LICENSING OF STANDARD ESSENTIAL PATENTS IN THE VALUE WEB OF THE INTERNET OF THINGS OR REIMAGINING SEPS LICENSING

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ABSTRACT

Existing standard essential patent (SEP) licensing practices limit licensing transactions to a single level in the value chain. Commonly, this is the end-product level. In Europe, the landmark dispute between Nokia and Daimler, which was escalated up to the Court of Justice of the European Union, is the most recent illustration of such thinking. Core to the Nokia vs. Daimler dispute were the questions of who in the value chain should take a SEP license, and whether a license should be available to everyone in the supply chain. The underlying rationale of such reasoning is that value is established in a linear way and that by consequence, either the end-product manufacturer or the component manufacturer must be offered a SEP license. This study is not interested in addressing "where in the value chain" a SEP license should be situated; rather, it holds that the concept of a value "chain" does not necessarily hold for the Internet of Things.

The Internet of Things (IoT) thrives on multidirectional exchange and typically collapses the traditional notion of a linear value chain. Instead, the IoT

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is an ecosystem, where network dynamics and interconnectivity dominate business opportunities, and value is co-established between various business partners. To reflect this reality, this study introduces the notion of the "value web." The value web describes the multidirectional architecture and clustered exchange that characterizes the IoT from a business perspective.

Existing legal reasoning, hinged on the notion of a value chain, may fail to adequately reflect these novel economic realities afforded by the IoT. Limiting the licensing of SEPs to one single layer in the IoT space, which is typically the end-product level, may therefore not be the best way to reflect the service driven nature of the IoT space. Assessing the question as to "who should take a license in the value chain" may, therefore, be beside the point. This can lead to judicial decisions anchored in outdated economic realities and concepts of value. To help overcome these existing limitations, this study fleshes out the economic underpinnings of the IoT system and establishes why altered SEP licensing practices may be in a better position to reflect these.

INTRODUCTION

New technologies regularly give rise to innovation amongst economic actors by changing the way business is thought about, opening new revenue streams, redefining relationships between the firm and the consumer, and paving the way for new business models. We might think of how the steam engine paved the way to the Industrial Revolution, or how the personal computer enabled the Information Age. Although the diffusion of new technologies can be an unpredictable process, several scholars have shown this to be one that carries profound impacts.[1]

Recently, the Internet of Things (IoT) has joined this array of paradigm-shifting technological developments. Both businesses and consumers are now negotiating on what this new paradigm looks like and what changes to the commercial landscape will accompany it.

Understanding how drastic technological change asserts itself on existing frameworks, whether legal or commercial, is a challenge that remains difficult to overcome without the substantial advantage of hindsight. It is all too common for specific technologies to be lauded as transformational and indicative of a new future without a deeper understanding of the forces underlying these changes. As an example, the growth of electronic commerce through the internet in the 1990s attracted grand pronouncements, but detailed understandings of the phenomena at play were all too often absent.

Likewise, implementation of new technologies takes time, regardless of how great a challenge to existing norms. That said, the next wave of digital technologies will be disruptive and will trigger paradigm shifts. The IoT is at the forefront of these shifts, as it interacts with simultaneous technological advance—such as machine learning and quantum computing—and gives rise to new business opportunities.

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[1] Gary C. Moore & Izak Benbasat, *Development of an Instrument to Measure the Perceptions of Adopting an Information Technology Innovation*, 2 INFO. SYS. RSCH. 192, 196 (1991); Everett M. Rogers, *Diffusion of Innovations: Modifications of a Models for Telecommunications, in* DIE DIFFUSION VON INNOVATIONEN IN DER TELEKOMMUNIKATION 25, 25–26 (Matthias-W. Stoetzer & Alwin Mahler eds., Springer 1995); Louis G. Tornatzky & Katherine J. Klein, *Innovation Characteristics and Innovation Adoption-Implementation: A Meta-Analysis of Findings*, 29 IEEE TRANSACTIONS ON ENG'G MGMT. 28, 28–29 (1982).

Fundamental to these new opportunities is a movement from product-oriented industrial structures to service- and experience-based economic structures. The IoT has already given rise to novel business models and will continue to do so into the future. These business models will have an impact upon all elements of the economic system and will integrate themselves into a wide range of sectors.

When viewed through the prism of SEPs, such an adjustment may move the point of value afforded by SEPs from sale to use. Despite this, the reasoning around SEPs has not kept pace with these market adjustments, and reasonable and non-discriminatory (RAND) terms or fair, reasonable, and non-discriminatory (FRAND) terms for SEPs remain focused on products.[2] Because it introduces a service-oriented approach to the business environment, the IoT creates commercial practices for which SEP licensing approaches are currently not aligned.

This may be a problem, given that the very function of SEPs is to protect inventions whilst also ensuring adequate access to them and promoting efficient economic activity. This paper argues that the SEP licensing ecosystem should catch up with the new market realities being presented through the IoT, especially in relation to the way licensing transactions are organized.

Against this backdrop, the focus of this study is not on specific technological developments or markets, but on the interplay of this novel technology and the licensing of SEPs. While the focus is on SEPs, it is important to keep in mind that the challenges outlined here do not necessarily only hold for SEPs—the licensing of non-standard essential patents equally constitutes a challenge. However, these issues are outside the scope of this study.

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[2] For purposes of this article, F/RAND will refer to both types of licensing commitments.

To the best of my knowledge, I am the first to point to this discrepancy, as the traditional discourse is stuck phrasing SEP licensing through the prism of a linear value chain. In doing so, I hope to advance existing concepts of value underpinning SEP licensing. This, so it is hoped, will advance a further understanding of the practice of valuation and F/RAND royalty rate determination.

This study first discusses the nature and features of the IoT and the way value is established within IoT systems. It then argues that forward-looking technology markets, such as the Internet of Things, can be characterized by network-based business models. Finally, the clustered effect of these shifts is considered, and practical case studies are offered to illustrate the argument.

The Status Quo of SEP Licensing

Patents can be essential to a specific standard, thus being termed standard essential patents. Owners of SEPs make a commitment to license their SEPs on F/RAND terms. F/RAND represents an effort to reconcile the opposing paradigms of standards and patents by making the patents available for implementation without disincentivising the cycle of invention that produced them.

Standards create a joint technical baseline between manufacturers and service providers that is mutually understood and utilized. They offer market participants use of a specific technology that has been normed. Companies implement standards for business reasons, and those who implement successful standards benefit from economies of scale.[3]

[3] Economies of scale refer to the cost advantages that arise with increased output of a product. *See e.g.*, Will Kenton, *Economies of Scale: What Are They and How Are They Used?*, INVESTOPEDIA (Aug. 19, 2024), http://www.investopedia.com/terms/e/economiesofscale.asp#ixzz3xc75sYet [https://perma.cc/A7AL-M2VR].

The landscape becomes more complicated when patents are associated with standards, which are an equally important driver of technological progress with a radically different incentive mechanism. Patents center on the ability to exclude others from implementing a particular invention for a fixed period of time, thereby granting a temporary monopoly. With this monopoly, the inventor is incentivized to recoup the investment made into the invention process. The monopoly is limited both in time and scope, as a patent can only protect specific claims of an invention. In practice, this balance is subject to continued debate regarding access to essential technologies and the artificial inflation of prices as a consequence of patent protection.

Patents and standards appear to work in conflict with one another. Patents are successful when they provide the owner with strong protection against unlicensed third-party use, whilst standards are successful when the maximum number of parties are making use of them. Patents are built on exclusion; standards are built on dissemination. In an attempt to mitigate this conflict, the concept of F/RAND was established, and the licensing of SEPs is supposed to respect the F/RAND commitment.

Recently, the SEP licensing debate has been dominated by the question of where in the "value chain" one should take a license.[4] In a landmark case, the issue came up in the context of the SEP dispute between Nokia and Daimler in Germany[5]—a case that, in my opinion, impacted the licensing of SEPs worldwide. Nokia, a Finnish-headquartered telecommunications firm, owns SEP portfolios that read, amongst others, on 3G (UMTS) and 4G

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[4] Gerard Llobet & Damien Neven, *Investment and Patent Licensing in the Value Chain*, 19 J. COMPETITION L. & ECON. 527, 527 (2023).

[5] Mathieu Klos, *Nokia and Daimler Settle All Global Litigation in Connected Cars Dispute,* JUVE PATENT (June 1, 2021), https://www.juve-patent.com/cases/nokia-and-daimler-settle-all-global-litigation-in-connected-cars-dispute/ [https://perma.cc/4ANU-VVT9].

