cities and, at the same time, the object, rationale and content of IP. This conceptual intersection promises to shed light on the relation between the two 'worlds', yet remained so far unexplored in the literature.

[1] Hans Schaffers and others, 'Smart Cities and the Future Internet: Towards Cooperation Frameworks for Open Innovation' in John Domingue (ed), *The Future Internet. Future Internet Assembly 2011: Achievements and Technological Promises* (Springer 2011) 431–434 ('The Internet and broadband network technologies as enablers of e-services become more and more important for urban development [...] the Internet and Web 2.0 as potential enablers of urban welfare creation through social participation.'); Jesse Shapiro, 'Smart Cities: Quality of Life, Productivity, and the Growth Effects of Human Capital' (2006) 88 The Review of Economics and Statistics 324.

[2] indicating 'intellectual property' as key resource for smart mobility projects (assessing its relevance from 40% to 100% of the pool of key resources involved). See also Adriano Tanda and Alberto De Marco, 'Business Model Framework for Smart City Mobility Projects' (2019) 471 IOP Conference Series: Materials Science and Engineering; Renata P Dameri and Francesca Ricciardi, 'Smart City Intellectual Capital: An Emerging View of Territorial Systems Innovation Management' (2015) 16 Journal of Intellectual Capital 860, 861 ('The smart city community strongly believes that knowledge is the key to the future, and that the pivotal strategies in the development of "smart" knowledge are technological innovation, collaborative networking and participative social interactions.').

[3] The main definitions of smart city innovation pivot on the investment component. See, inter alia, Andrea Caragliu, Chiara Del Bo and Peter Nijkamp, 'Smart Cities in Europe', *3rd Central European Conference in Regional Science* (2009) ('[...] when investments in human and social capital and traditional [transport] and modern [ICT] communication infrastructure fuel sustainable economic growth and a high quality of life.').

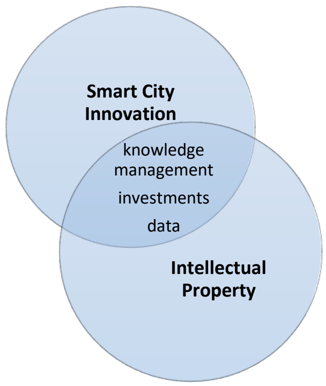

Figure 1 - Intersection between Smart City Innovation and Intellectual Property

2. The problem of incentives and viable perspectives to address it

Smart city innovations and IP law, however, intersect also on specific problems they both aim at tackling: on the one hand, the problem of generating the incentives to innovate; on the other hand, the protectability of data. Both problems have been extensively and separately analyzed. As this paper demonstrates, their contextualization in the intersection drawn above adds value to the analysis and, in particular, to an up-to-date understanding of the impact of IP law in the smart city context.

The paper focuses only on the problem of incentives, which is the first to come into play in the innovation process. The questions on whether, what and how data come into play and can be protected would necessarily require expanding the discourse beyond the IP domain, going beyond the scope and length of this contribution.[4].

Smart city innovation requires to be incentivized. Even though the goals of enhancing the quality of urban life and the environmental sustainability of cities are appealing to the most and long reflected in local, national and even supranational policies, the necessary technological infrastructures and know-how are yet to be fully developed .From this perspective, the scenario of smart urban mobility is a highly representative test bed to verify the incentivizing potential of IP. In fact, not only do smart mobility and transportation represent a key component of what is understood as 'smart city',[5] but also require significant investments, carried out by either public or private entities,[6] covering both the development costs of ICT and digital technologies (e.g. broadband networks, software applications,

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[4] See Teresa Scassa, 'Public Transit Data Through an Intellectual Property Lens: Lessons About Open Data' (2014) 41 Fordham Urban Law Journal 1759.
[5] Tanda and De Marco (n 2) 2.
[6] *ibid* 5–6.

sensors and actuators) and other infrastructures (e.g. vehicles, related insurance and maintenance costs).[7]

IP law fundamentally deals with the 'incentive problem'. Besides specific arguments attached to the various IP legal sectors,[8] the core justification of IP protection as a whole lies in the utilitarian perspective, according to which time-limited exclusive rights serve as artificial incentives to reach innovation and progress. This is particular evident when engaging with the economic analysis of IP law, which emphasizes on the resemblance of its subject matter with public goods: information, know-how, culture are, in fact, not only intangible, but also non rival resources, which are hard to exclude, features shared also by the classic examples of a lighthouse and national security.[9]

Nevertheless, recent developments emerging from the digital environment have prompted the question: **is IP protection really necessary to stimulate innovation?** The hypothesis has arisen that IP may play rather an *ex post* role, an afterthought that people involved in innovative industries consider during or even after the realization of a project as part of the strategy on how to maximize their profits. In this light, patent and trademark law have been challenged in their structure and effects, highlighting the high costs of filing and litigation and their misuses, which jeopardize the underlying incentive mechanism.[10] Similarly, the role of copyright in creating a stimulus for creativity has been questioned in a wide array of contexts, from the open software movement[11] to the fashion industry,[12] from cooking recipes[13] to urban art.[14] The criticisms moved against this cautious view on the IP incentive

[7] Schaffers and others (n 1) 435.
[8] E.g. a more or less accentuated natural law dimension of copyright, an *ad hoc* consumer-oriented justification for trademarks. See, in this regard,
[9] Niva Elkin-Koren and Eli M Salzberger, *The Law and Economics of Intellectual Property in the Digital Age. The Limits of Analysis* (Routledge 2013) 57 ff.; Robert P Merges, *Justifying Intellectual Property* (Harvard University Press 2011).
[10] *Inter alia*, Peter Georg Picht, 'Standard-Essential Patents: Limiting Exclusivity for the Sake of Innovation' in Josef Drexl and Anselm Kamperman Sanders (eds), *The Innovation Society and Intellectual Property* (Edward Elgar 2019); Ansgar Ohly, 'Free Riding on the Repute of Trade Marks: Does Protection Generate Innovation?' in Josef Drexl and Anselm Kamperman Sanders (eds), *The Innovation Society and Intellectual Property* (Edward Elgar 2019); Kevin Emerson Collins, 'Patent Failure: A Tragedy of Property' <https://ssrn.com/abstract=1156434> accessed 10 October 2019; James E Bessen and Michael James Meurer, *Patent Failure: How Judges, Bureaucrats, and Lawyers Put Innovators at Risk* (Princeton University Press 2008).
[11] See Josh Lerner and Josh Tirole, 'Some simple economics of Open Source' (2002) J. Ind. Econ. 50, 197; Yochai Benkler, 'Coase's Penguin, or Linux and the Nature of the Firm' (2002) 112 Yale Law Journal 369.
[12] Kal Raustiala and Christopher Sprigman, 'The Piracy Paradox: Innovation and Intellectual Property in Fashion Design', 61 Stanford Law Review 1201 (2009); Stefan Bechtold, 'The Fashion of TV Show Formats' (2013) Mich. St. Law Review 451.
[13] Emmanuelle Fauchart and Eric von Hippel, 'Norms-based Intellectual Property Systems: The case of French chefs' (2008) Organization Sci. 19, 187; Christopher Buccafusco, 'On the Legal Consequences of Sauces: Should Thomas Keller's Recipes be Per Se Copyrightable?' (2007) 24 Cardozo Art and Ent. Law Journal 1121; Emily Cunningham, *Protecting Cuisine Under the Rubric of Intellectual Property Law: Should the Law Play a Bigger Role in the Kitchen?,* 9 J. HIGH TECH. L. 21 (2009).
[14] Marta Iljadica, *Copyright Beyond Law: Regulating Creativity in the Graffiti Subculture* (Hart Publishing 2016); Cathay YN Smith, 'Street Art: An Analysis under U.S. Intellectual Property Law and Intellectual Property's Negative Space Theory' (2013) 24 DePaul Journal of Art & Intellectual Property 259 ff.

