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Patent Aggregation Definitions and Taxonomy of its Activities Useful for Competition Law

SOMMARIO: 1. Introduction. – 2. Contextualizing Patent Aggregation. – 3. Defining Patent Aggregation. – 4. Existing Classifications of Patent-Related Businesses. – 4.1. Patent Market Intermediaries. – 4.2. Patent Monetization Strategies. – 4.3. Patent Enforcement. – 4.4. Patent Aggregators. – 5. New Patent Aggregation Taxonomy. – 6. Conclusion.

1. Introduction

Patent aggregation is a multifaceted phenomenon which is recently spurring in the electrical engineering sector [1] Generally, it comprises any business model that holds collections of patents and profits not from sales of patent-implementing products but rather from licenses of the underlying technology. Some of these businesses have already been studied in isolation, for example patent pools [2], patent-assertion entities ("PAEs") [3], and

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[1] The electrical engineering sector, according to the WIPO Technology Classification for Country Comparisons, comprises electrical machinery, audio-visual technology, telecommunication, digital communication, computer technology, information technology methods for management and semiconductors. Sometimes information communication technology ('ICT') is used as synonymous with electrical engineering, yet the latter contains the first in a genus-species relation. See U. SCHMOCH, *Concept of a Technology Classification for Country Comparisons*, Final WIPO Rep. (2008), at 5. Albeit this paper limits its scope to the electrical engineering industry, patent aggregation may become relevant in the near future in other technology-intensive sectors, such as the life-science or mechanical engineering ones.

[2] Patent pools are agreements between patentees to license certain patents to each other or to third parties through some medium, such a joint venture or an independent party, which

technology transfer offices ("TTOs")[4]. However, the complexity and distance of patent aggregation from conventional patent exercises prevent its relationship with innovation from being clearly assessed. On the one hand, it may help resource-constrained inventors to bridge the so-called valley of death, namely the gap between the invention and its successful commercialization[5]. Indeed, insofar as patent aggregation brings efficiencies in licensing and litigation, conveys liquidity to inventors, eases technology transfer or internalises sunk research and development ("R&D") costs, it may spur technological progress alleviating patent hold-out and royalty-stacking issues. On the other hand, patent aggregation might also unduly tax innovation by enforcing otherwise dormant patents, facilitating patent hold-up or foreclosing access to commercially significant technologies[6].

administers the pool and retains a fee. See J. LERNER, J. TIROLE, *Efficient Patent Pools*, in 94 *The American Economic Rev.*, 691 (2004).

[3] PAE is a term coined by Chien to refer to firms that use patents primarily to get licensing fees rather than to transfer technology. See, *inter alia*, C.V. CHIEN, *From Arms Race to Marketplace: The Complex Patent Ecosystem and Its Implications for the Patent System*, in 62 *Hastings L.J.*, 297 (2010), and Federal Trade Commission, *Patent Assertion Entity Activity: an FTC Study* (2016).

[4] TTOs are those organizations assisting universities and other public research organizations to manage and commercialize their intellectual property rights. See, among others, P. VAN EECKE *et al.*, *Monitoring and analysis of technology transfer and intellectual property regimes and their use* (2009).

[5] In the economics scholarship on innovation and technology transfer, the valley of death represents the gap between a technical invention and its successful commercial exploitation. It is also referred to as the Darwinian Sea or the challenge between proof of concept and start of mass production. See. P.E. AUERSWALD, L.M. BRANSCOMP, *Valleys of Death and Darwinian Seas: Financing the Invention to Innovation Transition in the United States*, in 28 *J. of Technology Transfer*, 227 (2003).

[6] Patent hold-out, also known as reverse patent hold-up, consists in patent users freeriding and not seeking licenses for the patents they practice. See, among others, S.K. SHRESTHA, *Trolls or Market-Makers? An Empirical Analysis of Non-Practising Entities*, 110, *Columbia L. Rev.*, 114, (2010). Instead, royalty stacking is an issue typical of patent-intense industries where manufacturers must conclude many licenses with multiple patentees in order to commercialize their products, incurring several mark-ups because of double-marginalization and Cournot-complements problems. In this sense, see M.A. LEMLEY, C. SHAPIRO, *Patent Holdup and Royalty Stacking*, in 85 *Texas L. Rev.*, 1991 (2007). Last, patent hold-up refers to the situation where a patentee exploits his market power over patent users that cannot design around or substitute its proprietary technology. This lock-in situation occurs because users either have incurred sunk costs, or would incur switching costs, or are subject to technological path dependence. When multiple patentees engage in patent hold-up, the problem escalates to royalty stacking. The literature on patent hold-up, hold-out, and royalty stacking is copious especially in the field of standardisation and standard-essential patents ('SEPs'). Among all see J.R. ORR, *Patent Aggregation: Models, Harms, and the Limited Role of Antitrust*, in 28 *Berkeley, Technology L.J.*, 525 (2013), or C.V. CHIEN, *Holding Up* and *Holding Out*, in 21 *Michigan Telecommunication and Technology L. Rev.*, 1, (2014).

The last negative scenario would be especially problematic in the electrical engineering standardisation milieu, where key-enabling or general-purpose technologies are jointly set by the industry participants within standard-setting organisations [7].

Without knowing how patent aggregation definitively impacts innovation, it remains uncertain how European competition law should treat patent aggregation. Several conducts theoretically related to patent aggregation raise issues in almost all fields of competition law. For example, acquisitions of large sets of patents could be questioned either *ex-ante* in light of the merger control regulation if the patents constitute a business per se with its own turnover over specific thresholds [8], or scrutinized *ex-post* as anticompetitive abuses by dominant undertakings under Art. 102 TFEU. In addition, aggregating patents by directly filing applications to patent offices could potentially be an abuse of dominance, too, depending on whether the direct filing or strategic amendment of patent applications harms competition [9].

Patent enforcement could also fall foul of either Art. 101 TFEU in the case of anticompetitive licenses falling outside the reach of the technology transfer block exemption regulation [10], or Art. 102 TFEU, for exclusionary and exploitative monopolistic behaviours. Finally, State subsidies for the creation of patent aggregation entities, as in the case of France Brevets which is sponsored by the French government [11], could constitute a violation of Art. 107 TFEU whether those subsidies exceed the requirements regarding R&D projects of the relevant general block exemption regulation [12]. Additionally, the same public interventions could represent indirect violations of Arts. 101 and 102 TFEU by the Member States where the publicly financed patent aggregation activities distort competition.

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[7] For an introduction to technology standardisation and standard-setting organisations, see M.A. LEMLEY, *Intellectual Property Rights and Standard-Setting Organisations*, in 90 *California Law Review*, 1889 (2002).

[8] See Council Regulation 139/2004, OJ 2004 L24/1.

[9] Patent applications filed during standard-setting procedures only with the view of obtaining patents that will become essential for the implementation of future standards could represent a hypothesis of abuse of dominance in patent prosecution. Boehringer Ingelheim 2011 investigation.

[10] See Commission Regulation 316/2014, OJ 2014 L93/17.

[11] See *http://www.francebrevets.com/* (accessed 15 January 2019).

[12] State-backed patent funds are particularly questionable since public finance measures add to the already granted patents, which alone should suffice as state incentives to innovate. See Commission Regulation 651/2014, OJ 2014 L187/1, arts. pp. 25-29.

Beyond hypotheticals, several competition law cases on the licensing or enforcement of electrical engineering patents reveal the growing significance of patent aggregation in the European Single Market. Between 2008 and 2009, the European Commission investigated three electrical engineering firms, namely IPCom [13], Rambus [14] and Qualcomm [15], for alleged abuses of a dominant position in the markets for licensing their respective patent portfolios. In 2012, Google's acquisition of Motorola Mobility for 12,5 billion US dollars, which involved the transfer of about 17,000 patents, passed the European Commission's merger control only after Google publicly committed to engage in good faith licensing negotiation for the transferred patents [16]. More recently, the Samsung and Motorola cases both involved the abuse of a dominant position by such undertakings for seeking preliminary injunctions against Apple, which was however judged willing to sign appropriate licensing agreements for the infringed SEPs [17] Finally, the Court of Justice of the EU in the Huawei/ZTE preliminary ruling expressed its view on how licensing negotiations should be conducted and court remedies pursued in the context of SEPs for which a Fair, Rea-

[13] The IPCom case related to a change in the ownership of certain SEPs for which the new owner sought excessive royalties, avoiding the Fair, Reasonable and Non-Discriminatory ("FRAND") licensing commitments given by Bosch, the former patent-holder, to the relevant standard-setting organisation. The case was closed without sending the statement of objections when the new patent-holder publicly announced its readiness to concede FRAND licenses. See Case COMP38636 *IPCom* Commission Press Release December 10, 2009 MEMO/09/549.