(LTE) technologies, which it alleged were infringed by the German-headquartered automotive manufacturer Daimler.[6]

Daimler argued that it was a widespread practice in the automotive sector to request component suppliers to indemnify them against third-party infringement. It insisted that Nokia offers its FRAND[7] license to its component suppliers rather than to itself. On their side, component manufacturers expressed their willingness to take a license, going so far as to sue Nokia for refusing to make them a FRAND offer for their SEP portfolio.

The Mannheim District Court issued an injunction in this case without referring the question to a higher court.[8] Similarly, injunctions were issued by the Munich District Court in *Sharp v. Daimler* (2020)[9] and *Conversant v. Daimler* (2020)[10]—cases which also address where in the value chain licenses should be taken—without referring these questions to any higher courts.

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[6] *Nokia v Daimler, Higher Regional Court (Oberlandesgericht) of Karlsruhe*, 4IP COUNCIL, https://caselaw.4ipcouncil.com/german-court-decisions/olg-karlsruhe/nokia-v-daimler [https://perma.cc/7N9C-G428].

[7] In a European context, FRAND is the adequate terminology. *See, e.g.*, *Questions and Answers on Standard Essential Patents*, EUR. COMM'N (Apr. 26, 2023), https://ec.europa.eu/commission/presscorner/detail/en/qanda_23_2457 [https://perma.cc/7UKZ-GMTB].

[8] LG Mannheim 2. Zivilkammer (LG Mannheim) [Mannheim Regional Court] Aug. 18, 2020, 2 O 34/19, ¶¶ 138, 291, WIPO (Ger.) https://www.wipo.int/wipolex/en/text/591427 [https://perma.cc/9HG8-NPHM].

[9] LG München I (LG Munich) [Munich Regional Court] Sept. 10, 2020, 7 O 8818/19, ¶¶ 237–40 BAYERN.RECHT (Ger.) https://www.gesetze-bayern.de/Content/Document/Y-300-Z-GRURRS-B-2020-N-22577?hl=true [https://perma.cc/J25K-GZLA].

[10] LG München I (LG Munich) [Munich Regional Court] Oct. 23, 2020, 21 O 11384/19, ¶¶ 249, 278, BAYERN.RECHT (Ger.) https://www.gesetze-bayern.de/Content/Document/Y-300-Z-GRURRS-B-2020-N-50637 [https://perma.cc/4RG9-N3GP].

However, the Dusseldorf District Court eventually requested the Court of Justice of the European Union (CJEU) to interfere in *Nokia v. Daimler*.[11] The German judiciary asked, among other things, for clarification from the CJEU as to whether SEP owners who have a commitment to license their SEPs on FRAND terms also have an obligation to license upstream component suppliers.[12] The CJEU did not pronounce itself on the matter, as the case settled in confidence and was withdrawn, with Daimler in the end taking a license from Nokia for an undisclosed rate. The Federal Court of Germany, which is the country's Supreme Court, determined in *Sisvel v. Haier* that judgements over willingness to take a license are specific to each case, and the assessment of willingness is "ist eine Frage des Einzelfalls, deren Beurteilung den nationalen Gerichten obliegt . . . und grundsätzlich Aufgabe des Tatrichters ist [incumbent on the national courts . . . and is in principle the task of the judge.]"[13]

Despite the paucity of judicial guidance on the question, the *Nokia v. Daimler* dispute and other similar cases triggered a debate on "where in the value chain one should take a license" and whether one should offer a "license-to-all" or "access-to-all." The term "license-to-all" implies that all the component manufacturers in a value chain obtain a license. Advocates of the license-to-all approach argue that licensing at the device level risks overcompensating the SEP holder and exposes component-level manufacturers to unacceptable risk and legal

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[11] LG Düsseldorf [Düsseldorf Regional Court] Nov. 26, 2020, 3C O 17/19, ¶ 41, WIPO (Ger.) https://www.wipo.int/wipolex/en/text/591426 [https://perma.cc/BCS2-KHPM].
[12] *Id.* at ¶ 1–15.
[13] Bundesgerichtshof [Federal Court of Justice] Nov. 24, 2020, KZR 35/17, ¶ 78, WIPO (Ger.) https://www.wipo.int/wipolex/en/text/591421 [https://perma.cc/NZC6-VXLJ].

uncertainty, while licensing at the component level reduces transaction costs.[14]

Proponents of license-to-all further argue "that all entities in the chain of production of standardized products need licenses to SEPs to be able to participate in the relevant industries."[15] Because of the need for licenses, the F/RAND commitments entered into by SEP holders should be interpreted to require granting licenses to all comers to carry out their part of the products on the value chain.[16]

The term "access-to-all" suggests that "not all entities need SEP licenses and that the FRAND commitment does not necessarily require that SEP holders grant licenses to all, only that they make their patented technologies available by granting licenses on FRAND terms and conditions."[17] In the latter scenario, the license is concluded at the end-product level (i.e. the car).

This paper remains agnostic as to whether SEPs should be licensed where they were first implemented (i.e. the component) or at the end-product level. Rather, it considers the entire debate as poorly fit to match the market realities of the Internet of Things, which thrives on multidirectional exchange and joint value creation, rather than on a linear value chain.

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[14] Damien Geradin & Dimitrios Katsifis, *End-Product- vs Component-Level Licensing of Standard Essential Patents in the Internet of Things Context*, (2021), https://papers.ssrn.com/abstract=3848532 [https://perma.cc/FLH8-2UW9].

[15] Anne Layne-Farrar & Richard J. Stark, *License to All or Access to All? A Law and Economics Assessment of Standard Development Organizations' Licensing Rules*, 88 GEO. WASH. L. REV. 1307, 1308 (2020).

[16] *Id.* at 1331.

[17] *Id.* at 1309.

UNDERSTANDING THE IOT FROM A VALUE WEB PERSPECTIVE

Perhaps the most apparent factor driving the growth of the IoT is the availability of standards such as 5G, WiFi 6, NB-IoT (Narrowband Internet of Things) and other standardized technologies. These standards support the rapid transfer of large amounts of data, a vital capacity to support the management of data generated by IoT devices. These standards are populated with patents, making the question of the licensing of SEPs a central underpinning of the IoT ecosystem. Improving an understanding of value capture in the IoT space therefore matters.

The IoT incorporates many contributors through both formalized and informal commercial relationships to produce a network of value-adding nodes. This is a departure from other commercial enterprises, which have defined linear relationships between actors, and is reflected in the innovative business models to which the IoT gives rise. The network architecture of the IoT is also central to how institutions such as the US National Institute of Standards and Technology (NIST) have defined the IoT: "[A] network of devices that contain the hardware, software, firmware, and actuators which allow the devices to connect, interact, and freely exchange data and information."[18] Furthermore, it describes IoT devices as: "Devices that have at least one transducer (sensor or actuator) for interacting directly with the physical world and at least one network

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[18] COMPUT. SEC. RESOURCE CTR., *Definition of "internet of things,"* NAT'L INST. OF STANDARDS AND TECH., https://csrc.nist.gov/glossary/term/internet_of_things [https://perma.cc/5KTL-N6EH] (follow "Glossary" hyperlink; then search for "internet of things").

interface (e.g., Ethernet, Wi-Fi, Bluetooth) for interfacing with the digital world."[19]

Other definitions of the IoT vary,[20] but strike upon consistent features that reflect the interconnectivity underlying the IoT: (1) the presence of devices (hardware) which are (2) connected and (3) able to communicate with one another and (4) perform tasks.[21]

IoT services refer to the connectivity and software products that interact with, enable, and are enabled by the IoT hardware to compose an IoT system, including device and connectivity management services, data management services, analytics, and applications.[22]

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[19] COMPUT. SEC. RESOURCE CTR., *Definition of "IoT device,"* NAT'L INST. OF STANDARDS AND TECH., https://csrc.nist.gov/glossary/term/iot_device [https://perma.cc/W854-BR7A] (follow "Glossary" hyperlink; then search for "IoT device").

[20] Somayya Madakam et al., *Internet of Things (IoT): A Literature Review*, 3 J. COMPUT. & COMMC'NS, 164, 165 (May 2015), https://www.scirp.org/pdf/JCC_2015052516013923.pdf [https://perma.cc/NAV6-D5VS]; Bruno Dorsemaine et al., *Internet of Things: A Definition & Taxonomy*, NINTH INT'L CONF. ON NEXT GENERATION MOBILE APPLICATIONS, SERVS. & TECHS. 72, 73 (Sept. 2015).