solution have been mostly grounded on the fact that the selection of examples and case studies is limited and highly sectorial.[15]

Yet, as forms of innovation and creativity are rapidly evolving, it is particularly worth inquiring into the effective role of IP in incentivizing cutting-edge technological advancement. In this vein, smart cities and, in particular, smart urban mobility innovations are an insightful scenario to explore. Not only this innovative sector has a remarkable impact on society, thus sharing IP's core purpose of enhancing technological progress for the general benefit, but also it tends to rely on an inclusive, if not entirely open, dimension of knowledge management,[16] which seems to clash with the individual exclusive rights structure of IP protection.

3. The knockoff economy: an insightful perspective into the smart city

Questioning whether the introduction of an incentive to innovate is really needed leads to the notion of 'IP negative space'.[17] This concept refers to a beneficial absence of IP protection in certain fields of invention and creativity, or – in other words – to spaces where, even without IP right being enforced, value gets generated. As mentioned above, studies in this direction have addressed well-defined scenarios, which, nevertheless, allowed for wider theories to emerge.

Among them, Raustiala and Sprigman introduced the notion of **knockoff economy**.[18] The theory highlights two main features of IP negative spaces. First of all, actors are not moved by the promise of exclusive entitlements over their works.[19] Subsequently, a highly permissible 'copying' culture get generated: innovators heavily rely on existing works, using, imitating and building on them, thus carrying out what is called productive infringement;[20] at the same time, they are accommodating towards third parties using their own works as they value the reciprocal advantage in borrowing from each other.[21] By this token, a tight interconnection between inventions comes into being and the IP utilitarian justification is

[15] See Robert Merges, 'Economics of Intellectual property law' in Francesco Parisi, *The Oxford Handbook of Law and Economics* (2017).
[16] Schaffers and others (n 1) 433 ('Common, shared research and innovation resources as well as cooperation models providing access to such resources will constitute the future backbone of urban innovation environments').
[17] See Elizabeth L Rosenblatt, 'A Theory of IP's Negative Space' (2011) 34 Columbia Journal of Law & the Arts; Rochelle C Dreyfuss, 'Does IP Need IP? Accommodating Intellectual Production Outside the Intellectual Property Paradigm' (2010) 31 Cardozo Law Review.
[18] Kal Raustiala and Christopher Sprigman, *The Knockoff Economy: How Imitation Sparks Innovation* (Oxford University Press 2012).
[19] *ibid* 45.
[20] Varada Balachandran, 'Negative Spaces of Intellectual Property. A Cursory Glance' (2016) The i.p. site, <https://theipsite.wordpress.com/2016/03/31/negative-spaces-of-intellectual-property-a-cursory-glance/> accessed 17/9/2019 ('Productive infringement is an innovation that builds closely on its forbear.').
[21] Raustiala and Sprigman (n 18) 58 ('[...] extensive imitation—call it borrowing, copying, or, if you prefer, piracy.').

challenged at its core: in the knockoff economy it is not the limited monopoly, but rather 'copying [that] spurs innovation'.[22]

Smart cities innovation and, in particular, the sector of smart urban mobility share the two core features identified by the knockoff economic theory. First and foremost, the involved actors are generally moved by incentives, which differ from the expectation of exclusive right to profit from (and decide upon) the use of the created technology. This is mainly due to the rise of the 'city' itself – especially big cities hubs – as a collaborative driver of innovation:[23] individuals pool together efforts with the intent to find concrete solutions to the problems of the city and enhance the quality of life, rather than aiming at an immediate profit *stricto sensu*. Universities play a major role in this development, but also private and public entities funding smart mobility projects show a complementary, if not completely different, intent, moving a step away from the economic gain and towards the wider benefits of a sustainable and inclusive innovation.[24] In turn, this promotes an inclusive and multi-faceted environment of innovation, where the access to knowledge resources is more often shared than licensed.

a) The features of IP negative spaces

The existence of creativity and innovation outside the IP realm is a phenomenon that has been noticed and described already in the mid-1900s with regard to academic science,[25] and later on even in sectors above any suspect, such as the English iron industry in the 19th century.[26] With the third Industrial Revolution and the advent of the so-called Knowledge Economy, based on the production and commercialization of information goods,[27] research and development processes have progressively become cumulative, and often based on networks.[28] At the same time, traditional IP rights have proven to be ill-fit to protect innovations characterized by pure informational content,[29] triggering in response either the expansion of scope and duration of existing entitlements, or the introduction of new forms

[22] *ibid* 7.
[23] The city as an example of 'collaboration *within* the innovation process'. See Schaffers and others (n 1) 431–432, 442 ('[...] cities are increasingly assuming a critical role as drivers of innovation in areas such as health, inclusion, environment and business. [...] considered not only as the object of innovation but also as innovation ecosystems empowering the collective intelligence and co-creation capabilities of user/citizen communities for designing innovative living and working scenarios.').
[24] See Eric von Hippel, *Democratizing Innovation* (MIT Press 2005).
[25] As in the case of Robert K Merton, 'Science and Technology in a Democratic Order', 1 K. Legal & Pol.Soc. 115 (1942). Merton is cited as the precursory of the debate by Rebecca S Eisenberg, 'Proprietary Rights and the Norms of Science in Biotechnology Research' (1987) 97 Yale Law Journal 177, 179 and by Rochelle C Dreyfuss (n 17) 1443-4.
[26] Described in the work of Robert C Allen, 'Collective Invention' (1983) 4 Journal of Economic Behavior & Organization 1.
[27] For a contrast with the first and second Industrial Revolution, see Bradford L Smith, 'The Third Industrial Revolution: Policymaking for the Internet' (2001) 3 Columb. Sci & Tech. L. Rev 1, 2-4.
[28] See Manuel Castells, *The Rise of the Network Society* (Blackwell 2010).
[29] Dreyfuss (n 17) 1140; Yochai Benkler, 'Open Access and Information Commons' in Francesco Parisi (ed), *The Oxford Handbook of Law and Economics: Private and Commercial Law* (vol 2) (2017).

of exclusivity.[30] The broadening and fragmentation of knowledge privatization has led to an increase in the transaction costs faced by second-comers to develop subsequent innovations and to the creation of new barriers to entry and hold outs, while the number and variety of actors involved in the innovation processes have increased, and so did the divergence in their nature and motivating forces.[31] Critiques against the efficiency of the IP system in incentivizing and sustaining the progress of arts and sciences have thus again heated up,[32] coupled with a renewed attention towards open innovation communities and sectors labelled as IP negative spaces.