[14] Rambus was investigated by the European Commission under Art. 102 TFEU for having deceptively concealed the existence of certain patents which were essential for the DRAM standard. This way, Rambus evaded the FRAND commitment, mandatory for all SEPs, and tried to obtain excessive licensing terms. The case was closed by a commitment decision providing for a five-year cap on the royalty asked by Rambus. See Case COMP/38636 *Rambus* Commission Commitment Decision, Summary in OJ 2010 C30/17.

[15] The European Commission for four years investigated the claims of a number of mobile phone producers, including Nokia and SonyEricsson, accusing Qualcomm of charging excessive royalty rates for its SEPs relating to the W-CDMA telecommunication standard in breach of the FRAND commitment given to the relevant SSO. Since the complaints were withdrawn, the case was closed without any decision. See Case COMP/39247 *Qualcomm* Commission Press Release November 24, 2009 MEMO/09/516. For a commentary, see M. Mariniello, "Fair, Reasonable and Non-Discriminatory (FRAND) Terms: A Challenge for Competition Authorities", 7(3) *Journal of Competition Law & Economics* 523 (2011), at pp. 524-525.

[16] See Case COMP/M.6381, *Google/Motorola Mobility*, Commission Merger Clearance Decision of February 13, 2012 OJ C75 of 14 March 2012.

[17] See Summary of Commission Decision of 29 April 2014 (*Motorola*), OJ 2014 C 344/6 and Summary of Commission Decision of 29 April 2014 (*Samsung*), OJ 2014 C 350/8. For an overview of the cases see N. GALLI, *The FRAND Defense up to Huawei/ZTÈ*, 7 *Bocconi Legal Papers*, 155 (2016).

sonable and Non-Discriminatory ("FRAND") commitment was given to the appropriate standard-setting organisation [18]. Despite the number of cases, their divergent outcomes do not suggest an unequivocal impact of patent aggregation on innovation. Rather, these cases show the delicate balance of interests between granting access to patented technologies to interested firms and rewarding the patentees for such access.

The first step to clarify the relations between patent aggregation and innovation, and therefore to correctly assess patent aggregation under competition law, is to define what patent aggregation is and what activities it encompasses. Patent aggregation, beyond the intrinsic meaning of gathering patents, is not a self-explanatory concept that can be easily researched. Overly abstract definitions prevent instances of actual patent aggregation from being observed. Similarly, definitions that are overly practical would identify the phenomenon with the abovementioned TTOs, PAEs or patent pools. This paper thus proposes a new definition of patent aggregation that is specifically aimed at applying competition law [19]. It does so by engaging closely with economics and empirical legal scholarship to pinpoint the conducts underlying patent aggregation into a new taxonomy. By laying a new foundation, subsequent inquiries should then be better able to identify evidence of patent aggregation, assess its effects on innovation, and then determine the potential for competition law to intervene when patent aggregation stifles technological development.

In this context, the exposition is organised as follows. The second section recalls the economic rationales behind the patent system that led to the division of innovative labour enabling patent aggregation, plus the characteristics of the electrical engineering industry where the phenomenon is most prominent. The third section builds on existing scholarship to propose a definition of patent aggregation purposeful for further competition law analysis. The fourth section maps the existing types of patent-related businesses that fit the proposed patent aggregation definition, which are then synthesised in the fifth section into a new taxonomy of patent aggregation activities. The conclusion paves the way for subsequent research, both empirical and competition law-related [20].

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[18] See Case C-170/13, *Huawei v ZTE*, EU:C:2015:477. For a commentary, see e.g. P. PICHT, *The ECJ Rules on Standard-Essential Patents: Thoughts and Issues Post-Huawei*, in 37 *European Competition Law Review*, 365 (2016).

[19] On definitional efforts directing further empirical research, see R.M. LAWLESS, J.K. ROBBENNOLT & T.S. ULEN, *Empirical Methods in Law* (2016), at pp. 35-37.

[20] Notwithstanding that tax and corporate reasons might also influence patent aggregation

2. Contextualizing Patent Aggregation

Patent aggregation, or the business models where patents are amassed for non-productive goals, represents a further advancement in the division of innovative labour experienced by several patent-intense industries [21]. Because patents are as transferable as any other property, patentees can monetise their inventions by selling or licensing them. This alienability allows them to specialise in inventing without having to undertake the risks involved in actually making the invention into a final product and its associated commercialization [22].

The alienability of patents, besides allowing for economic specialisation, also allows knowledge transfer. Information about inventions without patent protection would fulfil all the features of pure public goods. Indeed, once an inventor reveals an unpatented invention, it is inherently hard to prevent others from using it (i.e. non-excludability), also considering that a single use does not prevent or diminish subsequent ones (i.e. non-rivalry and joint consumability). Because of the difficulty of appropriating the rents descending from inventions [23], the proponents of the patent system posit that in its absence society would experience less innovation since no inventor would undertake the required R&D expenditure if there was no prospect of being able to recoup it [24]. In contrast, the right to exclude any-

activities, this paper limits its scope to patent and competition law considerations. On patent boxes see e.g. F. GAESSLER, *"Should There Be Lower Taxes on Patent Income?"*, *MPI-IC Research Paper* 2018-18.

[21] Arora *et al.* describe how the chemicals, software, life science and electrical engineering sectors have each experienced an extensive division of innovative labour, whereby specialized firms, respectively specialized engineering firms, software houses, dedicated biotechnology firms, and fabless/chipless firms, supply technology inputs to downstream manufacturers. In this regard, see A. ARORA, A. FOSFURI & A. GAMBARDELLA, *Markets for Technology* (2001), at pp. 45-89.

[22] In this sense, see PATENT INFORMATICS TEAM, *"Patent thickets An overview"*, UKIPO Report [2011], at pp. 17-18.

[23] The inventors' problem of preventing free-riding of their creations is the so-called appropriability problem. On the topic, see, above all, K. ARROW, *Economic Welfare and the Allocation of Resources for Invention*, in *Universities – National Bureau Committee for Economic Research The Rate and Direction of Inventive Activity: Economic and Social Factor* [1962] 609. More recently, A. LOPEZ, *Innovation and Appropriability Empirical Evidence and Research Agenda*", in *WIPO*, The Economics of Intellectual Property. Suggestions for Further Research in Developing Countries and Countries with Economies in Transition (2009), at pp. 1-40.

[24] Patent antagonists argue that there are other ways of incentivising innovation, such as public subsidies, open source movements, trade secrets, first-mover advantages, and prizes. On

one from practising one's own invention, enforceable in courts through property and liability remedies, enables patent owners to charge implementers supra-competitive prices and to inhibit free-riding[25]. Hence, during the years of patent protection, patentees can recover their R&D costs and devote their rents to new inventions.

Patent exclusivity and alienability are the incentives to innovate that patents grant[26]. In consideration of these incentives, society benefits from the disclosure of novel, inventive and industrially applicable creations[27]. Consecutively, these creations lead to newer and better products, available to consumers at a premium price during the patent-term, and at a competitive price once they enter the public domain.

Notwithstanding the division of innovative labour brought by the patent system in several industries, patent aggregation has its most radical effects in the electrical engineering sector[28]. This is because the innovation ecosystem in such an industry is more incremental, technological convergent and fast-paced than in other patent intense fields[29]. First, electrical engineering products are ever more complex, relying on several complementary patented technologies that are cumulatively built one upon the other. Smartphones

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the appropriability problem, see e.g. D.W. KENNETH, *The Economic Underpinnings of Patent Law*, in 23 *J. of L. Studies*, 247 (1994).

[25] In patent law, property remedies are essentially injunctions banning infringing products from the market, while liability remedies are damage awards compensating the patentee for the infringement. On the appropriateness of liability and property rules to remedy patent infringement, see C. SHAPIRO, *Property Rules vs. Liability Rules for Patent Infringement*, U. California at Berkeley Working Paper 2017. Specifically, the twenty-year term of protection for European patents starts from the day of first filing of an application *ex* Art. 63 EPC.

[26] Another choice provided to patentees by all European patent systems, except Spain, is to just not to use their inventions. However, mandatory provisions discourage such choice. Generally, grounds to obtain a compulsory license from the national patent office are the lapse of a certain time from the patent grant, the insufficient exploitation of the patent to satisfy domestic demand, and proof of having tried to conclude a license with the patentee on reasonable commercial terms, see J. BROUGHTON, *Compulsory License provisions across Europe* (Patent Law Update 2007:28, *https://www.aplf.org/compulsory__provisions_across_europe/index.html* accessed 15 January 2019).