[21] *See, e.g.*, *The Internet of Things: Why It is Relevant to your Business and How to Embrace It*, NTT 2, https://services.global.ntt/-/media/ntt/global/solutions/intelligent-business/drive-business-strategy-and-transformation/understand-how-to-use-iot-latest-thinking.pdf [https://perma.cc/2BTT-JVAQ]; *Integrating IoT in Factory Automation: Enabling Smart Manufacturing*, MITSUBISHI ELEC., https://mitsubishisolutions.com/integrating-iot-in-factory-automation-enabling-smart-manufacturing/ [https://perma.cc/JPB7-PDWS]; *Accelerating AI and IoT Application – Toward the World Where Edge AI is for Everyone*, SONY (June 8, 2023), https://www.sony-semicon.com/en/feature/2023060801.html [https://perma.cc/SQ2A-MYVL].

[22] *What is IoT (Internet of Things)?*, AMAZON WEB SERVS., https://aws.amazon.com/what-is/iot/ [https://perma.cc/286V-NP8B]; Agustin Pelaez, *Heard of the IoT "Value Chain"? Here's How It Works*, UBIDOTS (Feb. 28, 2023), https://ubidots.com/blog/iot-value-chain/ [https://perma.cc/KY88-FE3V].

For the purpose of this study, I accept the definition as set forward by Dutton as, "internet enabled applications based on physical objects and an environment that seamlessly integrates into an information network."[23]

The IoT as an ecosystem challenges the traditional notion of a linear "value chain." The IoT value chain is not linear or one directional. It might therefore be better characterized as a value web, with multiple nodes that interact with one another and, through this interaction, generate value. This conceptualization therefore stresses the interconnection of devices, services, and users. Looking at the IoT as a system of "layers" of value is a useful tool for framing the concept of the value web. The value "web" redefines how a firm delivers products and services, how it builds relations with customers, and how the company efficiently performs its activities. The value "web" of the IoT also affects the cost and revenue structure of each individual market participant in this novel ecosystem.

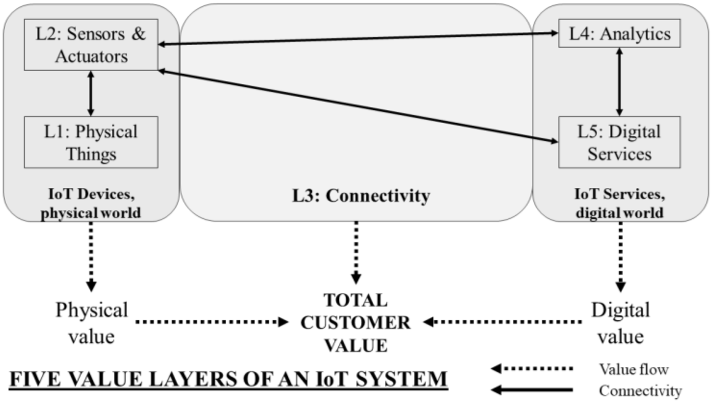

Figure 1: The five value layers of an IoT system adapted from Fleisch et al.[24]

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[23] William H. Dutton et al., *The Internet of Things*, at 8 (June 20, 2013), https://ssrn.com/abstract=2324902 [https://perma.cc/CBT8-4E6R].
[24] Elgar Fleisch et al., *Geschäftsmodelle im Internet der Dinge*, 51(6) HMD PRAXIS DER WIRTSCHAFTSINFORMATIK, 812, 818 (Dec. 2014),

Value in the IoT arises from the physical end-product, the sensors and actuators that collect or act upon data, the standardized connectivity technologies that transmit this data either to or from the services that collect and analyze that data, and return instructions to the end-product device in the inverse direction.

One can talk here of directionality—and implicitly, therefore, linearity—in this sense only because one is addressing only one end-product device, standardized connectivity technology, and service, as detailed in the figure above. However, the core of the IoT is that this process is repeated amongst and between many different elements of each layer, forming a value web.

This model differs from linear value chains because of the multidirectional interactions between layers in IoT that are not replicated elsewhere. Users of IoT technology do so precisely because of these interactions; they are what creates value. The IoT device sends data to a service and simultaneously is in receipt of instructions from it: "Through rapid access to data and information about objects, IoT enables highly innovative and efficient services."[25] Those same services also enable value creation in the IoT devices they serve. It is this multidirectional flow of data and the networked effects of devices and services that creates value in the IoT. As such, value must be assessed at the level of the ecosystem, not an individual device.[26]

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https://doi.org/10.3929/ethz-b-000091912 [https://perma.cc/7XQK-DD76].

[25] Concetta Metallo et al., *Understanding business model in the Internet of Things industry*, 136 TECHNOLOGICAL FORECASTING AND SOCIAL CHANGE, 299 (Nov. 2018), https://iranarze.ir/wp-content/uploads/2018/02/E5774-IranArze.pdf [https://perma.cc/5YBS-B7KH].

[26] Dominik Bilgeri et al., *The IoT Business Model Builder*, BOSCH INTERNET OF THINGS & SERVS. LAB, at 1 (Oct. 2015), https://www.iot-lab.ch/wp-content/uploads/2015/10/Whitepaper_IoT-Business-Model-Builder.pdf [https://perma.cc/U9FK-3REH].

Of course, it is worth stating that a mobile device can become an IoT device as a byproduct of the communications standards with which it is imbued. But this is at the discretion of the user and their desire to network the mobile device with other IoT devices (e.g., wearables) and IoT services. A mobile device need not be an IoT device if the user chooses not to use it in this way. An IoT device, by contrast, would be individually useless—or at least of no more value than a non-IoT capable equivalent—without its connectivity with other devices and services.

A single business cannot drive economic growth at the levels seen within the IoT. That growth is the product of many innovative business models operating in the same marketplace. What individual innovative business structures can demonstrate, however, is the way that transformational changes are triggered by a technological development. The IoT is implemented into the business model and causes changes to it. The business model is defined for the purpose of this study as a mediating structure between technical inputs and economic outputs.[27] Because of the scale of change introduced by the IoT, it is appropriate to speak of business model innovation enabled by the IoT, as economic actors capitalize on the new technology to create drastic alterations in commercial practices.

These changes occur in the way value is created and captured. By understanding the innovative business models enabled by IoT, we are able to more fully understand why and where different approaches may need to be taken to apportion the value added by SEPs to the IoT system.

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[27] Henry Chesbrough & Richard S. Rosenbloom, *The Role of the Business Model in Capturing Value from Innovation: Evidence from Xerox Corporation's Technology Spin-Off Companies*, 11(3) INDUS. & CORP. CHANGE 529, 536 (June 2002), https://www.semanticscholar.org/reader/605f1c5f799c07f3ed71881de3d71dbe8f0d65cf [https://perma.cc/98L2-FVTM].

The underlying network rationale of the IoT has also prompted firms to look outside their own company and appropriate value through third parties. The IoT as a "system of systems" provides for a platform-based ecosystem.[28]

The platform architecture means that value can be co-created jointly with other firms operating in the same ecosystem. The type of business innovation that the IoT has triggered is a radical departure from the traditional "one-stop-shop," where value is created and delivered within the narrow boundaries of the firm. Rather, the IoT emphasizes the role of "partner structures," or as Open Innovation scholar Westerlund puts it: "[T]he concept of business model, which is traditionally associated with a single organization's business model, could be replaced with the term 'value design', [sic] which is better suited to ecosystems."[29] While this may be known to management scholars, none of this is so far reflected in the legal scholarship or in judicial reasoning, as the *Nokia v. Daimler* dispute suggests.

THE IOT VALUE WEB AS "SERVITIZATION" OF THE IOT

Another way to encapsulate the value web is through the concept of "servitization." This is because the IoT establishes a "product-service system."[30] Paiola and Gebauer, for example, note that the IoT provides an opportunity to implement service-oriented business models

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[28] AMRIT TIWANA, PLATFORM ECOSYSTEMS: ALIGNING ARCHITECTURE, GOVERNANCE, AND STRATEGY 5 (Elsevier Sci. & Tech. 2014).
[29] Mika Westerlund et al., *Designing Business Models for the Internet of Things*, 4 TECH. INNOVATION MGMT. REV. 5, 11 (July 2014).
[30] Anna Rymaszewska et al., *IoT Powered Servitization of Manufacturing – an Exploratory Case Study*, 192 INTERNATIONAL JOURNAL OF PRODUCTION ECONOMICS 92, 92 (2017).

which may present both enormous advantages and disruptive consequences in business strategies.[31]

Through access to data from and about connected objects, the IoT enables highly innovative and efficient services.[32] A key finding from many of these investigations into IoT businesses is how the IoT introduces service-based business models, either to new companies who operate in this way from the outset, or to existing companies with existing product-based business models which can be adapted.