For almost two decades now, the topic has engaged economists, lawyers, management and social scientists. The free software movement is generally identified as the first successful example of a commons-based peer-production of innovation by users, organized in non-hierarchical groups, not motivated by the attribution of proprietary rights over their intellectual creations, and developing a product which is accessible, updated, and tailored to their needs.[33] Subsequent contributions have focused on the role played by so-called prosumers in the generation of creative content and on the general determinants of user innovation in specific sectors,[34] followed by case studies on creative sectors characterized by a widespread diffusion of copying as accepted social behavior which supports, instead of hindering, a thriving intellectual production. Examples range from stand-up comedy[35] to

[30] The expansion of IP protection has characterized the development of the discipline affecting both the duration and scope of IP protection, as summarized, among others, by Richard A Posner, 'Intellectual Property: The Law and Economics Approach' (2005) 19 Journal of Economic Perspectives 2, 72 ff.
[31] See Graeme B Dinwoodie and Rochelle C Dreyfuss, 'Intellectual Property law and the Public Domain of Science' (2004) 7 Journal of International Economic Law 431.
[32] James Boyle, *The Public Domain. Enclosing the Commons of the Mind* (Yale University Press 2008); Lawrence Lessig, *Free Culture. How Big Media Uses Technology and the Law to Lock Down Culture and Control Creativity* (Penguin 2004).
[33] Benkler (n 11) 378-9. The theory is further elaborated in Yochai Benkler, *The Wealth of Networks: How Social Production Transforms Markets and Freedom* (Yale University Press 2006), where Benkler introduces the concept of "Networked Information Economy", made possible by the Internet and the increased media access and based on the commons-based peer-production of information along non-proprietary strategies.
[34] See, e.g. Pamela D Morrison, John H Roberts and Eric von Hippel, 'Determinants of User Innovation and Innovation Sharing in a Local Market' (2000) 46 Management Science 1513.
[35] Dotan Oliar and Christopher Sprigman, 'There's No Free Laugh (Anymore): The Emergence Of Intellectual Property Norms And The Transformation Of Stand-Up Comedy' (2008) 94 Virginia Law Review 8, 1787.

graffiti and street arts,[36] typefaces,[37] cuisine,[38] magic tricks,[39] fashion,[40] fan fiction,[41] musical genres such as hip hop,[42] or styles such as those of jambands,[43] furniture,[44] sports.[45] Studies of economic history have showcased similar patterns in now patent-dominated fields such as animal and plant breeding,[46] or computer hardware.[47] Scholars have analyzed organizational processes and structures featuring open innovation settings,[48] developed indicators to measure their performance, and tried to generalize their numerous empirical observations in theoretical frameworks, which could describe the common traits of sectors and industries operating as IP negative spaces.[49]

In fact, IP negative spaces appear in two different forms.[50] Some creations, inventions or, more generally, information may be completely outside the scope of IP rights, or lay in "low-IP" zones, where the protection granted is limited and hard to get. Fashion and furniture

[36] Cathay Y N Smith, 'Street Art: An Analysis under U.S. Intellectual Property Law and Intellectual Property's Negative Space Theory' (2013) 24 DePaul Journal of Art, Technology & IP Law 259; Enrico Bonadio, 'Street art, graffiti and copyright' in Enrico Bonadio and Nicola Lucchi (eds), *Non-Conventional Copyright. Do New and Atypical Works Deserve Protection?* (Edward Elgar 2018).
[37] Arul G Scaria and Mathews P George, 'Copyright and Typefaces' in Enrico Bonadio and Nicola Lucchi (eds), *Non-Conventional Copyright. Do New and Atypical Works Deserve Protection?* (Edward Elgar 2018); Raustiala and Sprigman, *The Knockoff Economy* (n 18) 145-155.
[38] Emmanuelle Fauchart and Eric A von Hippel, *Norms-Based Intellectual Property Systems: The Case of French Chefs*, 19 ORG. SCI. 187 (2008); Christopher J Buccafusco, *On the Legal Consequences of Sauces: Should Thomas Keller's Recipes Be Per Se Copyrightable?*, 24 CARDOZO ARTS & ENT. L.J. 1121 (2007).
[39] Jacob Loshin, 'Secrets Revealed: How Magicians Protect Intellectual Property Without Law' (2007) <https://ssrn.com/abstract=1005564> accessed 19 October 2019.
[40] Kal Raustiala and Christopher Springman, 'The Piracy Paradox: Innovation and Intellectual Property in Fashion Design' (2006) 92 Virginia Law Review 8, 1687.
[41] Rebecca Tushnet, 'Legal Fictions: Copyright, Fan Fiction, and a New Common Law' (1997) 17 LOY. L.A. ENT. L. REV. 23, 651.
[42] Tonya M Evans, 'Sampling, Looping and Mashing… Oh My! How Hip Hop Music is Scratching More Than the Surface of Copyright Law' (2011) 4 Fordham Intellectual Property, Media and Entertainment Law Journal 843.
[43] Mark F Schultz, 'Fear and Norms and Rock & Roll: What Jambands Can Teach Us About Persuading People to Obey Copyright Law' (2006) 21 BERKELEY TECH. L.J. 651.
[44] Daniel J Kevles, *Patents, Protections, and Privileges: The Establishment of Intellectual Property in Animals and Plants*, 98 ISIS 323 (2007).
[45] Peter Mezei, 'Copyright protection of sport moves' in Enrico Bonadio and Nicola Lucchi (eds), *Non-Conventional Copyright. Do New and Atypical Works Deserve Protection?* (Edward Elgar 2018); Scott F Kieff, Robert G Kramer and Robert M Kunstadt, 'It's Your Turn, but It's My Move: Intellectual Property Protection for Sports "Moves"' (2009) 25 SANTA CLARA COMPUTER & HIGH TECH. L.J. 765, 766, 774–6; Raustiala and Sprigman, *The Knockoff Economy* (n 18) 126-136.
[46] Michael A Heller and Rebecca S Eisenberg, *Can Patents Deter Innovation? The Anticommons in Biomedical Research*, 280 SCIENCE 698 (1998);
[47] Peter B Meyer, 'Episodes of Collective Invention' (2003) U.S. Bureau of Labor Statistics, Working Paper No. 368.
[48] Siobhán O'Mahony and Fabrizio Ferraro, 'Managing the Boundary of an "Open" Project' (2004) IESE Bus. Sch., Univ. of Navarra, Working Paper No. 537.
[49] Jeroen PJ de Jong and Eric von Hippel, 'Transfers of User Process Innovations to Process Equipment Producers: A Study of Dutch High-Tech Firms' (2009) 38 RES. POL'Y 1181.
[50] Rosenblatt categorizes them in three areas, the third one covering products of uses that are exempted from IP infringement liability for they are covered by legislative exceptions. The category is not sector-specific and largely undefined, but for the inclusion of scholarly writing and medical techniques. See Rosenblatt (n 17) 335.