[27] According to Arts. 52, 54, 56 and 57 of the EPC, the patentability requirements are in fact novelty, inventive step, and industrial application. Moreover, provided exceptions exclude in any case the patentability of specific inventions, such as those against public order or morality.

[28] Actually, also the life science sector experiences to a limited extent patent aggregation in the form of non-profit patent pools with humanitarian goals. See Section 4.D.

[29] For an analysis of the semiconductor industry, as a specific type of electrical engineering industry, see ROSEMARIE HAM ZIEDONIS, *Don't Fence Me In: Fragmented Markets for Technology and the Patent Acquisition Strategies of Firms*, in 50 *Management Science*, 6 [2004] 804-820, at p. 819.

embedding telecommunications, audio-video, and semiconductor technologies are a ubiquitous example. By contrast, pharmaceutical products cover less patents each, usually held by the same entity [30]. Second, electrical engineering products are also technological convergent because of the need for interoperability. In this sense, with the advent of the Internet of Things, every product embeds wireless communication standard technologies which were once exclusively implemented in mobile phones. Last, electrical engineering technological development is increasingly fast-paced to answer the constant consumer demand for improved products, whose life-cycles are in turn shortened. For instance, cellular network standards and the products implementing them have been released at tighter intervals: first generation cellular analogue communications started in the late 1970s, second generation digital standards ("2G") arose in the early 1990s, third generation (3G) in the early 2000s, 4G before 2010, while 5G trials started in 2017 [31].

In this incremental, convergent, and fast-paced innovation ecosystem patents have gained strategic importance [32]. By the late 1980s, electrical engineering companies had started exploiting patents not only internally for manufacturing better-designed products or preventing imitation (so-called closed innovation paradigm), but also externally (so-called open innovation paradigm). On the one hand, companies began to allow third parties access to their proprietary technology in consideration of either or both a price and mutual proprietary technology through cross-licenses [33].

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[30] For example, in 2011 RPX Corp., a Defensive Patent Fund, estimated that smartphones cover more than 250,000 patents, see RPX Corp. "Registration Statement (Form S1)" (2011), at 55. On the small number of patents embedded in drugs see L. LARRIMORE OUELLETTE, *How Many Patents Does it Take To Make a Drug? Follow-On Pharmaceutical Patents and University Licencing*, in 17 *Michigan Telecommunication and Technology L. Rev*., 299 (2010). In the same vein, see WESLEY M. COHEN, RICHARD R. NELSON, JOHN P. WALSH, *Protecting Their Intellectual Assets: Appropriability Conditions and Why U.S. Manufacturing Firms Patent (or Not)*, NBER Working Paper Series 7552 [2000], at pp. 19-24.

[31] For an overview of cellular standards up to 3G, see T. DUNNEWIJK, S. HULTE, *A brief history of mobile communication in Europe*, in 24 *Telematics and Informatics*, 164 (2007). For 4G, see ERICSSON, *World first 4G/LTE network goes live today in Stockholm* (Press release 14 December 2009). Regarding 5G, Ericsson and Huawei, two of the major electrical engineering patentees, have both reported successful trials during 2017. See ERICSSON, *AT&T expands fixed wireless 5G trials to additional markets* (Press release 30 August 2017); HUAWEI, *Huawei and NTT Docomo mark milestone in 5G joint trials with successful high speed and long distance mmWave Field Trial at Tokyo Skytree* (Press release 7 December 2017).

[32] Rivette and Kline in 2000 compared the recent strategic importance of patents to the discovery of a forgotten masterpiece in an attic. See K.G. RIVETTE, D. KLINE, *Rembrandts in the Attic*, (2000).

[33] Ross-licenses involve the negotiation and agreement between two firms to license their re-

On the other hand, undertakings increasingly blocked competitors, patenting around the rival's products, and then gate-keeping the availability of their proprietary technologies [34].

This shift from closed to open innovation, where patents are strategic assets in electrical engineering competition, brought a surge in patenting. Statistics from the European Patent Office ("EPO") report that in 2008 the number of electrical engineering patent applications amounted to approximately 41,000 resulting in more than 14,700 granted patents. In 2017, these numbers had risen to approximately 47,500 and 27,800, respectively.

Additional evidence of the strategic importance of patents in the electrical engineering field is the fact that of the twenty-five overall top applicants listed each year by the EPO, a growing number are predominantly or actively operating in such field. In 2010, eighteen out of twenty-five of the top applicants were electrical engineering undertakings, while in 2017 the number had raised to twenty of the twenty-five [35].

More electrical engineering patents being held by many dispersed owners has led to what Carl Shapiro in 2001 called the patent thicket, namely "a dense web of overlapping intellectual property rights that a company must hack its way through in order to actually commercialise new technology" [36]. Such a patent thicket presents a high risk of blocking situations, where products inadvertently infringing on proprietary technologies are either altogether banned from the market by means of injunctions or offered at higher prices reflecting the mark-ups of all the licenses necessarily concluded with holders of infringed patents. Market players, in a private ordering way, have tackled this risk with portfolio licenses, cross-licenses,

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spective intellectual property rights. See for example JOEL I. KLEIN, *An Address to the American Intellectual Property Law Association, on the subject of cross licensing and antitrust law*, (2 May 1997), at p. 3.

[34] For the theoretical foundations of external patent exploitations, see H.W. CHESBROUGH, *Open Innovation: The New Imperative for Creating and Profiting from technology*, (2006).

[35] Impressively, considering the yearly EPO top twenty-five overall applicants, the Chinese firm Huawei jumped from the eighteenth position in 2010 to the first in 2017, while the Canadian Research in Motion, producer of BlackBerry phones, disappeared from the 2017 list. The French Alcatel left its 2017 place to its acquirer Nokia, which in turn was not a top twenty-five applicant in 2010; see Case COMP/M.7632 Nokia/Alcatel-Lucent EC Merger Clearance Decision OJ 2015 C329. The most recent list also sees the entry of electrical engineering firms Intel, Microsoft, Valeo, Philips Lighting, and ZTE. All the EPO data mentioned is available at *https://www.epo.org/about-us/annual-reports-statistics/statistics.html* (accessed 15 January 2019).

[36] C. SHAPIRO, *Navigating the Patent Thicket: Cross s, Patent Pools and Standard Setting*, in A.B. JAFFE, J. LERNER & S. STERN (eds.), *Innovation Policy and the Economy*, (2001) 119, at p. 121.

standard-setting organizations, patent infringement settlement, and, as a remedy of last resort, patent litigation [37]. Patent aggregation intersects with each of these solutions insofar as it strengthens the bargaining position in licensing negotiations, augments the weight in standardization procedures, allows infringement claims to be fought against, and shields business operations from patent-invalidity findings. Furthermore, it is also a response in itself to patent thickets when it allows the pooling of complementary electrical engineering patents in the hands of one-stop shop licensor, thus solving royalty-stacking problem.

Having introduced the economic rationales of the patent system and the specificities of the electrical engineering industry to which patent aggregation mostly pertains, the next section specifically defines patent aggregation. In particular, it considers the advantages of the existing definitions, their limits, and proposes a new one significant for further competition law analysis.

3. Defining Patent Aggregation

Existing scholarship on patent aggregation spans economics and law fields. Because of the novelty of non-manufacturing patent exploitations, few studies have covered patent aggregation in its entirety. However, specific activities that might fit within the concept of patent aggregation, such as patent licensing and litigation, have long existed and are already addressed by competition law [38].

Economics literature on innovation management is the pioneer in the research of patent aggregation as an entire phenomenon. In the context of

[37] SSOs enable coordination on and certification of technical standards in interoperability-driven industries. See A. HAGIU, D.B. YOFFIE, *The New Patent Intermediaries: Platforms, Defensive Aggregators, and Super-Aggregators*, in 27 *J. of Economic Perspectives*, 45 (2013).