Gordon Hui notes this: "[M]aking money in the connected space is not limited to physical product sales; other revenue streams become possible after the initial product sale, including value-added services, subscriptions, and apps, which can easily exceed the initial purchase price."[33] Paiola & Gebauer focus on the concept of "servitization" to describe the shift from product– to service–oriented business models in manufacturing industries.[34]

Indeed, they argue that IoT-enabled servitization is "at the base" of business redefinitions and may pave the way for "the transition from a transactional view of the customer to a relational one" wherein "the product ceases to be the only reason for the business relation and becomes instead just an element of that relation."[35]

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[31] Marco Paiola & Heiko Gebauer, *Internet of Things Technologies, Digital Servitization and Business Model Innovation in BtoB Manufacturing Firms*, 89 INDUS. MKTG. MGMT. 245, 245 (Aug. 2020).

[32] Jean-Louis Monino, *Data Value, Big Data Analytics, and Decision-Making*, 12 J. KNOWLEDGE ECON. 256, 259–60 (Mar. 2021).

[33] Gordon Hui, *How the Internet of Things Changes Business Models*, HARV. BUS. REV. (July 29, 2014), https://hbr.org/2014/07/how-the-internet-of-things-changes-business-models [https://perma.cc/R6XF-4F57].

[34] Paiola & Gebauer, *supra* note 31, at 247.

[35] *Id.* at 248.

Fleisch et al. extend the focus on services to examine the processes by which value is created in an IoT system. They identify five "layers" of an IoT system using the example of a lightbulb: (1) the physical thing (the lightbulb), (2) sensors or actuators equipped to the physical thing, (3) connectivity, (4) analytics (often a cloud-based system), and (5) a digital service layer (such as a web service or a mobile application).[36] The physical thing provides physical, local value, while the digital services provide digital, global value, which together represent the value proposition of the IoT system. Fleisch et al. are careful to stress that, although these elements are expressed as discrete layers, they "nicht unabhängig voneinandererstellt werden können [cannot be created independently of each other]," and as such, the hardware is "damit zunehmend von den darüber liegenden digitalen Ebenen beeinflusst [increasingly influenced by the digital levels above it]."[37]

Rather than the business model acting on one layer, it is all layers within the IoT system that constitute its value proposition, creation, and capture processes. As such, Fleisch et al. go on to identify two "eigenständige geschäftsmodellmuster [business model patterns]"—paradigmatic business models—that emerge from sensor-based digital services: "Digitally charged products," where digital services are linked with physical products to create a hybrid that is a single whole, and "sensor as a service," the collection, processing, and selling of sensor data from one subsection of the IoT ecosystem to another.[38] Additionally, they note that the IoT boosts other "erfahren bekannte [classic]" business operations.[39] Returning to Gordon Hui, he cites a senior figure at Microsoft who addresses this:

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[36] Fleisch et al., *supra* note 24, at 817–18.
[37] *Id.* at 819.
[38] *Id.* at 822.
[39] *Id.*

> Business models are about creating experiences of value. And with the IoT, you can really look at how the customer looks at an experience—from when I'm walking through a store, buying a product, and using it—and ultimately figure out what more can I do with it and what service can renew the experience and give it new life.[40]

The increasing leverage of services goes so far as to turn mere products into an experience. The service is, however, experienced on the spot and is a one-off experience. This is a big difference to a product. Most products can usually be used several times, but the experience of a service can only be consumed once. Services can also not be stored. The services rendered through the IoT are, however, always digital in nature. The IoT also expands into novel segments of the market. Often, these expansions are accompanied with altered pricing structures.

The IoT is therefore not just technologically innovative; it is operationally innovative. The IoT is changing the very way that people go about doing business, adjusting existing business models and—crucially—generating new ones. The lines between product and service are blurred to the extent that the two are inseparable, representing instead only single elements of a large hybrid whole, such that whilst Fleisch et al. speak of "digitally charged products," it would be just as appropriate to speak of product-charged digital services.

This raises important considerations for understanding where value is created. Value is not confined to the immediate utility of a lightbulb, for example, if an IoT system can make it a security light or make it "learn" the habits of those who occupy the house. Likewise, an app providing a digital service is only as valuable as the

[40] Hui, *supra* note 33.

connected products that gather data and act on it. Therefore, it is appropriate to reconceptualize the value proposition and value creation processes of IoT systems—not as simple modifications to existing business models, but as entirely new things.

Moreover, there is a need to examine the IoT system as a whole when seeking to understand innovative IoT business models, because all layers of the system contribute to that business. Indeed, this represents a comprehensive challenge to traditional conceptions of firms, which may only focus on the product or the service layers; such an approach simply does not translate to examinations of IoT business model innovation. These again, will need to be further examined with respect to the licensing of SEPs.

CASE STUDY METHODOLOGY

A review of value capture and value creation in the IoT space provides an empirical starting point to depict the characteristics of these overarching changes in economic behavior and illustrates why the way value is currently reflected in the licensing of SEPs fails to mirror value capture in this space.

Case study analysis is the most commonly used method in qualitative research. It lends itself particularly well in situations where the research question at stake remains so far poorly assessed, or where the research at stake is rather novel. Benbasart states: "[R]esearch and theory are at their early, formative stages, and 'sticky, practice-based problems where the experiences of the actors are important and the context of action is critical.'"[41]

I undertake this case study analysis through desk research to encapsulate the "value web" and establish the

[41] Izak Benbasat et al., *The Case Research Strategy in Studies of Information Systems*, 11 MGMT. INFO. SYS. QUARTERLY 369, 369 (1987).

failed relationship of existing SEP licensing practices. The IoT has been presented as analogous to electrification: A technology that will transform from specialized and isolated to a pervasive building block of the modern industrialized world, and as such, case studies are drawn from a range of sectors to reflect this breadth.[42] Existing studies have addressed IoT business models in the automotive, industrial agriculture, transportation, retail, and enterprise sectors.[43] To that end, these case studies are also drawn from a range of sectors, namely transportation, supply chain & logistics, agriculture, and automotive. This begins to reflect the IoT's breadth and permits a wide range of potential case studies to be assessed.

The function of the case studies is not so much to study the companies themselves as it is to utilize them to illustrate paradigmatic shifts in value capture in the IoT and the need to adapt SEP licensing practices accordingly. By illustrating these business models with real-world examples, this method is able to qualitatively demonstrate the paradigmatic changes that are underway in the IoT ecosystem. This is done with specific reference to the interplay of SEP licensing and value generation.

This framework recognizes that it is embedded in a wider environment of technological advancement and innovation diffusion that must be understood from a SEP licensing perspective. Whilst the study does not claim that individual innovative businesses themselves give rise to the requirement for systematic interrogation of present SEP licensing practices, the aggregation and review of several paradigmatic case studies from multiple IoT-affected sectors

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[42] AMMAR RAYES & SAMAER SALAM, INTERNET OF THINGS FROM HYPE TO REALITY 239–68 (Cham: Springer eds., 2019); VASUKY MOHANAN ET AL., POWERING THE INTERNET OF THINGS WITH 5G NETWORKS 148–75 (IGI Glob., 2018), https://doi.org/10.4018/978-1-5225-2799-2 [https://perma.cc/6RAY-FE3V].
[43] *Id.*

illustrates IoT ecosystem-wide disruptions, which require addressing from a SEP licensing perspective. These case studies draw out critical insights and assess the interplay of innovative IoT business operations from the perspective of SEP licensing.

ASSET-SHARING & PAY-AS-YOU-USE (MICRO-MOBILITY)

Asset-sharing is a type of business where assets are utilized by many different customers without forcing ownership of that asset.[44] It is associated with the emergent "access economy," where goods and services are traded on the basis of access only,[45] or the "sharing economy," where the economic system is based on sharing possessions and services usually organized through the internet.[46] The IoT has enabled the innovative expansion of these approaches into new markets, such as micro-mobility, by lowering the barriers for information transaction.[47] As a result, it has extended the pattern of "servitization," associated with IoT technologies, into personal transportation.[48] This has important implications for SEP licensing because it relocates value away from the vehicle and instead locates it throughout the IoT service as a whole, of which the connected vehicle is just one element.