design, typesets, recipes, perfumes, business method, sport moves, raw data, fall within this category.[51] Others may be eligible for protection, but authors and inventors do not commonly resort to enforcement against infringements, as in the case of programmers of open source software, academics, magicians, comedians, street art and tattoos artists.[52] In both cases, creativity and innovation are present and thrive without relying on IP, but thanks to sector-specific social and business norms. Despite their heterogeneity, the various areas share similar features, which scholars have tried to outline in an attempt to propose a general theory of what makes a creative or industry sector an IP negative space.

Rosenblatt[53] identifies four conditions that, when present, are likely to flag an IP negative space, which are met when (i) the incentive is given not by exclusivity but by other types of rewards not dependent on financial gain; (ii) exclusivity hinders or harm subsequent innovation/creation; (iii) there is high interest in free access from the public and from authors/inventor; and (iv) authors/inventors are keener to invest in new innovation/creation rather than in IP enforcement.

If a creator is motivated by recognition, she will be willing to renounce to the benefit of exclusivity, in order to decrease the cost of her work and foster access and dissemination. Some sectors are strongly characterized by this feature (e.g. academia),[54] others witness a wider variety of individual approaches. Similarly, if the driver is the desire to belong to a community regulated by social norms that embrace a free sharing culture, creative works and inventions will be generated to contribute to the commons, and not on the basis of the promise of a future profit. The peer-production sustaining the free software movement, Wikipedia and fun fiction is based on such mechanisms.[55] Incentives may also come from outside IP law, or from the perspective of indirect, future gains. In the case of innovations which are inexpensive to produce, expensive to reverse-engineer and subject to quick obsolescence, for example, the inventor's competitive advantage derives from being the first comer, while obtaining and enforcing IP rights may be inefficient cost-wise.[56] By the same token, creations which obtain market success and increase their value thanks to network effects incentivize their makers to allow free uses – and thus forfeit exclusivity - in order to stimulate the adoption of the technology by a large number of customers, and profit from the commercialization of related products at a later stage.[57]

[51] Although sport moves may be qualified under the second category in those legal systems where they have been considered eligible for protection. In this respect see Rosenblatt (n 17) 333; Raustiala and Springman, 'The Piracy Paradox' (n 41) 1774; Kieff, Kramer and Kunstadt (n 46) 774-6.
[52] The three categories are suggested by Rosenblatt (n 17) 323-4.
[53] ibid 322.
[54] See Thomas Eger and Marc Scheufen, *The Economics of Open Access* (Edward Elgar 2018) 261 highlighting the two characterizing features of the reward system in scientific production, i.e. scholars' curiosity as 'intrinsic *motivation'* and the 'extrinsic motive' of 'recognition of priority of their research and the expected gain in reputation with their peers.'
[55] See Yochai Benkler, 'Sharing Nicely: On Shareable Goods and the Emergence of Sharing as a Modality of Economic production', 114 Yale Law Journal 273 (2004), 321-322. On fun fiction see Rebecca Tushnet, 'Legal Fictions: Copyright, Fan Fiction, and a New Common Law', 17 Loyola Entertainment Law Review 651 (1997).
[56] As in Raustiala and Sprigman (n 41) 1719-29.
[57] On network effects, see Dan Burk, Mark Lemley, Policy Levers in Patent Law, 89 Virginia Law Review 1575 (2003), 1586-88.

While exclusivity and the fragmentation of IP ownership have the general effect of increasing the cost of new creations and inventions, naturally constraining their output, some sectors are more negatively affected by exclusivity than others, to the extent that legislative exceptions to IP rights are not enough to compensate and rebalance. This may depend on the higher risks of infringement and costs of enforcement compared to the profit deriving from the monopolistic position granted by IP, and on the relatively contained economic damages caused by the competitors' copycatting.[58] Creations featuring these characteristics, such as fashion design, recipes, perfumes, sport moves are usually more likely to become IP negative spaces.

The third condition identifies spaces that legislators carve out from IP laws in consideration of the strong public interest in maintaining certain creations and inventions in the public domain, or in excluding certain uses from infringement.[59] The legislative balance is based on the belief that, in spite of the missing or reduced exclusivity, other drivers will still sustain the production of knowledge and innovation, and/or the market will still grant to the affected authors and inventors a satisfactory income.

IP negative spaces are also likely to arise when authors and inventors are more prone to invest in the generation of new works than in obtaining protection and enforcing IP rights. This may happen when the costs of applying and maintaining the exclusivity are too high compared to the actual value of the subject matter of the protection, the ease (and costs) of enforcement, and the overall financial capabilities of the applicant. Examples range from the case of authors producing numerous small works to creations having fast obsolescence, sectors featuring massive infringers or large numbers of non-infringing substitutes, or works the infringement of which is generally hard to prove, leading to high uncertainties on the outcome of potential litigations.

The four conditions may be or not be present at the same time, and characterize, with different degrees, an entire sector or only part of it. The more conditions the sector features, the higher their degree of intensity and the more homogeneous their diffusion, the more the chances will be that creativity and innovation will flourish outside traditional IP schemes, and be hampered by the introduction of exclusivity rules.

IP negative spaces may entail both individual, solo production and networked peer-production as standard setting.[60] The same applies to open innovation platforms, where the development of new technologies and creations may be either fully conducted in a joint fashion or entail the reciprocal free sharing of know-how, skills, expertise and knowledge to support and foster individual production.[61] While individual creations and inventions take place following the creative norms of the sector involved and do not need specific conditions to be satisfied in order to take place, peer-production requires the common project to have particular characteristics in order to function well and reach satisfactory results. Benkler

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[58] See Kevin E Collins, 'Patent Failure: A Tragedy of Property' (2008) <https://ssrn.com/abstract=1156434> accessed 21 October 2019; James Bessen and Michael J Meurer, *Patent Failure: How Judges, Bureaucrats and Lawyers Put Innovators at Risk* (Princeton University Press 2008).
[59] Rosenblatt (n 17) 349.
[60] Ibid 325
[61] See Henry Chesbrough, *Open Innovation. The New Imperative for Creating and Profiting from Technology* (Harvard Business School Press 2003), 72-73.