[38] The European Commission has set soft-law regarding the compatibility of patent licenses with Art. 101 TFEU in its guidelines on the application of the 2014 Technology Transfer Block Exemption Regulation and on the applicability of Art. 101 TFEU to Horizontal Cooperation Agreements. See Communication from the Commission, Guidelines on the application of Article 101 of the Treaty on the Functioning of the European Union to technology transfer agreements, OJ 2014 C89/3, and Communication from the Commission, OJ 2011 C11/1. On sham litigation as an abuse of a dominant position by intellectual property owners, both the General Court and the Court of Justice of the European Union have already shed light, see Case T-111/96 ITT Promedia v Commission EU:T:1998:183, Case T-119/09 Protégé International v Commission EU:T:2012:421, and Case C-170/13 Huawei v ZTE EU:C:2015:477.

external patent exploitation strategies, Bader *et al.* systematised patent aggregation within patent intermediation practices, among pure patent brokering and patent financing [39]. Nevertheless, they did not clearly define patent aggregation besides equating it to the aggregation of patent portfolios [40]. It was Rüther, who characterised the entities that engage in patent aggregation, that in 2012 indirectly provided the first definition. Focusing on the benefits that vertically integrated patentees, so-called practising entities ("PEs"), can derive from exploiting patent aggregators' services, she defined patent aggregating companies as those undertakings that "focus on amassing patents, see R&D not as a core competency, and do not produce or manufacture own physical goods …" [41].

A second definition emerged later at the 2014 EPO workshop titled Patent aggregation and its impact on competition and innovation policy [42]. At that event, participants from industry, academia, legal practice, along with public officials concluded that patent aggregation "describes any activity where patents that were previously owned by a number of different parties, are brought under the control of a single actor or entity". They further specified that patent ownership or control "means the right to decide which party gets access to the patents and under what terms". As a result, patent aggregation, beyond patent purchases, is also achieved by means of exclusive patent licenses with sublicensing rights. Finally, the participants deemed irrelevant for definitory purposes any teleological concern behind patent aggregation. Consequently, the ends to which patent aggregation activities aim, such as gaining freedom to operate or improving the patentee's bargaining position, do not qualify what conducts meet the definition or not.

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[39] Patent brokering facilitates the matching of patent demand and supply, while patent financing provides capital to patentees using their patents or the descending royalty revenues as collateral or security. See M.A. BADER *et al.*, *Handbook: External patent exploitation*, (2013), at p. 13.

[40] Patent portfolios, according to Parchomovsky and Wagner, who have extensively researched them, are strategic collections of distinct-but-related patents that combined offer competitive advantages to their holders. See G. PARCHOMOVSKY and R.P. WAGNER, *Patent Portfolios*, in 154 *University of Pennsylvania L. Rev.*, 1 (2005), at p. 27.

[41] Depending on the actual business model pursued, Rüther concluded that PEs can exploit patent aggregators to obtain either short-term financial rewards, such as additional cash flows from patent sales or out-licenses, or long-term financial and non-monetary rewards, respectively patent maintenance cost savings, immediate realization of R&D investment, entry in new markets, standard-setting and learning effects. See F. RÜTHER, *Patent Aggregating Companies: Their Strategies, Activities, and Options for Producing Companies*, (2012), at p. 13.

[42] See EPO Economic and Scientific Advisory Board, Patent Aggregation and its impact on competition and innovation policy, (Workshop Report 2014), at p. 7.

Later, in 2015, the European Commission Expert Group on Patent Aggregation echoed the outcomes of the EPO workshop [43].

Another, yet brief, definition of patent aggregation is included in the detailed taxonomy of intellectual property ('IP') related services from Bartsch *et al.*, according to whom patent aggregation consists of the process of scouting for existing patents, acquiring them, and then pursuing either offensive or defensive purposes [44].

Last, the European Commission Joint Research Centre (JRC) 2016 Science for Policy Report Patent Assertion Entities in Europe, following Rüther, indirectly defines patent aggregation by reference to its actors. Distinguishing PAEs from patent aggregators, the report states that these latter "comprise companies that predominantly do not produce goods … but accumulate large patent portfolios encompassing a significant amount of patents on the rights of which they often assert" [45]. This report also highlights the difficulty in defining and categorizing patent aggregators since they employ substantially different strategies.

All the definitions, focusing on either the change in patent ownership or on the accumulation of patents, diverge from Bader *et al.'s* systematization of patent aggregation among patent intermediation. They exclude patent intermediaries that just facilitate the meeting of patent buyers and sellers without taking patent ownership or control risks [46]. Furthermore, the described studies commonly conceive patent aggregation from the patent grant onwards, finding it as soon as a group of patents, at least ten for Rüther, changes ownership or control. In this way, patent prosecution, that is the filing of patent applications, is explicitly outside the definition of the EPO and Bartsch *et al.* and implicitly from that of Rüther. Indeed, despite the fact that the timely first definition opens the terminology to "amassing patents", it is difficult to see how a firm which sees "R&D not as a core competency" could file patent applications. Moreover, Rüther excludes

[43] See P. GIURI *et al.*, *Report of the Expert Group on Patent Aggregation*, (2015), at p. 12. Moreover, this report builds on a 2012 report of a different Expert Group which explored the feasibility of direct EU policy intervention to enhance patent valorisation through sales and s. See A. GAMBARDELLA *et al.*, *Options for an EU instrument for patent valorisation*, (2012).

[44] See F. BARTSCH *et al.*, *Intellectual Property Services Classification (IPSC)* (Fraunhofer IMW 2016, retrieved from *http://s.fhg.de/IPSC*, accessed 15 January 2019.

[45] See Europe Economics, Patent Assertion Entities in Europe – Their impact on innovation and knowledge transfer in ICT markets (JRC Science for Policy Report 2016), at p. 16.

[46] However, as shown in the next section, the distinction between aggregation and intermediation is blurred because market players might pursue different activities over or at the same time.

from her inquiry pure R&D companies, such as Tessera Technologies[47], but includes those firms that buy patents and then pursue proof of concept or prototyping activities only for commercialization purposes[48]. At a maximum, patent prosecution fits all definitions insofar as it enlarges the geographical and technological families of acquired patents[49]. By contrast, only the JRC conceives patent aggregation as including the development of patent portfolios by internal R&D.

Each definition leaves patent aggregation open-ended, without specifying the purpose for aggregating patents. Bartsh *et al.* circumscribe this openness by vaguely limiting patent aggregation to defensive and offensive purposes, whereas the JRC Report states that patent aggregators often assert the accumulated patents. Lacking clear boundaries, this flexibility is desirable in order to catch unforeseen patent aggregation practices emerging in electrical engineering technology markets[50].

Overall, the major distinction between the existing studies regards the possibility for PEs to engage in patent aggregation activities. On the one hand, Rüther, almost followed by the JRC Report, excluding Pes from her definition, equals patent aggregators to Non-Practising Entities ("NPEs"), namely those patentees operating only upstream on the technology input side, who monetise their patents without practising the technologies themselves. On the other hand, the other definitions leave the scope open for patent aggregation by PEs without limitations.

Acknowledging that no definition is inherently wrong[51], given the aim of facilitating future competition law analysis, it does not seem appropriate either tout court excluding or including PEs from the patent aggregation phenomenon. Indeed, on one side, PEs engage in the aggregation of pa-

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[47] See *https://www.tessera.com/* (accessed 15 January 2019).

[48] See Rüther, above n. 41, at p. 14.

[49] A patent family is a group of patents that are all linked by a common source or priority, and usually consists of a number of patents filed in more than one country for a single invention. See Patent Informatics Team, "Patent thickets An overview", UKIPO Report [2011], at 61. Transfers of patent applications *ex* Art. 71 of the European Patent Convention could also be considered *lato sensu* part of patent prosecution, therefore fitting the definition centred on the change of patent ownership.

[50] Notably, for the purpose of competition law analysis, technology markets comprise both the upstream market where patents are traded as technological inputs, and the downstream market for patent implementing outputs. Depending on the relevant conduct, patent aggregation might affect both or either the upstream and downstream markets. In this sense, see the European Commission Guidelines on Art. 101 TFEU, above n. 38, respectively at para. 20 and 116.

[51] In particular, Rüther's definition is perfectly sound from the point of view of her research on the benefits that PEs can derive from interacting with patent aggregating companies.

tents as much as NPEs since they are both able to amass patents and then out-license, sale or litigate them[52]. To the opposite, PEs, in contrast to NPEs, have long aggregated patents for manufacturing purposes, protecting their products from copying and asserting their huge portfolios in case of infringement by competitors. Thus, it is important that the definition goes beyond the traditional form of aggregation by PEs, and emphasises its new manifestations typical of open innovation, where PEs externally exploit their patents. Inasmuch as PEs aggregate patents beyond manufacturing, they share commonalities with NPEs that are worth studying under the patent aggregation category. In addition, excluding PEs from the definition misses a substantial part of European patent aggregation activities, since these are the undertakings allegedly most active with regard to both electrical engineering patent prosecution and litigation[53].