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[44] *Asset Sharing*, PROJECT BREAKTHROUGH, http://breakthrough.unglobalcompact.org/breakthrough-business-models/asset-sharing/ [https://perma.cc/A4CL-UCH9].
[45] *Access Economy*, SCHOLARLY CMTY. ENCYC. (Nov. 4, 2022), https://encyclopedia.pub/entry/32792 [https://perma.cc/G5E4-CTJD].
[46] *Sharing Economy*, CAMBRIDGE DICTIONARY, https://dictionary.cambridge.org/dictionary/english/sharing-economy [https://perma.cc/JSK7-WFZ4].
[47] Uday M. Apte et al., *Strategy in Information Intensive Services*, *in* RESEARCH HANDBOOK ON SERVICES MANAGEMENT 2 (Edward Elgar Pub. 2022).
[48] *Id.*

Micro-mobility, like so much of the IoT, is a nascent phenomenon without firm definition, but understandings generally center around small size, low speed human or electrically-powered transportation devices, such as bicycles, electrically-assisted bicycles, electric scooters (e-scooters), and "other small, lightweight wheeled conveyances."[49] Dockless micro-mobility has become a common sight in many major cities, with companies such as Lime, Forest, Tier, and many others operating.[50]

Bicycle hire is not a new concept, but unlike similar non-IoT business models, dockless micro-mobility is much more convenient because of enabling IoT technologies.[51] In addition, there is no need for high capital expenditure or maintenance costs to burden the user because they do not own the assets themselves and are only responsible for them for the duration of use. Some companies are also utilizing the environmental value proposition and advertise these services to users as environmentally friendly, with Forest, for instance, claiming to be "the most sustainable mode of

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[49] Jeff Price et al., *Micromobility: A Travel Mode Innovation*, 85 PUB. ROADS 1, 8 (2021), https://highways.dot.gov/sites/fhwa.dot.gov/files/2021-05/Public%20Roads%20Spring-2021.pdf [https://perma.cc/7SY3-L4A4].

[50] LIME, https://www.li.me/en-gb (last visited Jan. 29, 2024); FOREST, https://www.humanforest.co.uk/ [https://perma.cc/BTU8-58HC]; TIER, https://www.tier.app/en/ [https://perma.cc/YMA5-ADYS]; *see also Ofo Bicycle Internet of Things Case Study*, GSMA (Jan. 2018), https://www.gsma.com/iot/wp-content/uploads/2018/01/iot_ofo_bicycles_01_18v4.pdf [https://perma.cc/AL4D-2T5Q].

[51] *Santander Cycles*, TRANSP. FOR LONDON, https://tfl.gov.uk/modes/cycling/santander-cycles [https://perma.cc/AN7G-JMKP].

transport in London," whilst one of Lime's mission statements is to make transportation "carbon-free."[52]

As a consequence, much of the value proposition is tied to the digital layers of the IoT-enabled micro-mobility value web, as this differentiates the service offering from transportation alternatives. Indeed, value creation and capture take place through the smartphone app that connects with the vehicle in all of these services. The vehicles are connected devices, employing standardized cellular wireless communications technology, near-field communication, and GPS technology.[53] Users are charged on a pay-per-use basis, often with a flat fee to unlock the vehicle and then a charge accumulating per minute of use.[54]

In this paper's opinion, current SEP licensing practice is focused on the connected device and does not reflect the crucial role of the digital layer in the micro-mobility IoT system. The key differentiator between an IoT micro-mobility service and non-IoT alternatives is the convenience afforded by connecting the device (the hired vehicle) with the user's own smartphone, which is ubiquitously accessible amongst modern consumers. The digital service is fundamental to the value proposition underpinning this service, as well as being the source of value creation when paired with the connected hardware and the platform through which value is captured. As a consequence, SEP licensing, as it is currently practiced at the

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[52] FOREST, *supra* note 50 (offering itself as the most sustainable mode of transportation in London); *Who We Are*, LIME, https://www.li.me/en-gb/about (last visited Jan. 29, 2024) (claiming its mission is to make transportation "carbon-free").
[53] GSMA, *supra* note 50; Emma Cole, *Best Bike Share and Rental Bicycles London: Lime vs. Santander and Alternatives*, CYCLIST (Jan. 9, 2023), https://www.cyclist.co.uk/reviews/ridden-and-rated-ultimate-guide-to-london-s-bike-sharing-rental-bicycles [https://perma.cc/E8WU-N7ND].
[54] Cole, *supra* note 53.

device level, cannot reflect how value is being captured in this instance.

Further, this paper argues that because customer interaction is all digitally facilitated, additional value capture methods can be trialled and employed, thereby augmenting the innovative service further by introducing flexibility. For instance, Forest introduced a monthly e-bike subscription model, providing for sixty minutes of daily riding and eliminating parking fees, although this has not been adopted more broadly.[55]

Revenue is also generated, in some cases, through advertising in the app.[56] Moovr, a Philippine-based micro-mobility company, reported making more than a quarter of its revenue from both in-app and traditional advertising.[57] Likewise, Forest uses advertising revenue to subsidize the cost of using its vehicles; advertisements appear at the beginning and end of rides, play within the app, which is the only way for users to access the vehicles, and users can choose to watch additional advertisements to earn free minutes of vehicle use.[58]

This adds additional weight to the argument that current SEP licensing is failing to reflect the business reality of IoT systems by neglecting the digital layer in the IoT system; the digital layer of the value web is itself a value

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[55] Rebecca Morley, *Forest Launches Monthly E-Bike Subscription Model Following Spike in Demand*, EBIKETIPS, (Oct. 28, 2023), https://ebiketips.road.cc/content/news/forest-launches-monthly-e-bike-subscription-model-following-spike-in-demand-4919 [https://perma.cc/A6UW-6AE8].
[56] Ben Hubbard, *Micromobility Firm Moovr Makes Quarter of Revenue from Advertising*, ZAG DAILY (Nov. 7, 2022), https://zagdaily.com/trends/micromobility-firm-moovr-makes-quarter-of-revenue-from-advertising/ [https://perma.cc/RUS2-RAX5**].**
[57] *Id.*
[58] Freya Pratty, *Behold! A Profitable Micromobility Startup*, SIFTED (Nov. 22, 2023), https://sifted.eu/articles/forest-bikes-profitability-micromobility [https://perma.cc/G7CC-53WS].

creating element independent of the device through advertising. However, because advertising is an auxiliary value creation process, it would not be effective without the connected device also being within the IoT service. Put another way, no customer would use the app and watch advertisements without knowledge that doing so is a condition of, or allows, access to the vehicle. Therefore, even in auxiliary value creation processes, the symbiosis between connected devices and digital service in an IoT service is apparent.

Moreover, third-party services can make use of the connected micro-mobility devices to augment their own value proposition. This suggests that the service offering is not confined to the micro-mobility operator's own service but can be networked with other services in the value web to develop new value propositions through the IoT. This connectivity is between the connected device and the third-party service, which will in turn interact with the operator's digital service, thereby demonstrating the non-linearity across the micro-mobility value web, which lies at the heart of IoT systems.

Connectivity has made a reimagining of existing business operations for the IoT age possible and expanded that business into an industry in which it would not otherwise have existed. Moreover, because of the interactions of connected devices, micro-mobility service operators are able to open new revenue streams through in-app and traditional advertising, combining previously disparate business models into a single new whole. Without IoT connectivity technologies, each layer of the micro-mobility value web would be individually useless, or at least much less valuable than it is with IoT functionality.

The binary approach to current SEP licensing practices (end device versus component level) cannot reflect this non-linearity because it is focused on the physical layer of the value web only. Just as the digital service layer is not presently reflected, the new avenues for the business model to incorporate third-party digital services, such as navigation, are also not accounted for under current SEP licensing practices. This is in spite of the fact that the connectivity afforded by the underpinning standards is a fundamental element of their ability to network with the connected device—which they do not own—and therefore their own value proposition. As such, the utility afforded by the standardized connectivity technologies for enabling both the direct service of the operator and third-party services that benefit from that connectivity to positively augment their value propositions are not reflected in the way SEPs are currently licensed.