identifies these features in (i) modularity, which is the divisibility of the project into components that can be developed independently, thus also at a different time and incrementally; (ii) heterogeneous granularity, which allows its fragmentation among a large number of contributors, who will not risk to lack motivation since the effort required from them is relatively small or can be tailored to their degree of engagement; (iii) low-cost integration of the numerous contribution into a quality-controlled final product.[62]

In order to understand whether and to which extent urban mobility represents an IP negative space, it is useful to briefly delve into the characteristics of its main technological pillars.

b) Constituents of innovation in urban mobility settings

Smart urban mobility shares with smart cities the main constituents of its operation: (i) big data, (ii) traditional software infrastructures and interfaces and more sophisticated artificial intelligence algorithms, and (iii) the new technologies underlying smart transportation means and related accessory devices. Understanding their characteristics and the mechanisms leading to their production represents the key step to define which sets of incentives the legislator should provide and which innovation ecosystem it should shape in order to support the effective, efficient and sustainable development of smart mobility innovation.

i. (Big) data

Data generated by users and their devices are key constituents of smart mobility innovation, and pillars for the development and functioning of its products and services.[63] As in any system leveraging the Internet of Things, data collected and processed by anybody for a specific purpose may be used by other market players for other purposes.[64] Smart cars register information to signal and predict the need for maintenance services, but can also collect data on road conditions, volume of traffic, viability changes. Each data corpus may be aggregated to the data collected and processed by other devices, and used by municipalities to plan interventions, by intermediaries to offer traffic monitoring services, by public transportation providers to manage delays, envision alternative routes or deploy additional units, and by users to smartly plan their itineraries.[65] The greater the amount of data processed, the greater the reliability of the conclusions derived from their aggregation and analysis, and the larger the amount of information their correlations may provide and the number of questions it may answer to.

Data used in smart mobility programs stem inevitably from different sources, some of them private, others public. A central role is played by user-generated data, which fundamentally contribute to the functioning of the mobility service or product offered: suffice it to think of the information shared by users on locations, routes, traffic, possible disfunctions and, not less significantly, about their own preferences.

[62] Benkler (n 11), 375-376.
[63] Tanda and De Marco (n 2) 2.
[64] Similar observations can be found in Josef Drexl, 'Designing Competitive Markets for Industrial Data – Between Propertization and Access' (2016) Max Plank Institute for Innovation and Competition Research Paper No. 16-13, 10.
[65] (cross-reference with case studies)

Realizing the importance to grant access to public sector information (PSI) to businesses to foster innovation in the data economy, the EU legislator has already intervened with a Directive that aims at creating a level playing field to facilitate their commercial re-use.[66] The efficiency of sharing and cooperation against business models and policy options based on data propertization has also been clearly perceived by private actors, as proven by the skepticism they have opposed against regulatory proposals of introduction of exclusive rights for data producers.[67] The results of the online public consultation and specialized workshops held to discuss the policy options proposed by the European Commission (EC) in early 2017 have underlined the increasing dependency of companies on data producers by others, with three quarters of respondents sharing their data, on the basis of contracts providing either open reuse conditions or payment of license fees.[68] At the same time, half of the respondents – particularly SMEs - have complained about problems experienced in accessing data held by competitors, and the totality of stakeholders supported the goal of making more data available for reuse to foster innovation and competitiveness.[69] One common observation, however, is of key relevance, and confirms earlier findings of the economic literature emphasizing the absence of evidence on market failures that would justify a regulatory creation of property rights.[70] Data holders, in fact, agree on the fact that the current regulatory ecosystem well protect their investment in data collection capabilities, and underline how the data value chains and business models shaping the current data economy are so varied and fast evolving that crystallizing a one-size-fits all legislative solution would entail greater risks than benefits.[71] On the contrary, freedom of contract, if sterilized from anti-competitive and opportunistic behaviors from intermediaries and other big players,[72] is perceived as more instrumental to the organic development of smart

[66] Directive 2003/98/EC on the re-use of public sector information [2003] OJ L 345/90, amended by Directive 2013/37/EU [2013] OJ L 175/1. The importance of sharing and cooperation between the public and private sectors are well emphasized by OECD, 'Data-Driven Innovation: Big Data for Growth and Well-Being' (2015) <https://www.oecd.org/innovation/data-driven-innovation-9789264229358-en.htm> accessed 23 October 2019, 402-408.

[67] In its Communication on "Building a European data economy", 10 January 2017, COM(2017) 9 final, 13, the EC proposed the introduction of a data producer's right to protect non-personal data generated within the EU from misappropriations by extra-EU companies. In the words of Guenter Oettinger, then heading DG CONNECT and thus leading the proposal, the economic importance of data was particularly visible in the automotive industry and for the developed of self-driving automobiles (G. Oettinger, 'Wem gehören die Daten?', Frankfurter Allgemeine Zeitung, 14 October 2016). On the industry rejection and its underlying reasons see Drexl (n 69) 5 and Heiko Willems, 'Trading in Data: An Industry Perspective' in Sebastian Lohsse, Reiner Schulze and Dirk Staudenmayer (eds), *Trading Data in the Digital Economy: Legal Concepts and Tools* (Nomos 2017) 323.

[68] As summarized in the Synopsis Report of the Public Consultation on Building a European Data Economt, available at http://ec.europa.eu/information_society/newsroom/image/document/2017-36/synopsis_report_-_data_economy_A0EFA8E0-AED3-1E29-C8DE049035581517_46646.pdf (last accessed 28 October 2019), 4.

[69] *Ibid* 6.

[70] Nestor Duch-Brown, Bertin Martens and Frank Mueller-Langer, 'The economics of ownership, access and trade in digital data' (2017) JRC Digital Economy Working Paper 2017-01.

[71] See Bernt P Hugenholtz, 'Against Data Property', in Hanns Ullrich, Peter Drahos and Gustavo Ghidini (eds), *Kritika: Essays on Intellectual Property: Volume 3* (Edward Elgar 2018) 48, noting how business models working with big data are constantly changing, and crystallizing entitlements in a property right when the object is a very risky policy option when the object of the right is such a moving target.