Accounting for the division of innovative labour inherent to the patent system, this paper does not follow existing definitions. It approaches the JRC understanding as it equally treats acquired and internally prosecuted patents, as well as PEs and NPEs, yet it departs even from that solution as it only considers patent aggregation beyond manufacturing goals. Therefore, patent aggregation is here defined as any business model that aggregates under common ownership or control electrical engineering patents, patent applications or commercialization rights, through direct prosecution or transfer, and then uses them for non-manufacturing purposes.

Further economic reasons are outside the definition, recognizing that patent aggregation pursues divergent goals, both defensive, such as clearing one's own downstream market position or preventing copying, and offensive, such as raising rivals' costs or heightening market-entry barri-

[52] Actually, the biggest and most famous electrical engineering patent acquisitions have been conducted by PEs. For example, in July 2011 Rockstar Bidco, a consortium of Apple, Microsoft, Sony and RIM, bought 6,000 Nortel Network patents for $4,5 billion. Google followed in 2012 by purchasing Motorola's 17,000 patents and 7,500 patent applications for $12,5 billion. See Orr, above n. 6, at 567. Furthermore, cross-licensing, a well-known strategic patent use, is only pursued by PEs. Whatever the purpose, portfolios aggregated for licensing or assertion exploit the same weaknesses of the patent system as portfolios aggregated for defence and cross-licensing, and thus provide similar advantages. See Parchomovsky and Wagner, above n. 40.

[53] As we have seen in Section 2 above, the most active patent applicants at the EPO in the electrical engineering sector are prominent manufacturing companies, such as Huawei, Samsung or Ericsson. Regarding patent litigation, Love *et al.* found that PEs account for about 80% of patent suits filed in Germany between 2000 and 2008 and the United Kingdom between 2000 and 2013. See B.J. LOVE *et al.*, *Patent Assertion Entities in Europe*, in D.D. SOKOL (ed.), *Patent Assertion Entities and Competition Policy*, (2017) 104, at pp. 106-109.

ers[54] Hence, the definition does not discriminate according to the patent origin or patentee type and focuses on novel patent aggregation conducts, the most challenging from a competition law perspective. Moreover, the definition is also size-neutral. In other words, the definition applies to any undertaking that, driven by non-manufacturing aims, aggregates at least two patents, recognizing that even a small portfolio of SEPs or commercially important patents can constitute a relevant product market for competition law analysis[55].

Having defined the phenomenon of interest, the next section delves into the details of twenty available taxonomies of patent-related businesses in order to find which commercial activities meet the proposed patent aggregation definition and what characterises them.

4. Existing Classifications of Patent-Related Businesses

Studies into individual types and taxonomies of patent-related business models tend to be fragmented and span various streams of economics and law scholarships on IP management, markets for technologies, patent intermediaries, and patent litigation. This section reviews twenty classifications, published between 2007 and 2017, to identify those commercial activities that fall within the proposed patent aggregation definition[56].

From a methodological perspective, it is possible to categorise the retrieved taxonomies under six dimensions. First, their research scopes range from broad, such as participants in patent markets, to narrow, such as PAEs. Consequently, the detail level is rather granular for those taxonomies with a narrow scope, whereas aggregated for those with a broad scope. Second, their geographical focus is either American, European or holistic – the older

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[54] See GIURI *et al.*, above 43.

[55] An anonymous reviewer deserves credit for this thoughtful insight.

[56] This paper does not purport to have located all existing taxonomies of patent intermediaries or aggregators since the deployed research techniques, i.e. desktop-based research and foot-note surfing, have limitations. Particularly, foot-note surfing or snowballing, namely the process of retrieving unknown publications from references in known ones, might conduct to research bubbles where certain non-cited publications are ignored. On this matter, see C. MORRIS and M. CIAN, *Getting a PhD in Law*, (2011), at 44, and B. JOHNSON and L. CHRISTENSEN, *Educational Research: Quantitative, Qualitative, and Mixed Approaches*, (2010), at pp. 231-232.

classifications focusing on American experiences, while only the more recent ones focus on the European context. However, since many of the classified businesses operate on both sides of the Atlantic, and to a lesser extent in prominent Asian markets, most taxonomies are holistic[57]. Third, the authors' backgrounds vary, with four studies coming from industry participants, eleven from academia, and five from mixed public policy expert groups. Fourth, the methodologies used comprise traditional black-letter research, qualitative empirical methods, such as case studies or surveys, and some even quantitative methods. Together, the heterogeneity in backgrounds and methodologies balance and triangulate the sample, allowing it to provide a verisimilar representation of the real-world patent market[58]. Fifth, eleven taxonomies have only one level of specification, while nine identify further species for certain or all of the classified genres. Last, each piece of research is based on different variables. Some of these variables are agreed across more studies, for example, the business characteristics, the patent monetization strategy employed, the value added to the patent or the commitment put into patent transactions by the classified entity.

For the sake of brevity and coherence with the proposed definition of patent aggregation, this research omits those businesses that do not acquire or control patents, and that instead amass patents solely for manufacturing purposes[59].

Practically, the paper groups the classifications into four subsections, reflecting commonalities in the research scope dimension. From the broadest research scope to the narrowest one, these are 1. Patent Market Intermediaries, 2. Patent Monetization Strategies, 3. Patent Enforcement, and 4. Patent Aggregators.

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[57] This notwithstanding, the age and geographical focus of the classification suggest a relative more mature patent market in the US than in Europe.

[58] The verisimilitude of a sample, also called ecological validity, differs from its external validity, the only characteristic that combined with internal validity allows generalizing from the sample to the entire population of interest. On the validity of research results in empirical research see Johnson and Christensen, above n. 56, at pp. 256-277.

[59] The examples of real firms provided by all references, totalling 151 entities, are collected in a separate table available upon request. Considering the difficulty of classifying patent-related businesses that might undertake distinct activities over or at the same time, the table highlights both whether or not sampled studies have similarly classified same companies, and if classified firms have received multiple labels.

4.1. Patent Market Intermediaries

This subsection comprises both the broadest research scopes, ranging from patent market players to patent intermediaries and services, and the oldest study encountered, namely that of Laurie and Millien from 2007 [60]. In general, of all the patent intermediaries classified only a few meet the proposed patent aggregation definition, being directly involved in the acquisition or prosecution of patents themselves. Many of these businesses are simply middlemen that facilitate the meeting of patent buyers and sellers without taking patent ownership or control risks [61].

Generally, the broad classifications that focused on patent market intermediaries drew a primary distinction of patent-related businesses: PEs and NPEs. PEs are the traditional patentees while NPEs represent a new genre of patent intermediaries, as Hagiu and Yoffie explain [62]. In fact, PEs, including IP subsidiaries of manufacturing companies, represent vertically integrated patent-holders that implement certain of their proprietary technologies into some end-product. The second genre, NPEs, runs exclusively in the upper part of the supply chain and provides the patented technologies used as inputs by manufacturers. To conduct further competition law analysis of the relevant markets and market power, it is helpful to consider in detail the different types of NPEs, so to understand which are their customers, suppliers, and competitors.

Albeit with different labels, the taxonomies further point to six main types of NPEs considering the entrepreneurial practices pursued. These are TTOs, R&D firms, patent pools, patent funds, PAEs, and defensive patent funds. First, according to Laurie and Millien, TTOs manage the patent portfolios of universities and public research organizations, providing patenting and commercialization services for their inventions [63]. Second, R&D firms internally develop technologies, file patent applications, and

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[60] See R. LAURIE, R. MILLIEN, *Meet the Middlemen*, in 28 *Intellectual Asset Management*, 53 (February/March 2008); R. LAURIE, R. MILLIEN, *A Summary of Established and Emerging IP Business Models*", in 9 *The Sedona Conference Journal*, 77 (2008).

[61] In this sense, for example, Kelley distinguishes patent market facilitators between brokers, auction houses and online platforms. See A. KELLEY, *Practicing in the Patent Marketplace*, in 78 *University of Chicago L. Rev.*, 115 (2011), at pp. 121-123. For the same reason, also Hagiu and Yoffie exclude patent-related services such as patent valuation, rating or screening from their classification, see HAGIU, YOFFIE, above n. 37, at p. 46.

[62] See HAGIU, YOFFIE, above n. 37, at pp. 51-60.