The IoT-enabled asset-sharing, exemplified through micro-mobility, shows that the focus of value has moved and expanded such that the vehicle itself is no longer the center of value as it would be in a traditional asset-sharing business model. The connected device does support new value possibilities, but this is only enabled through the rest of the IoT system, and so the value creation and capture process must be understood in system-wide terms with particular focus on the digital service layer of the value web. This is the layer in the connected network of things constituting an IoT micro-mobility system through which value is predominantly accessed by a user and captured by the operator. From a SEP licensing perspective, therefore, the IoT-enabled micro-mobility industry reflects the complications that underpin the IoT more broadly. All nodes within the network connect with one another, and all therefore benefit from each other, contributing to a single overall service. All layers benefit from the value added by SEPs, but only the physical layer is subject to SEP licensing.

Standards are the constitutive enabling element within the value proposition of IoT-enabled micro-mobility. In this way, IoT-enabled asset-sharing in micro-mobility exemplifies the transition from a product-oriented to a service-oriented industrial structure in the IoT more broadly, underpinned by standards and the requirement to reconsider SEP licensing practices as a result.

ASSET TRACKING & SUBSCRIPTION (LOGISTICS)

The IoT has also reinvented the subscription business model in the logistics industry through IoT telematics and asset management.[59] Logistics companies benefit from real-time tracking of their vehicles and cargo and require this to be effective over a very large area, even across countries.[60] Implementation of IoT-enabled telematics enables connectivity between the driver, vehicle, and a central office from which administration is conducted, as well as the accumulation of valuable data for supporting vital business functions, such as cargo audit, payroll, and compliance requirements.[61] A comprehensive service is therefore created by networking connected devices with a digital service. This example demonstrates the servitization caused by the IoT and the failure of current SEP licensing to account for this market reality.

By utilizing aftermarket connected hardware, logistics vehicles can be fitted with connectivity capabilities that they otherwise would not have. Fleet vehicles fitted with many IoT sensors and devices enable cargo conditions, such as temperature and humidity, to be monitored and

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[59] Yoon-Min Hwang et al., *Understanding Internet of Things (IoT) Diffusion: Focusing on Value Configuration of RFID and Sensors in Business Cases (2008–2012)*, 32 INFORMATION DEVELOPMENT 969, 979 (2016).

[60] Naveena Pathuri, *IoT-Enabled Cross-Platform Applications for Real-Time Logistics Monitoring*, 10 INT. J. SCI. RES. COMPUT. SCI. ENG. INF. TECHNOL 1179, 1181 (2024).

[61] The Ultimate Guide to IoT - Transport & Logistics Edition, TELETRAC NAVMAN, https://www.teletracnavman.co.uk/fleet-management-software/resources/iot-in-transportation-logistics-the-ultimate-guide [https://perma.cc/3PKS-XDJV].

adjusted in transit by working with the vehicle's built-in systems.[62] Data can also be logged and alarms configured if cargo conditions leave the desired parameters, alerting both the driver and the centralized control center of this fact.[63] The value proposition to fleet operators is the accumulation of significantly more valuable data than they would otherwise be able to have, whilst existing data collection processes can be made more efficient.[64] This data is communicated to the cloud and is accessible from anywhere with an internet connection. This service is uniquely possible because of the standardized wireless connectivity technologies that underpin the IoT, which permit the communication of data by mobile assets.[65] It is clear, therefore, that the digital layer is benefiting from the value imparted by SEPs.

GPS-Buddy is a service provider that operates a subscription-based asset-tracking business model.[66] By fitting vehicles and cargo with a range of sensors and connected devices, large quantities of data can be gathered,

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[62] Naveena Pathuri, *IoT-Enabled Cross-Platform Applications for Real-Time Logistics Monitoring*, 10 INT. J. SCI. RES. COMPUT. SCI. ENG. INF. TECHNOL. 1179, 1180 (2024).

[63] *Using Oracle Internet of Things Fleet Monitoring Cloud Service*, ORACLE HELP CENTER (2023), https://docs.oracle.com/en/cloud/saas/iot-fleet-cloud/iotfm/create-rules-monitorr-issues.html#GUID-C77C44C8-F0CC-414D-8059-3FAF7E0C1698 (last visited Mar 20, 2025).

[64] ANDREAS HOLTSCHULTE, DIGITAL SUPPLY CHAIN AND LOGISTICS WITH IOT: PRACTICAL GUIDE, METHODS, TOOLS AND USE CASES FOR INDUSTRY 169 (Springer 2022).

[65] Luke McDonagh & Enrico Bonadio, *Standard Essential Patents and the Internet of Things*, THINK TANK EUROPEAN PARLIAMENT, 10 (2019), https://www.europarl.europa.eu/thinktank/en/document/IPOL_IDA(2019)608854 [https://perma.cc/2M76-YB5B].

[66] *Grip on moving assets*, GPS-BUDDY, https://www.gps-buddy.com/en/ [https://perma.cc/82U3-Y3P5].

communicated, and analyzed.[67] Moreover, this is an aftermarket solution, meaning the vehicle does not have to be manufactured with connectivity hardware, and the hardware used can be adapted to new or changing business requirements.[68] Services offered include vehicle tracking, trip registration, remote tachograph data collection, conditioned transport, machine operating hours recording, timesheet data gathering, and asset management.[69] All of these services make use of IoT-connected hardware interacting with software, which is developed in-house.[70] The systems are modular and pricing is made according to the functionalities used, which can be activated and deactivated remotely.[71] Crucially, all services are run through a single digital service, whereby the full range of data gathered by the many different connected devices is centralized and can be accessed anywhere.[72] This allows us to locate the service layer, rather than the device layer, as the focus of value creation in the IoT system. From a SEP licensing perspective, this would demonstrate that licensing is currently overly focused on the device layer and is not reflecting the networked value creation processes or trend of servitization present within IoT systems.

Value is created through the connected hardware working in conjunction with the cloud data collection and analytics within digital services. A range of hardware exists according to the specific requirements. For instance, in

[67] *Solutions*, GPS-BUDDY, https://www.gps-buddy.com/en/solutions/ [https://perma.cc/CQ9L-7RV3].
[68] *About Us*, GPS-BUDDY, https://www.gps-buddy.com/en/about-us/ [https://perma.cc/6W53-7MG5].
[69] GPS-BUDDY, *supra* note 67.
[70] GPS-BUDDY, *supra* note 68.
[71] *XT4*, GPS-BUDDY, https://www.gps-buddy.com/en/solutions/xt4/ [https://perma.cc/2E2W-WVH7].
[72] For GPS-Buddy's solution for tachograph data, *see* GPS-BUDDY, https://www.gps-buddy.com/en/solutions/tachograph-reading/ [https://perma.cc/5U7G-DW48].

situations where assets do not have a power supply, the AT4 asset tracker is suitable as it has a battery life of 1.5 years and can be wirelessly charged.[73]

Value is captured through the connected devices, which are provided under a hardware-as-a-service ("HaaS") model and recurring subscription costs associated with the management environment software.[74] Because all devices are connected, pricing is adaptive such that functionalities can be activated or deactivated, and users are charged only according to what they use.[75] Because of this feature, companies implementing GPS-Buddy services can, for example, expand their operations with new functionalities over time as business needs evolve. The flexibility around pricing and the ease with which it can be altered is indicative of the advantages of adopting a service orientation in the business model and creating the digital service as the node through which the user accesses the IoT system as a whole. The marginal costs associated with adjustments to digital products are very low, thereby permitting this flexibility and partly explaining why service-oriented business models are so prevalent in this technology space. The implication for SEP licensing is a need to adjust to this orientation, something not presently accounted for in existing SEP licensing practices.

GPS-Buddy creates its hardware in-house but takes its 4G connectivity modules from a supplier.[76] It is not clear where in this production chain SEP licensing takes place.

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[73] *AT4,* GPS-BUDDY, https://www.gps-buddy.com/en/solutions/at4/ [https://perma.cc/56ZV-D5DE].

[74] Dominic DeVito, *GPS-Buddy CONNECT,* CRUTCHFIELD, https://www.crutchfield.com/p_059GPSB007/GPS-Buddy-CONNECT.html (last visited Mar 20, 2025).

[75] GPS-BUDDY, *supra* note 68.

[76] *GPS-Buddy: True One-Click Functionality to Transform Fleets*, TELIT CINTERION, https://www.telit.com/resources/case-studies/gps-buddy-fleet-management-iot-case-study/ [https://perma.cc/ZH9W-MFHE].

This paper argues that the digital service is a key element in the overall service offering, and this will currently not factor into any SEP royalty payments. Indeed, without the digital service, the business model simply would not function. Moreover, the service and its continued use is a key element of the value capture process within this business model because of the subscription required to maintain access to it.