[72] For instance, with the application of FRAND rules to ensure fair access and re-use of data corpora.

industries and their specific needs. Reinforcing the legal status of data is believed not to be conductive to any facilitation in the tradability of data, but rather to create legal uncertainty as to the allocation of exclusive rights and their scope, and to consequently raise transaction costs and other costs linked to the increased risk of litigation.[73]

The observations advanced by industrial stakeholders are in line with the concerns voiced by several scholars in response to the EC's proposal of introducing a data producer's right.[74] Aside from the legitimate systematic objections related to the problematic overlaps that the new exclusive right would have with other IP rights,[75] commentators have shed lights on the incompatibility of a regulatory framework based on exclusivity with the main technical and economic features of business models based on big data. The "3 Vs" giving value to big data – volume, velocity, variety – are directly dependent on the different and large range, source and format of data analyzed in a dynamic and fast fashion, and on the real-time information which may be extracted from them to provide smart products and services.[76] The traditional vertical value chain, where goods and services acquired value in their progression down the production and distribution chain until they reached the final consumer, are now substituted by dynamic value networks, where smart goods and services increase their value thanks to horizontal, real-time and dynamic cooperation.[77] A propertized setting is hardly compatible with the needs such features pose. Similarly, the decision on where to allocate property rights would face the difficulty of defining and distinguishing the economic value to be attributed to the syntactic and semantic information contained in the data corpora, which are, respectively, the rough coded data, collected through the investment of the device producer, and the meaning that can be extracted from it, generally extracted by data analysts – two players which may or may not correspond.[78]

Big data analytics in general, and even more in the context of urban mobility, presents all the four characteristics of IP negative spaces. Despite the absence of strong exclusive rights, data analytics has not experienced any halt, nor companies have reduced their commitment to big data innovation. There is agreement on the fact that exclusivity would create barrier to access, increase transaction costs, have chilling effects on sharing and cooperation, thus hindering innovation. Both market players – particularly SMEs – and the public have strong interest in maintaining free access to data, and little or none of their investments are directed

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[73] See Synopsis (n 68) 7.
[74] See Drexl (n 69); Hugenholtz (n 76) at 48.
[75] Ibid.
[76] For a literature review and empirical assessment see Rob Kitchin, Gavin McArdle, 'What Makes Big Data, Big Data? Exploring the Ontological Characteristics of 26 Datasets', 3(1) Big Data and Society (2016).
[77] See, eg, Nadine Côrte-Real, Tiago Oliveira, Pedro Ruivo, 'Assessing business value of Big Data Analytics in European firms', 70 Journal of Business Research 379 (2017); Philipp Max Hartmann, Mohamed Zaki, Niels Feldmann, Andy Neely, 'Capturing Value From Big Data- A Taxonomy of Data-Driven Business Models Used by Start-up Firms', 36(10) International Journal of Operations & Production Management 1382 (2016); Daniel Q. Chen, David S. Preston, Morgan Swink, 'How the Use of Big Data Analytics Affects Value Creation in Supply Chain Management', 32(4) Journal of Management Information Systems 4 (2016).
[78] Drexl (n 69) 15-16. On the three conceptual layers of big data see Herbert Zech, 'Data as a Tradeable Commodity', in Alberto De Franceschi (ed), *European Contract Law and the Digital Single Market, Implications of the Digital Revolution* (Intersentia, 2017) 53–54.

to protect their exclusivity on the data corpora individually produced, acquired and processed.

ii. Software infrastructures and interfaces

Innovation in smart urban mobility involves also the development of algorithms used for big data analysis, software managing the collection and storage of data, operating smart transportation systems and means in automated or semi-automated ways, offering friendly interfaces to users, suggesting information on possible combinations of multiple mobility services.

Most of these tools may find protection under software copyright and, in case of computer-implemented invention – under patent law, with the exception of the functionality of a program, abstract principles, and underlying general algorithms, falling outside the scope of both IP rights.[79] Proprietary solutions have been developed by big players to secure portions of the market, especially in the automotive and transportation vehicles sectors, in order to recoup remarkably high investments.[80] However, stakeholders converge in signaling the need for the development of interoperability standards, particularly with regard to data formats, cloud security, data protection and APIs,[81] indicating how a strong enforcement of exclusive rights is detrimental to innovation, particularly when the most significant technological developments require cooperation and are boosted by network effects.

Interoperability and alignment to open standards are also in the interest of local governments, public research centers, public-private networks and entities carrying out publicly funded research, in light of the regulatory and financial constraints they are subject to, and of the risk management strategies they are required to implement.[82] The acquisition, implementation and maintenance of proprietary software to run local urban mobility programs entails high costs and risk of vertical hold-ups which these players are incentivized or compelled to minimize or avoid. At the same time, in the development of urban mobility solutions software programs do not represent core innovation, nor can they be easily licensed out in other sectors. This reduces the incentive to invest in obtaining, maintaining and enforcing exclusive rights, and particularly patents, making developers keener to invest in new innovation/creation rather than in IP enforcement.[83]

In specific contexts, smart urban mobility interfaces and applications are built through peer-production mechanisms based on controlled open innovation platforms, where access is controlled on the basis of the participation or affiliation to development projects. The reason behind the adoption of a hybrid, tempered form of openness derives from the fact that, while the incentive to create is indeed "given not by exclusivity but by other types of rewards not dependent on financial gain", the programs to be developed do not present all the features

[79] As noted also by Josef Drexl et al, 'Data Ownership and Access to Data - Position Statement of the Max Planck Institute for Innovation and Competition of 16 August 2016 on the Current European Debate', Max Planck Institute for Innovation & Competition Research Paper No. 16-10 (2016), available at https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2833165 (last accessed 28 October 2019), 5-6.
[80] (cross-reference with case studies)
[81] Synopsis (n 68) 7.
[82] (cross-reference with case studies)
[83] (cross-reference with case studies)

that may allow a successful peer production. More specifically, while modularity is almost always present, heterogeneous granularity characterizes only user interfaces and common apps, but it is harder to find in algorithms for data analysis or software embedded in proprietary transportation means.[84]

With due distinctions, urban mobility software presents all the four characteristics of IP negative spaces. Despite the fragmented protection offered by IPRs, the innovation in the field has not slowed down. Scholars point at the negative effects that more pervasive exclusive rights would create, and market players and the public value interoperability and affordability high enough to prefer a low-IP setting, the former limiting their investments in protection and rather directing the same sums towards research and development.

iii. Smart transportation means and accessory devices

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Commented [GP1]: Mia idea è: cambiare in intro e premettere che ci concentriamo su innovative intangibles (data, softwares, know how) e su smart mobility a livello organizzativo (non di nuovo mercato, per esempio dell'auto elettrica), pertanto
- Trattiamo sia problema di incentive sia problema di (big) data protectability
- la produzione di smart vehicles e accessori (eg colonnine ricarica auto elettriche etc) è beyond the scope of this paper. Per non ignorare del tutto questo aspetto, nei case studies ho fatto un distinguo e tratto due considerazioni proprio sulla produzione vehicles.

4. Smart urban mobility as an IP negative space?

The theorizations of IP negative spaces and the study of the defining components of smart mobility innovations jointly help assessing the way the legislator incentivizes, or could better incentivize (if at all), such development. Interestingly, several detected features of the urban mobility scenario hint at the presence of an IP negative space behind the curtains of smart vehicles and transportation practices. In fact, not only some of the involved resources are particularly hard to exclude – *in primis*, the user-generated data upon which smart mobility apps show a great reliance –, but also information results to be shared for the purpose of a better performance of the offered product or service, such as in the cases of software interoperability and integration between diverse technologies (e.g. electric engine and autonomous driving).[85]

A close analysis of case studies provides further evidence of the presence of an IP negative space underlying the smart mobility sector. A selection of relevant scenarios has been carried out respecting the scope of this paper, hence limiting the research to the European context and, at the same time, valuing the diversity of smart mobility projects and experiences having been already developed.