[63] See R. LAURIE, R. MILLIEN, *Meet the Middlemen*, in 28 *Intellectual Asset Management*, 53 (February/March 2008), at p. 57.

then monetize in the market the obtained patents [64]. Third, patent pools, a traditional patent institution for Hagiu and Yoffie, administer the licensing programs of patents bundled from different owners [65]. Fourth, patent funds raise money from PEs or from capital markets, acquire patents that fit coherent patent portfolios, and then exploit them so as to achieve a return on investment [66]. Fifth, PAEs, initially called patent licensing and enforcement companies by Millien and Laurie or patent enforcers by Benassi and Di Minin, acquire patents to obtain licensing fees or damage awards in courts rather than transfer technology [67]. Last, defensive patent funds, which emerged as a private ordering response to increasing PAE activities, buy patents, either with own capital or upon members' solicitation and finance, to provide freedom-to-operate as a service to their members or subscribers [68].

To sum up, the taxonomies of patent market intermediaries confirm that both PEs and NPEs meet the advocated patent aggregation definition and that NPEs comprise a range of different actors. Because competition law scrutinizes conducts rather than business models, the next subsection specifically centres on what patentees do, beside implementing them into end-products, to profit from their proprietary technologies.

4.2. Patent Monetization Strategies

The second group of taxonomies is characterised more by its research results rather than by its scope. Despite variably concentrating on IP related businesses, IP intermediaries and NPEs, the studies here considered homogeneously produce classifications based on the external patent monetization strategy pursued. Essentially, all these classifications conceive four monetization options: out-licensing, sales, holding and enforcement [69].

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[64] ID., at p. 54.

[65] See HAGIU and YOFFIE, above n. 37, at p. 50.

[66] See R. LAURIE and R. MILLIEN, above n. 63, at p. 54.

[67] See R. LAURIE and R. MILLIEN, *A Summary of Established and Emerging IP Business Models*, in 9 *The Sedona Conference Journal*, 77 (2008), at p. 79; M. BENASSI, A. DI MININ, *Playing in between: patent brokers in markets for technology*, in 39 *R&D Management*, 68 (2009), at p. 80. For Hagiu and Yoffie, PAEs degenerate in patent trolls when they engage in nuisance value litigation or patent hold-up, see HAGIU, YOFFIE, above n. 37, at pp. 52-53.

[68] See BARTSCH *et al*., above n. 44; KELLEY, above n. 61, at pp. 119-120.

[69] See J. CLARK, *Working Regions: Reconnecting Innovation and Production in the Knowledge Economy*, (2014), at p. 68.

Out-licensing is the most natural patent exploitation strategy apart from vertically integrating and directly implementing the patented technology into products. As Yanagisawa and Guellec point out, TTOs, R&D firms, and patent pools specifically build their patent portfolios with the goal of reaching profitable licensing contracts with manufacturers in support of the latter's commercialization activities [70].

Patent sales, by contrast, pertain more to the operations of patent funds. These entities usually acquire undervalued patents, bundle them into coherent technological portfolios, and then sell them to profit from the arbitrage [71]. Nevertheless, PEs too can divest their patent portfolios, either to make revenue, to cut patent maintenance costs, or to exit non-core business sectors, as demonstrated by Google's recent sale of lithium battery patents to Amperex Technology [72].

The simple holding of patents is at the same time a traditional strategy for PEs, typical of the closed-innovation paradigm, and an emerging one for NPEs. Indeed, PEs have always aggregated patents and held them directly to disrupt the competitors' operation, gate-keeping the availability of their proprietary technologies. By contrast, when NPEs adopt a holding strategy, they do so essentially as defensive patent funds, which acquire and hold patents to ensure freedom to operate, lower search costs and safety from litigation of their members or subscribers. Wang specifies that defensive patent funds acquire patents either directly with their own finance raised from capital markets and subscription fees, or indirectly with subscribers' pooled resources [73]. In both cases, the financial backers of the defensive patent funds remain anonymous, so that they can benefit from information asymmetries in the technology market. Usually, defensive patent funds commit to the holding strategy and do not enforce their patents unless counter-attacking those who are suing their members. However, as Papst explains, holding may be followed by other monetization strategies both to recoup some of the patent acquisition costs and to prevent free-riding from non-members, which otherwise would benefit from the commitment not to sue. Thus, defensive patent funds also out-license the acquired patents to third parties and offer subscriptions to new firms (so-

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[70] See T. YANAGISAWA, D. GUELLEC, *The Emerging Patent Marketplace (OECD 2009)*, at pp. 21-25.

[71] See J. CLARK, above n. 69.

[72] See *https://www.bna.com/google-makes-first-n73014482079/* (accessed 15 January 2019).

[73] See A.W. WANG, *Rise of the Patent Intermediaries*, in 25 *Berkeley Technology L.J.*, 159 (2010), at pp. 171-177.

called catch and hold strategy), or license the bought patents to members and then resell them on the technology market (so-called catch and release strategy) [74].

Unlike the holding patent monetization strategy, the enforcement strategy sees patentees that generate rents through patent infringement damage awards in court and patent settlements out of court. Because of the variety of characteristics and motives behind patent enforcement, the next subsection is entirely dedicated to it.

4.3. Patent Enforcement

The classifications focused on patent enforcement consider features such as patent origin, patent use or litigation strategy. Overall, they show that heterogeneous entities assert their patents for non-manufacturing purposes, therefore engaging in patent aggregation activities.

First, patent enforcers differ regarding the origin of the asserted patents. For example, Optiz and Pohlmann classify those that prosecute patents through internal R&D as innovative patent enforcers, whereas they considers those that strategically acquire them as non-innovative patent enforcers [75]. These authors highlight the relevance of the litigated patents too, criticising the enforcement of patents that are of minor technological quality, blatantly invalid, vaguely scoped, or even non-infringed [76].

Then, the use made of the patents in suit characterises their enforcers. For example, Allison *et al.*, reporting US patent litigation data between 2000 and 2007, categorise several classes of patent infringement plaintiffs [77]. Among them, only one represents PEs, namely product company, while the other ten classes are specific types of NPEs, for example, universities or start-ups in the pre-product phase. This categorisation is in line with Optiz

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[74] See D. PAPST, *NPEs and Patent Aggregators – New, Complementary Business Models for Modern IP Markets*, in 48 *les Nouvelles*, 94 (2013), at p. 97.

[75] See M. OPTIZ, T. POHLMANN, *Typology of the patent troll business*, in 43 *R&D Management*, 103 (2013), at p. 113.

[76] Ibid.

[77] See J.R. ALLISON, M.A. LEMLEY & J. WALKER, *Extreme Value or Trolls on Top? The Characteristics of the Most Litigated Patents*, in 158 *University of Pennsylvania L. Rev.*, 1 (2009), at pp. 10-11. Their twelve classes are: 1) Acquired patents; 2) University heritage or tie; 3) Failed start-up; 4) Corporate heritage; 5) Individual inventor started company; 6) University/government/NGO; 7) Start-up in the pre-product phase; 8) Product company; 9) Individual; 10) Undetermined; 11) Industry consortium; 12) IP subsidiary of a product company.

and Pohlmann who also distinguish patent enforcers depending on whether their patents are directly implemented or non-practised ones [78].

Last, patent enforcers can be ranged depending on their litigation strategy. According to the JRC Report Patent Assertion Entities in Europe, patent pools, R&D firms and TTOs are patentees that usually assert their patents only after licensing negotiations have failed, whereas defensive patent funds go to court as soon as the freedom-to-operate of their members or subscribers is endangered [79]. Instead, the patent enforcement strategies of PAEs can correspond either to the prominent litigation of key enabling electrical engineering patents against big manufacturing companies or to the serial litigation campaigns against multiple defendants, suing both manufacturing firms and their customers [80]. Moreover, the Report notes that PEs, in order to limit the freedom to operate of competing manufacturers without reputational or other operational risks, can recur to ad hoc PAEs, sometimes known as privateers, which assert the patents on the PEs' behalf [81].

Again, the taxonomies on patent enforcement confirm that both PEs and NPEs meet the patent aggregation definition. Of course, PEs might assert their patents against competitors only to secure the implementing-product market for themselves without so engaging in patent aggregation. However, this likelihood is remote in the electrical engineering sector, where products rarely embed only the patents of just one PE.

4.4. Patent Aggregators

The fourth and last subsection consists of those taxonomies centred on the characteristics of patent aggregators. Three elements distinguish patent aggregators, namely the value they add to the patents they monetise, their

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[78] See M. OPTIZ, T. POHLMANN, above n. 75.

[79] See Europe Economics, above n. 45, at p. 45.