From a SEP licensing perspective, the example of GPS-Buddy demonstrates how the asset-tracking business model can combine with subscription-based models to focus value on the service provided, not the hardware. In this way, it is reflective of many IoT applications. In this example, customers value knowledge of where the vehicle is, not that the vehicle is carrying tracking hardware. Therefore, by employing hardware through a subscription model, which is inextricably linked through standardized connectivity technologies to a digital service accessed by the user, the model employed by GPS-Buddy provides the value that customers seek through a service. The hardware enables the digital service by providing the sensing capability and resulting data, but the service also enables the hardware by making the collected data useful, presenting it to the user, and allowing the user to make responsive decisions.

The service as a whole is contingent upon both physical and digital elements working together through the use of standardized communications technologies. Equally here, a SEP licensing practice, which is focused on either devices or component elements of those devices, does not reflect the market reality of this business undertaking, with substantial value being located outside of the device and in the service as a whole.

SUBSCRIPTION & DATA MONETIZATION (SMART AGRICULTURE)

Many data-based systems are reliant upon existing communications infrastructure, such as cellular infrastructure. For some applications, however, this is not possible, such as remote locations where infrastructure is either non-existent or unreliable. Agriculture is one example of an industry afflicted by these limitations, for which IoT solutions can be applied with efficacy, especially combined with subscription-based business models.[77] These physical solutions can also be combined with data management and monetization models to create a service offering.[78] This service offering is underpinned by the connectivity afforded by SEPs.

INCYT (pronounced "Insight")[79] provides IoT services for agricultural data gathering and management, with analytics services built into the service offering.[80] INCYT focuses on the design and production of IoT and electronics systems.[81] This combines the sensor devices installed in the field with local telemetry, network connectivity, and a digital service in the form of an app.[82]

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[77] *Everything You Need to Know About Smart Farming*, INCYT, https://www.incyt.com.au/blogs/everything-you-need-to-know-about-smart-farming?srsltid=AfmBOopped5KWF2qeC4eCzcOYxri_hR2KiWevjEIg1REQIox_wkgO7ju [https://perma.cc/W8D9-8FFC].

[78] *Product Catalogue*, INCYT, 10–11, https://19959436.fs1.hubspotusercontent-na1.net/hubfs/19959436/INCYT Product Catalogue 2024-WEB-SINGLES.pdf [https://perma.cc/G83Y-6JU3**].**

[79] *About*, INCYT, https://www.incyt.com.au/about [https://perma.cc/3QQD-M3WK].

[80] *Smart Agriculture*, INCYT, https://incyt.com.au/pages/smart-agriculture [https://perma.cc/AY9P-CGZC].

[81] LX, https://lx-group.com.au/ [https://perma.cc/Q4F8-Z64H].

[82] INCYT, *supra* note 79.

The value proposition in this case is the availability of varied data from across the farm that can be accessed remotely, supporting more efficient farm management. Because each element of the service (sensors, telemetry, network, and digital service) is discrete, the deployment of hardware can be precisely matched to the requirements of the individual farm.[83] INCYT's ecosystem, therefore, combines the convenience of an off-the-shelf solution with the additional value of a bespoke solution.

Every element in this bespoke solution incorporates SEPs and the value they add. Because of this, the system can also be made to interact with existing third-party IoT infrastructure (such as sensors, gateways, connectivity services, and digital services),[84] thereby expanding the overall value web to incorporate additional nodes. This demonstrates how SEPs act as a unifying element to IoT systems and the misalignment of associating their value only with the device layer, as present SEP licensing practice currently does.

Value is created in the INCYT system through the provision of all hardware required for the installation of the service and establishing connectivity with the digital service. The data storage, analytics, and reporting functionality built into the digital service are also a source of value; indeed, they are the predominant source of value within the overall service because the data provided by the hardware is inaccessible without it. Additionally, the digital service incorporates data analytics to provide an additional value

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[83] *Monitor & Control Assets Through One Central Dashboard*, INCYT, https://www.incyt.com.au/?srsltid=AfmBOop1_z5rvaFs40MHnmEUxJ-SOSYb7OlzD4dQ6apKCXwJaY5NxbHj [https://perma.cc/7QG7-5JV7].

[84] *All You Need to Know About IoT Network Connectivity for Your Farm*, ICYT, https://www.incyt.com.au/blogs/all-you-need-to-know-about-iot-network-connectivity-for-your-farm?srsltid=AfmBOorHD1nB3FuqJsTYfYJkhKqQ9GWFNlC-bhc8qUbZgRvgekK39-WJ [https://perma.cc/UW5Z-WC2X].

proposition to users beyond simple data collection and monitoring.[85] Value is also created through the connected devices, which are optimized for the specific conditions of a farm—namely its remoteness and exposure to the elements.

The "Blue node" telemetry device, for instance, provides power to sensors and enables communication between sensors and the digital service, has a ten-year battery life, and incorporates LoRaWAN and cellular connectivity through the XR base station.[86] That base station incorporates LoRaWAN, LTE-M, and NB-IoT connectivity to connect all sensors and telemetry across the farm into a single network and communicates that data to the digital service. Because all elements of the systems are constructed around the accumulation and transmission of data to the digital service, we see how this business model reflects the servitization associated with the IoT. The connected devices, although inseparable constitutive elements, only function to provide the data output required for proper functioning of the digital service, and it is this service that represents the predominant source of value to the users.

From a SEP licensing perspective, this may be argued to demonstrate how the way in which value is currently attributed—to IoT devices—does not reflect the market reality of IoT business models that place value on the service layer of the IoT system.

INCYT's business model uses two methods of value capture for the same services. The first involves outright purchasing of hardware and a subscription to the digital service. This digital service has four available plans with variations by functionality.[87] Each item of hardware can be purchased individually, and some have a modular capability allowing the hardware to be adjusted according to the

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[85] INCYT, *supra* note 79.
[86] INCYT, *supra* note 78, at 12–13.
[87] *Id.* at 22.

individual customer's requirements, such as the XR base station, which can have an additional solar power module fitter where a mains power supply is not available.[88]

The second value capture method is to employ a traditional HaaS model for the hardware, alongside a separate monthly subscription to the digital service.[89] Given the large upfront costs associated with outright purchase, it is likely that the value capture processes are built around the adoption of HaaS structures as a more convenient and feasible way for users to integrate the IoT service. INCYT captures value from data creation, communication, collection, and analytics, demonstrating data and its monetization at all stages to be at the core of the business model. Additional hardware maintenance services,[90] as well as consultation, training, and planning services,[91] are also available at additional charge, but cannot be said to constitute a key element of the business model; rather, they provide additional income streams and fulfill a supporting function. As such, value capture is also distributed throughout the IoT system, with a not insignificant element of that being focused on the service layer of the IoT system. Moreover, these value capture methodologies are not always simple purchase agreements, but instead use—and even encourage—subscription pricing structures for both device and service layers of the system. This, again, demonstrates the misalignment of current SEP licensing practices with the IoT market reality.

In many respects, the example offered by INCYT is similar to that of GPS-Buddy, with in-house connected devices being offered to customers on a HaaS basis and connected with a proprietary digital service through which the user interacts with the entire IoT system. As such, many

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[88] *Id.* at 17.
[89] *Id.* at 98.
[90] *Id.* at 31.
[91] *Id.* at 100–01.

elements are also shared when adopting a SEP licensing perspective. The total service offering can be scaled according to the customer requirements through the number and nature of connected devices leased through the HaaS model and connected to the digital service. This is naturally very important in an agricultural setting, where needs may vary considerably. Where INCYT's service offering differs is in its IoT service being specially adapted to environmental limitations—creating private IoT networks—and in its digital service integrating analytics capabilities, thereby adding value to the overall system. By doing so, the business model becomes one in which data itself is manipulated and monetized to create a new value offering. In that sense, even more of the overall system's value is located in the digital offering than in previous examples. That data, which is so central to the overall value proposition and the business model as a whole, is only accessible through the digital service because of the use of standardized communications technologies. Despite this, SEP licensing is focused on the connected devices, which misses the real source of value in the IoT service and fails to reflect the market reality that value is concentrated in the digital service layer of the value web.