The main trends emerging from the analysis of the selected cases can be summarized in a two-tiered structure. The first tier is represented by the rise of a **collaborative culture**, which finds primary expression in the formation of cross-country project consortia, the fundamental interdisciplinary approach to innovation and the significant cooperation between public and private entities.[86] Collaborative practices in smart mobility innovation

[84] (cross-reference with case studies)
[85] See Politecnico di Milano, 'Smart Mobility Report. Opportunità e sfide emergenti per la filiera della mobilità elettrica in Italia' (2019) 37.
[86] The cross-discipline nature of such collaborations seeing mostly informatic and traffic engineers, software developers, geographers and sociologists working together and the internationality of such projects in Europe majorly benefiting from the digital single market, which "(…) allows cities to attract talent around the world and really creating hubs, startups can pull talent (…) breaking the boundaries of the classical nations." See Davor Meersman for Antwerp City of Things project (interview) (2019); *BITRIDE Bike Sharing project,*

pave the way towards what is called "amplification intelligence", that is the enhancement of the efficiency of the project outputs by way of opening the access to relevant knowledge.[87]

Besides the numerous partnerships between universities, industry and local administrations,[88] another example of collaborative trends is represented by the crowdsourcing. Considered a "key success factor" for the business models deployed in the smart mobility sector,[89] the practice of "incentivization of the crowd" consists of putting in place mechanisms aimed at attracting users and having them sharing information, data and/or preferences.[90] The collaborative essence of this contribution lies in the pivotal role played by the users' contribution in enhancing the efficiency of the final service or product. Examples are countless: widespread smart mobility applications across Europe such as BlaBlaCar, car2go, oBike, Waze and Moovit[91] as well as local services like BusUp[92] base most of the operativity of their services on the information shared by the users. Interesting to note is the fact that the incentives contemplated by these crowdsourcing practices significantly vary, ranging from intrinsic motivation to social participation, being mostly non-remunerative.[93]

Against this collaborative background, the second tier of outcomes from the analysis of smart mobility innovation from an IP perspective is characterized by the development of so-

<https://cordis.europa.eu/project/rcn/208127/factsheet/en> *accessed 21 October 2019;* the Technical University of Munich Living Lab Connected Mobility Consortium and the Intelligent Transport Systems Factory described in Omer Uludag, Stefan Hefele and Florian Matthes, 'Platform and Ecosystem Governance' in Anne Faber, Florian Matthes and Felix Michel (eds), *Digital Mobility Platforms and Ecosystems. State of the Art Report* (TUM 2016) 7, 13.

[87] Nicos Komninos, 'Intelligent Cities: Variable Geometries of Spatial Intelligence' (2011) 3 Intelligent Buildings International 172.

[88] See, inter alia, the participants of EU funded project OBIS (Optimising Bike Sharing in European Cities), <https://ec.europa.eu/energy/intelligent/projects/en/projects/obis#results>; of the Smart Mobility Living Lab London, < https://www.smartmobility.london/partners> both websites accessed 21 October 2019.

[89] See Anne Faber and Florian Matthes, 'Crowdsourcing and Crowdinnovation' in Anne Faber, Florian Matthes and Felix Michel (eds), *Digital Mobility Platforms and Ecosystems. State of the Art Report* (TUM 2016) 37.

[90] Uludag, Hefele and Matthes, 'Platform and Ecosystem Governance' (n 91) 14. The definition of crowdsourcing applied, more generally, in industrial and scientific sectors is of "a transformation of tasks that are traditionally performed by employees to the crowd through an open call. Crowdsourcing models consist of an initiator who crowdsources a task, a mediating platform, and contributors from the crowd that perform these tasks." See Felix Michel, Yolanda Gil and Matheus Hauder. 'A virtual crowdsourcing community for open collaboration in science processes' in *Americas Conference on Information Systems* (2015).

[91] BlaBlaCar emphasizing on the pivotal role of the users' trust and data sharing in the success of their business model. See BlaBlaCar, 'You can be a superhero!' (2019) <https://blog.blablacar.co.uk/blablalife/reinventing-travel/social/building-trust-community> accessed 20 October 2019; Daniel Benamran, 'BlaBlaCar: How we built 25 million member strong community based on trust' (2016) <https://crowdsourcingweek.com/session/built-25-million-member-strong-community-based-trust> accessed 20 October 2019; for a comprehensive overview of crowdsourcing applications in the mobility sector see Faber and Matthes, 'Crowdsourcing and Crowdinnovation' (n 94) 42-43.

[92] A Spanish on-demand crowdsourced bus rental service, which received EU funding. See European Commission, 'BusUp: Multi-platform On-demand Crowdsourced Bus Transportation for Smart City Mobility' (2019) <https://cordis.europa.eu/project/rcn/210101/factsheet/en> accessed 21 October 2019.

[93] Anne Faber and Florian Matthes, 'Crowdsourcing and Crowdinnovation' in Anne Faber, Florian Matthes and Felix Michel (eds), *Digital Mobility Platforms and Ecosystems. State of the Art Report* (TUM 2016) 44.

called **living labs**.[94] This peculiar configuration of support service for project developers and innovators is not infrequent among urban mobility projects. Living labs can be defined as repositories of data, know-how, software interfaces and even prototypes of hardware,[95] which enable the sharing of such resources by implementing "open" policies with the aim to "provide a useful third party laboratory environment to encourage innovation based on an open platform to support and provide new mobility concepts."[96]

By and large, giving generous – if not completely unrestricted – access to resources, information and tool kits shows to be a consolidated practice in the European smart mobility scene.[97] This approach is at times accompanied with explicit endorsements of open access and open source policies,[98] while in other cases is more tacitly implemented.[99] In this regard, the cases of multi-mode mobility applications, such as Moovit and Urbi,[100] offer meaningful insights. Such services provide information about urban mobility options, suggesting the most convenient combinations of means of transportation to users. In such scenarios, in fact, it turns particularly evident how the need to "include" both users and other transportation businesses is crucial to the well-functioning of the service[101] and the needed incentive to do so is not strictly remunerative, but rather fundamentally related to individual comfort in travelling in the city and in self-promotion.[102]

Nevertheless, the analysis of the selected European case studies does not reach the conclusion that the remunerative incentive is excluded *in toto* from the smart mobility innovation sector. Manufacturers of smart vehicles and related physical accessories (e.g. batteries, infrastructures), in particular, are significantly wary of embracing an "open"