[80] ID., at pp. 130-134. Lemley and Melamed refer to lottery-tickets trolls for those NPEs that hold few yet valuable patents, which they use to achieve exemplary damages in court, while bottom-feeder trolls for those NPEs that send myriads of licensing demand letters to alleged infringers of their vast patent portfolios. See, M. LEMLEY, A. MELAMED, *Missing the Forest for the Trolls*, in 113 *Columbia Law Review*, 2117 (2013), at p. 2126.

[81] See Europe Economics, above n. 45, at pp. 31-32. For an extensive discussion of patent privateering, see T. EWING, *Indirect Exploitation of Intellectual Property Rights by Corporations and Investors: IP Privateering and Modern Letters of Marque and Reprisal*, in 4 *Hastings Science & Technology Law Journal*, 1 (2011).

public or private structure, and the rewards they pass on to inventors when they buy their patents.

Most importantly, these taxonomies emphasize the intermediate activities undertaken to add value to patents before their monetization [82]. They refer to two types of adding-value activities, mostly labelled as patent incubation and enrichment, eventually, yet not necessarily, conducted to make patents more attractive for the market [83]. On the one hand, patent incubation adds prominent value to patents and comprises all R&D efforts, such as proving the concept of an invention or prototyping, needed for an invention to successfully bridge the so-called valley of death [84]. On the other hand, patent enrichment adds limited value and involves the geographical enlargement of patent families or the bundling of many patents into technological coherent patent portfolios. Because of enrichment, patent portfolios are worth more than the sum of the individual values of the underlying single patents they comprise [85].

Another distinction of patent aggregators is their public or private origin and related ownership structure [86] .Gassmann *et al.* refer to government-sponsored patent funds that aggregate patents from national universities and SMEs to foster the domestic economy through protectionist strategies [87]. Besides protectionist public patent funds, there are also not-for-profit initiatives. Indeed, Buchtela *et al.* in their classification list public patent funds that provide finance to patentees only to pursue macroeconomic social benefits and seldom expecting returns to be paid back [88]. However, because these public patent funds do not acquire patent ownership, they do not engage in patent aggregation *stricto sensu*. Not-for-profit patent aggregators also exist in the private sector, such as those non-com-

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[82] See RÜTHER, above n. 41, at pp. 59-60.

[83] See A. GAMBARDELLA *et al.*, *Options for an EU instrument for patent valorisation*, (2012), at pp. 41-42.

[84] See R. GALIAKHMETOU *et al.*, *How to Enhance Patent Commercialisation? An Analysis of Patent Aggregators in Europe*, in 22 *Intl. J. of Innovation Management*, 1850040 (2018), at pp. 1850040-6.

[85] ID., at pp. 1850040-8. Parchomovsky and Wagner have chiefly highlighted that patent portfolios are often more valued than the individual patents they contain, see Parchomovsky and Wagner, above n. 40, at p. 52.

[86] See EPO Economic and Scientific Advisory Board, above n. 42, at p. 8.

[87] See O. GASSMANN, C. KRECH & F. RÜTHER, *Profiting from Invention: Business Models of Patent Aggregating Companies*, in 19 *Intl. J. of Innovation Management*, 1540005 (2015), at p. 1540005-11.

[88] See G. BUCHTELA *et al.*, SEE.IP Fund Feasibility Study (2010), at pp. 28-37.

mercial patent funds and patent pools described by Rüther that amass patents to neutralise licensing issues in social or humanitarian areas or to make patents freely available [89]. Nevertheless, also these non-commercial patentees are outside the scope of patent aggregation here purported since they prevalently belong to the agricultural, health, and environmental sectors [90].

Finally, patent aggregators are classified based on the type of reward they can provide to the original patentees from whom they buy patents [91]. Consideration for the sale of patents is the simplest monetary reward that inventors can receive, either immediate lump sum payment upon sale, or continued participation to the proceeds of the subsequent commercialisation of the sold patents. Additionally, patent aggregators with technical and entrepreneurial competencies can also provide long-term non-monetary rewards to original patentees, such as transfer of operational risks, protection from infringement litigation and R&D collaboration [92].

To sum up, patent-related businesses in general and patent aggregators in particular have been classified along several dimensions. Nevertheless, none of the reviewed studies centres its taxonomy on the specific activities accomplished by patentees. This solution would be beneficial for competition law purposes, which does not scrutinize market players but rather their behaviours. Hence, the next section synthesises a new two-dimensional taxonomy of patent-related conducts fitting the proposed patent aggregation definition.

5. New Patent Aggregation Taxonomy

Because market players engage in many economic activities over or at the same time, the new taxonomy focuses on patent aggregation actions rather than actors. This direction is in line with the proposed definition, which does not discriminate between patentee types, and which equally

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[89] See RÜTHER, above n. 41, at pp. 145-151.

[90] In this sense, see the UN Medicines patent pool (*https://medicinespatentpool.org/*, accessed 15 January 2019), the ECO patent commons (*https://www.eli.org/news/royalty-free-environmental-patents*, accessed 15 January 2019), and the Golden Rice Project (*http://www.goldenrice.org/index.php*, accessed 15 January 2019).

[91] See O. GASSMANN, C. KRECH & F. RÜTHER, *Profiting from Invention: Business Models of Patent Aggregating Companies*, in 19 *Intl. J. of Innovation Management*, 1540005 (2015), at p. 1540005-5.

[92] See RÜTHER, above n. 41, at pp. 95-96.

admits PEs and NPEs to engage in patent aggregation. Moreover, conducts and not entities have economic effects and are so subject to competition law scrutiny.

The departure point of the taxonomy is the proposed definition of patent aggregation, whose openness and uniqueness are both a strength and weakness at the same time. On the one hand, the flexible definition catches unforeseen practices emerging from the market. Yet it does not clarify what actual activities it includes. On the other hand, its singularity means it targets only the new patent aggregation practices typical of the open innovation paradigm. Yet it impedes to completely rely on any of the reviewed classifications, which might have unduly excluded or included activities in or out of the proposed definition. Consequently, a new taxonomy is needed so as to understand what conducts fall within the phenomenon of interest, and which in turn allows their empirical analysis.

At the methodological level, the new taxonomy includes all patent aggregation activities by any type of entity, balances each mutually exclusive category, adopts a self-explanatory nomenclature and is manageable in its granularity[93]. In practice, the structure of the taxonomy is two-dimensional, corresponding to the two meaningful propositions identifiable within the advocated definition. Indeed, the definition can be divided into a first prong, referring to the aggregation of electrical engineering patents under common ownership or control by prosecution or transfer, and a second prong, limiting the interest to only non-manufacturing patent uses.

Preliminarily, the reference to aggregation under common ownership or control excludes all those patent market intermediary activities that do not involve direct ownership or control of patents, patent applications or their commercialization rights. Therefore, patent brokering and financing, as shown at 4.1. above are outside the present taxonomy[94]. Furthermore, the first prong specifies that direct prosecution or patent transfer can lead to patent aggregation. While prosecution is univocally identified with the filing of patent applications, transfer is manifold. Indeed, the ownership or control of patents can be transferred either directly through patent purchases and exclusive long-lasting licenses, or indirectly by merging with or acquiring patent owners[95]. Finally, the second prong of the definition limits patent aggregation to non-manufacturing purposes, omitting the internal use of patents

[93] These principles mirror to a certain extent those used by Schmoch in its classification of technological sectors. See SCHMOCH, above n. 1.

[94] See, inter alia, BADER *et al.*, above n. 39, p. at 13.

[95] See EPO ECONOMIC AND SCIENTIFIC ADVISORY BOARD, above n. 42.

exclusively for productive goals. This limitation, albeit including PEs inasmuch as they use their patents beyond manufacturing, is not self-explanatory. Despite this opaqueness, it is reasonable to conclude that intermediary activities such as patent incubation or enrichment mentioned at 4.4. and occurring between the aggregation of patents and their exploitations are irrelevant for the purposes of the definition and so do not enter the taxonomy[96]. Moreover, the reviewed studies on patent monetization strategies have highlighted four non-manufacturing options that any patentee faces: out-licensing, selling, enforcing, or holding. Since these four options materially vary depending on whether the patentee is vertically integrated or not (i.e. a PE or a NPE) it is worth to explore them in greater depth so as to provide a clearer taxonomy.