SUBSCRIPTION (AUTOMOTIVE INFOTAINMENT)

The subscription-based business model is particularly prominent in IoT systems, and previous examples have incorporated subscription pricing structures alongside other business approaches.[92] In the case of automotive infotainment, however, this is an entirely

[92] Ankush Keskar, *Exploring Business Models for Software-Defined Vehicles: Subscription-Based Paradigms and Their Impact on Automotive Innovation and Consumer Adoption*, 1 WORLD J. ADV. RES. REV. 061, 068 (2019).

subscription-based business model.[93] The nature of this service is subtly different from the other examples, as the connected device—the car, in this case—holds value to the user beyond that created by the IoT service. The service is not required to make use of the device, although the service undoubtedly adds further value and functionality. The implications for SEP licensing, however, remain consistent, as this example also shows: Current SEP licensing practices neglect the servitization ongoing in the IoT and concentrate the royalty burden on only a small subsection of the total IoT value web, which fails to reflect market realities.

Modern cars can incorporate a wide range of connectivity technologies, including GPS, cellular connection, and local area connections (such as Bluetooth or NFC). Automotive manufacturers have used these connectivity technologies to introduce a large number of services that are accessible to users.[94] These are made available to users on a subscription basis, meaning they can be flexibly activated and deactivated according to the user's individual wants and budget.[95] These functionalities include navigation, live traffic visualization, live camera recording,

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[93] *Audi Connect Infotainment Services*, AUDI, https://www.audi.co.uk/en/owners/terms-and-conditions/infotainment-service/ [https://perma.cc/D54Y-KGVN]; *KIA LAUNCHES SUBSCRIPTION SERVICE FOR OVER-THE-AIR UPDATES*, https://www.kiapressoffice.com/releases/1669 [https://perma.cc/HNQ3-2QC9]; *A World of Cars in One Subscription*, PORSCHE NEWSROOM (2022), https://newsroom.porsche.com/en/2022/company/porsche-consulting-a-world-of-cars-in-one-subscription-30748.html [https://perma.cc/9G2Y-V9HB].

[94] *Connectivity*, TESLA, https://www.tesla.com/en_gb/support/connectivity (last visited Feb. 8, 2024); *Mercedes Me*, MERCEDES-BENZ, https://www.mercedes-benz.co.uk/passengercars/services/mercedes-me.html (last visited Feb. 8, 2024); *InControl Subscriptions*, LAND ROVER, https://www.landrover.co.uk/ownership/incontrol/touch/subscriptions/index.html [https://perma.cc/8YGG-E95W].

[95] *Id.*

satellite view maps, video streaming, music streaming, internet browsing, tele-diagnostics, remote maintenance management, and remote management of the car through a smartphone, and are offered by manufacturers such as Tesla, Mercedes Benz, and Land Rover.[96] The value proposition is composed of both the functionality and the flexibility to make use of it. Users do not need to acquire all functions; they are able to subscribe to either individual functions or function packages, depending on the specific manufacturer.

Value is created through the user's interaction with these services, which benefit from utilization of the sensors, actuators, and connectivity technologies already built into the vehicle. As such, the purchased services are entirely digital and can be flexibly activated or deactivated according to the user's requirements. Some of the infotainment services integrate with third-party digital services of which the user is also a customer, such as music streaming. In this way, the value web can spread to incorporate businesses that would otherwise be separate from the automotive industry.

This paper argues that, from a SEP licensing perspective, this introduces a complication, as the value proposition of the music streaming service is now also positively augmented by the user's ability to directly integrate it into their vehicle through the manufacturer's subscription-based infotainment service. Furthermore, this paper argues that when SEP licensing is concentrated at the connected device level—as it currently is—it cannot take into account the wide spread of the value web and the additional services that can be drawn into an IoT system. As a consequence, the royalty burden is misaligned with market realities. Other advantages for the user that create value are more pragmatic, such as over-the-air (OTA) provisioning, which allows vehicle software updates to be applied to the vehicle using an internet connection, thereby circumventing

[96] *Id.*

the need to take the vehicle to a workshop and increasing the convenience of car ownership through an IoT service.

Value is captured through the car's own infotainment system or through web portals, both of which act to connect the vehicle with the user's digital service account. The introduction of subscription-based models such as these represents a change for the automotive industry, and it is one made possible only by the IoT and connectivity technologies built into the vehicles from the outset. Traditionally, value-adding features on cars (e.g., radio, airbags, seatbelts, alloy wheels etc.) are either priced into the cost of the vehicle or can be added to the car during manufacture as optional extras for a one-time fee. With the introduction of IoT connectivity to cars, it is now possible to introduce these subscription-based features and create entirely new businesses around them. This is because the marginal cost of adding or removing digital functionality to the vehicles is essentially nothing. The vehicle is fitted from the factory with all the hardware required to support the services available to the user from the outset. The vehicle can be remotely provisioned with the digital functionality OTA, avoiding the need to bring the car to a workshop and the level of inconvenience to the user. This is indicative of the transition from a product-oriented industrial structure to one that is service-oriented by making use of the flexibilities afforded by IoT technologies—particularly the connectivity SEPs that underpin IoT systems.

The value of these subscription services is not currently reflected in SEP licensing practices, despite connectivity SEPs being fundamental to the operation of these services. Instead, the royalty burden is focused on the connected devices. Because the licensing is focused only on one layer of the value web, which is rendered widespread and complex through connection to digital service layers and third-party services, this breadth and complexity are not acknowledged. SEP licensing may better reflect the automotive infotainment marketplace through an acknowledgment of the multiple layers of the value web.

CONCLUSION

This study has sought to offer a critical insight into why and to what extent a shift in the existing SEP licensing regime is needed to better reflect the paradigmatic shifts in value creation by the IoT. This study demonstrates that current SEP licensing practices for the IoT are out of step with the market realities of a service- and experience-based market structure being created by the IoT.

The value web recognizes the interconnectivity that is fundamental to IoT systems and how this alters conceptions of value creation when compared to traditional business operations. The value web encompasses nodes from several different IoT layers and accounts for the formal and informal multidirectional exchange between these nodes that characterize an IoT system. It is through this multidirectional interaction that value is generated and captured within IoT systems. The value web is fundamental to understanding the new innovative business models to which the IoT has given rise.

A second fundamental transition brought about by the IoT on business models is a movement from a product-oriented industrial structure to one that is service- and experience-oriented. This has been termed "servitization."[97] Servitization describes how the IoT changes the focus of value creation and capture from physical things to digital services, thereby centering upon the experience from which the customer benefits. The implications of this reorientation upon SEP licensing are substantial, especially when viewed alongside the value web.

[97] Paiola & Gebauer, *supra* note 31, at 247.

Standards lie at the very heart of the IoT and the proper functioning of IoT systems. SEP-enabled connectivity is the "glue" that connects otherwise disparate nodes of the value web and through which value is created by providing a joint technical baseline between manufacturers and service providers. Currently, SEP licensing is focused on the connected device only, reflecting a product-oriented industrial structure that predates the IoT.

The value web and servitization in combination, however, have given rise to new business models that challenge that focus. The focus of value creation and capture has shifted onto IoT-enabled services. As a result, licensing practices structured around a product-oriented industrial structure are increasingly out of step with the market realities.

The qualitative case study analysis demonstrates that the transition to a service- and experience-based industrial structure is well underway and has also proven the value web's worth as a conceptual tool. Value is centered upon the digital layer and the services offering, resulting in new value creation opportunities, new pricing structures, and new markets. These innovative business models have been very successful, and it is therefore appropriate to speak of a business model revolution caused by the IoT.

The consequences for SEP licensing arising from these transformations are correspondingly significant. The forces of value creation and capture in IoT systems are not focused on the connected devices. Indeed, this layer is not even the predominant source of value creation and capture; rather, it is the digital services that serve as the main source. Despite this, SEP licensing practices are focused on the producers of end-product connected devices and their components alone. To correct this misalignment, it would be appropriate to consider the notion of the value web in the current SEP licensing discourse. An equitable distribution of the royalty burden amongst market participants may better reflect the market realities of non-linear, multi-directional exchange in the IoT and would circumvent the issue of royalties being concentrated on only one layer of the IoT system. Arguably, this would also better encapsulate the F/RAND commitment.

The question of SEP licensing equally occupies U.S. courts and policymaking alike. Undeniably, these legal issues cannot be understood in separation but must be perceived within the broader market context they are embedded in. This study illustrates that the IoT constitutes a disruptive innovation that has radically broken with traditional notions of doing business.

These changes call for equally original and creative approaches in the underlying legal reasoning that underpins high-growth markets. To that end, this paper hopes to have illustrated that traditional reasoning on SEP licensing stands in stark contrast to the market realities it is embedded in.