[94] See Hans Schaffers and others, 'Smart Cities and the Future Internet: Towards Cooperation Frameworks for Open Innovation' in John Domingue (ed), The Future Internet. Future Internet Assembly 2011: Achievements and Technological Promises (Springer 2011) 433; Grazia Concilio and Francesco Molinari, 'Living Labs and Urban Smartness: The Experimental Nature of Emerging Governance Models' in Andrea Vesco and Francesco Ferrero (eds), Handbook of Research on Social, Economic, and Environmental Sustainability in the Development of Smart Cities (IGI Global 2015).
[95] Project Antwerp City of Things
[96] Omer Uludag, Stefan Hefele and Florian Matthes, 'Platform and Ecosystem Governance' in Anne Faber, Florian Matthes and Felix Michel (eds), *Digital Mobility Platforms and Ecosystems. State of the Art Report* (TUM 2016).
[97] Anne Faber and Florian Matthes, 'Crowdsourcing and Crowdinnovation' in Anne Faber, Florian Matthes and Felix Michel (eds), *Digital Mobility Platforms and Ecosystems. State of the Art Report* (TUM 2016) 38 ('Crowdsourcing is by definition the usage of an open call, whereby the execution of openness differs.').
[98] E.g. CIVITAS Urban Mobility Tool Inventory and Learning Center <https://civitas.eu>; Collective Innovation for Public Transport, <http://europe.ciptec.eu/> both websites accessed 21 October 2019.
[99] E.g. Open & Agile Smart Cities Minimal Interoperability Mechanisms, <https://synchronicity-iot.eu/tech/> accessed 21 October 2019.
[100] Even though the former has been developed in Israel, both services are operating and increasing their presence in Europe. See Moovit, <https://editor.moovitapp.com/web/community>; Urbi, <https://www.urbi.co/faq> accessed 21 October 2019 ('URBI is already available in eleven cities in Italy, seven in Germany, Copenhagen, Amsterdam, Stockholm, Vienna, Barcelona, Madrid, Paris and Lisbon.')
[101] Moovit, <https://www.developers.moovit.com/> both websites accessed 20 October 2019.
[102] Omer Uludag, Stefan Hefele and Florian Matthes, 'Platform and Ecosystem Governance' (n) 11 ('(…) gamification plays a large role also in Moovit. Users get points and derived ranks for reporting delays, crowdedness, and temperature inside the vehicle or friendliness of the bus driver, to name a few. Additional incentive for editors is the "Community Spotlight", where particularly active editors are presented to the community within Moovit's blog.').

approach and giving away information over their products: their investments are remarkable[103] and the common *modus operandi* of big companies in the sector does count on the benefits of patents and trademarks.[104]

Also in this regard, the analysis of the case study sheds light on three considerations, which should not be underestimated and, to a certain extent, question the IP incentive mechanism. First, not only big companies, but a significant presence of small and medium enterprises and start-ups build the European smart mobility scene, the latter typologies of businesses often starting to operate in the sector without collecting remuneration, especially with no intention to sell the data for profit.[105]

Second, as the remarkable involvement of public funds indicates,[106] the output products and services stemming from the innovative process are mostly deemed to be for public use, thus accessible to anyone, without leaving much room for a strategy of authorization and a maximization of commercial licenses.[107] Third and tightly related, to the incentive to innovate, in the specific sector here under investigation, is inevitably to be added the incentive to comply with legal obligations and follow best standards from the viewpoint of environmental protection.[108]

5. Conclusion: a lesson for the IP world

The rising numbers of smart mobility projects and experiences across Europe should not imply that the incentive problem is solved by itself and innovation should be expected to

[103] Estimations show remarkable costs, ranging from 30,000 euro for a single electric vehicle to 6,000 euro for a single recharging station. See Politecnico di Milano, 'Smart Mobility Report. Opportunità e sfide emergent per la filiera della mobilità elettrica in Italia' (2019) 27-28.

[104] Politecnico di Milano, 'Smart Mobility Report. Opportunità e sfide emergent per la filiera della mobilità elettrica in Italia' (2019) 20; Sebastian Blanco, 'Your Future EV: Wireless Charging and Better Nav Systems' (2017) <https://www.motor1.com/news/135509/ev-future-patent/> accessed 21 October 2019.

[105] See, for instance, the cases of Byke in Germany illustrated by Guenter Murr, 'Geschäft mit Leihfahrrädern boomt in Frankfurt' (2017) <https://www.fnp.de/frankfurt/geschaeft-leihfahrraedern-boomt-frankfurt-10439941.html> accessed 21 October 2019, and of Rekova in Czech Republic, which started with recycled bikes donated by citizens, Rekola, 'FAQ' (2019) <https://www.rekola.cz/en/faq> accessed 21 October 2019; Don Dahlmann. 'Wir denken nicht uber den verkauf unserer daten nach' (interview) (2015) http://www.gruenderszene.de/allgemein/moovit-user-daten; Omer Uludag, Stefan Hefele and Florian Matthes, 'Platform and Ecosystem Governance' (n 91) 11.

[106] Among others, see the German government 300 million euro fund for the installation of recharging stations for electric cars. See Politecnico di Milano, 'Smart Mobility Report. Opportunità e sfide emergent per la filiera della mobilità elettrica in Italia' (2019) 169; the Flemish government 40 million euro fund for the project "Antwerp City of Things"; EU actions and funds for the development of Internet of Things and Smart Cities, such as SynchroniCity (15 million euro fund), https://synchronicity-iot.eu/ accessed 20 October 2019.

[107] Suffice it to think of recharging stations for electric cars, which, even when manufactured for private use, are at times coupled with regulatory incentives to make the benefits more broadly available, e.g. to co-workers. See *ibid* 26.

[108] *ibid* 21-23.

keep at a constant, fruitful pace. An effective legislation securing an incentive is needed, the stakeholders and project developers voicing a unanimous call for it.[109]

Building a case for a sensitive evaluation of the role of IP role in the smart mobility sector, the paper highlights important reasons to investigate more om the generation of value from IP negative spaces. This opens a new window on the study of the management and impact of IP laws in a rapidly evolving society, both from a technological and from a social value perspective.

Open innovation environments and 'knockoff economy' scenarios serve as exemplary phenomena to shed light on an, at least, partial retreat of the incentivizing power of IP rights protection, which should not be ignored. Against this background, smart urban mobility innovations, key to the evolution of smart cities, emerge as a new case of high relevance. As their technological, economic and social impact promise to overcome the boundaries of mobility services, the study of the developments of this flourishing sector revives the focus and calls for further research on the effectiveness of IP rights protection across the innovation spectrum.

[109] See, *inter alia*, the Parker project run in Denmark from 2016 to 2018, reported by Politecnico di Milano, 'Smart Mobility Report. Opportunità e sfide emergent per la filiera della mobilità elettrica in Italia' (2019) 143 ("To ensure an ever growing production (…) it is absolutely necessary to introduce rules that help the automotive industry standardizing the production of electric vehicles capable of providing services to the networks, so to turn today's innovation into practice.") (translation by the author); International Transportation Forum and OECD, 'Shared Mobility Simulation for Dublin. Case-specific Policy Analysis' (report) (2018) 7 ('Policy parameters will have to be set carefully so the desired benefits for society are maximised.').