The out-licensing scenario is, in principle, more circumscribed for NPEs than it is for PEs, as these latter operate on both the upstream technology market and the downstream product market. In fact, NPEs, not implementing patents themselves, are interested in maximizing royalty income, licensing either at a penetration price to any interested implementer or at a premium price exclusively to certain implementers. By contrast, PEs, besides maximizing their royalty income as NPEs with patent users, are also interested in concluding cross-licenses with other PEs. Such agreements give mutual access to the respective patent portfolios, enabling cost-savings or even profits if one portfolio is more valuable than the other, and so they require consideration on top of the reciprocal license. Accordingly, PEs might well discriminate the price to access their proprietary technologies, depending on whether or not the prospective licensees can offer valuable patents in return[97]. In theory, without NPEs and if cross-licenses were an industry custom, market entry could be foreclosed to new entities without valuable patents.

Conversely, the sale option appears more advantageous to NPEs than to PEs. Through patent sales, NPEs seek to maximise proceeds, selling to the highest bidder regardless of it being a vertically integrated patentee or a

[96] However, the exclusion of intermediate activities from the taxonomy does not mean that they do not affect innovation. As shown by the studies focused on patent aggregators, incubation and enrichment might well be decisive in determining the effect of patent aggregation on technological development and innovation cycles, and therefore on its competition law treatment.

[97] Hypothetically, also NPEs could conclude cross-licenses with other PEs. Such a contract could take a variety of forms. For example, it could first consist of a neutrality agreement where the parties agree not to enforce or invalidate each other's patents. Second, it could be a defensive alliance agreement, the NPE safeguarding freedom to operate on its portfolio to any PE in exchange for the reciprocal freedom to operate being provided by the PE to each of the NPEs licensees.

competing NPE. Instead, PEs might opt not to sell their proprietary technologies to rival downstream manufacturers. In addition, patent sales from a PE to an NPE can have reputational effects for the seller, either positive if the acquiring NPE pursues defensive monetization strategies, or negative if the NPE is known for being prone sue in court. Because of the incremental and convergent features of the electrical engineering sector, firms need to repeatedly cooperate with each other, granting reciprocal access to their technologies or jointly undertaking standardization endeavours [98]. Negative changes in reputation might deter other market players from cooperating, ultimately leading to the alienation of the aggressive firms.

Also, the enforcement option seems a monetization strategy more suitable for NPEs than PEs. First, NPEs asserting their patent rights in courts against alleged infringers do not bear any risk of infringement countersuit lacking manufacturing activities. Reversely, PEs, fearing retaliation risks, are deterred from intensively asserting their patents against other PEs, conscious that one patent infringement lawsuit might trigger other lawsuits in a mutually-assured-destruction setting [99]. Second, NPEs focused on patent enforcement benefit of a reputation for being tough patent infringement plaintiffs, which could incentivise potential infringers to quickly settle given the costs, length and uncertainty of patent litigation. To the contrary, PEs generally do not wish to be perceived as avid patent asserters by competing manufacturing firms both because that reputation might prejudice business relations, and even attract allegations of abuse of a dominant position [100].

Last, the holding scenario turns out to be more profitable for PEs than NPEs, since these latter can hold their patents without monetizing them exclusively if they benefit from some other income. In practice, NPEs just

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[98] See P.C. GRINDLEY, D.J. TEECE, *Managing Intellectual Capital: Licencing and Cross-Licencing in Semiconductors and Electronics*", in 39 *California Management Rev.*, 8 (1997), at pp. 9-10.

[99] The smartphone global patent war is an example of how patent infringement lawsuits can escalate. Indeed, smartphone manufacturers have sought injunctions in courts around the world for the infringement of their numerous patents. Because mobile phones, as any ICT product, include dozens of standards, which read on thousands of patents owned by many patentees, the likeliness of an involuntary patent infringement is at least probable. For an overlook of the smartphone patent wars see C. DUHIGG, S. LOHR, *The Patent, Used as a Sword*, in *The New York Times*, 7 October 2012, or J.I.D. LEWIS, R.M. MOTT, *The sky is not falling: navigating the smartphone patent thicket*, in 1 *WIPO Magazine* (2013).

[100] In this sense, see the EU jurisprudence on sham litigation as an abuse of a dominant position by IP owners, i.e. Case T-111/96 ITT Promedia v Commission EU:T:1998:183, Case T-119/09 Protégé International v Commission EU:T:2012:421. On the raising rival's costs strategy, see DANIEL L. RUBINFELD, ROBERT MANESS, *The Strategic Use of Patents: Implications for Antitrust*, in *François Lévêque and Howard Shelanski eds. Antitrust, patents, and copyright: EU and US perspectives*, 85 [2005].

holding patents are just defensive patent funds that offer freedom to operate as a service in exchange for membership or subscription fees. PEs instead have long held patents without asserting them, while still making profits in product markets. Actually, the holding option for PEs grew in its strategic function with the shift from the closed innovation paradigm to the open one. Indeed, in the old paradigm, PEs aggregated and internally held patents only to prevent the imitation of their proprietary manufacturing advantages, while in open innovation settings PEs have begun to externally leverage their patents strategically blocking competitors, raising rivals' costs or deterring market entry [101]. However, the non-manufacturing holding option implies for both NPEs and PEs risks of patent hold-out, namely implementers deliberately free-riding and infringing patents knowing they will not be pursued for infringement. Defensive NPEs, committed to never enforce their patents, might tackle patent hold-out with catch and release strategy [102], whereas PEs might develop profit-sharing mechanisms with NPEs, confidentially outsourcing the assertion of their patents without impacting their reputation.

Having analysed the non-manufacturing exploitation options, it is now possible to recap all those activities that fit the new two-dimensional patent aggregation taxonomy. Following the two prongs of the definition, the first group of patent aggregation activities comprises the means by which patents can be aggregated, namely exclusive licenses, mergers and acquisitions ("M&A") of patentees, patent prosecution, and patent purchase. Instead, the second group comprises the non-manufacturing uses of aggregated patents, namely enforcement, defensive holding, out-licensing and sales. The crossing of the two groups results in fifteen possible patent aggregation combinations [103].

Most patent aggregation categories can be pursued by any patentee-type, but with three exceptions. Indeed, M&A-sell and purchase-sale correspond to arbitrage activities typical of patent funds, which are far from

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[101] Parchomovsky and Wagner list several benefits of holding large patent portfolios: i) it eases subsequent innovation by broadening the scope of effective patent protection; ii) it attracts related external innovations through the power to exclude others from the marketplace; iii) it confers market power that avoids costly litigation; iv) it improves the bargaining position; v) it enhances the defensive aspects of patent protection through counter-infringement threats; vi) it increases the patentee's voice in the dynamics of the patent system; vii) it allows to attract and retain capital investments. See PARCHOMOVSKY, WAGNER, above n. 40, at pp. 33-37.

[102] See e.g. WANG, above 72.

[103] One less than the mathematical combinations since it is not legally possible for an aggregator to conclude patent exclusive licenses and then selling the patents, since exclusive licensees do not acquire ownership of the patents.

the core business of PEs. Instead, prosecution-defensive holding is the traditional strategy of PEs that are precluded to any NPEs, which could not recoup R&D investments just holding patents.

In terms of the individual types of NPEs businesses, PAEs can pursue all enforcement combinations except for prosecution-enforcement, which exclusively pertains to R&D Firms, as these latter are the only NPE engaging in patent prosecution. Furthermore, the defensive patent fund type uniquely occupies the defensive holding scenario, with the abovementioned prosecution-holding exception. In contrast, out-licenses options are varied, being the normal practice of most NPE businesses, yet the unique outcome of patent pools, which in-license patent commercialization rights from many patentees, and then sub-license the bundled patents to contributing patentees or third parties. M&A-sale and purchase-sale are then the usual enterprises of patent funds, while prosecution-sale are commonly done by R&D firms. Lastly, TTOs deploy several commercialization strategies, such as in-license-out-licensing, prosecution-out-licensing, and prosecution-sale, sometimes in the form of spin-offs of patent-based start-ups [104].

6. Conclusion

This paper is but a small step along the path to understanding the complexities of patent aggregation, its impact on innovation, and competition law treatment. Nonetheless, the proposed definition reduces patent aggregation to a consistent phenomenon, whose discrete conducts can be clearly categorised by using the taxonomy.

Notably, because patentees may engage in several economic behaviours over or at the same time, the taxonomy should not be statically used. Indeed, any PEs or NPEs might qualify for one or more patent aggregation combination depending on the circumstances. For example, a PE could stop its manufacturing operations and focus exclusively on enforcing its patents [105]. Likewise, an NPE could diversify its business, licensing as a pa-

[104] On spin-offs mechanisms for TTOs, see M. STEFFENSEN *et al.*, *Spin-Offs from Research Centers at a Research University*, in 15 *J. of Business Venturing*, 93 (1999), and P.N. PATTNAIK, S.C. PANDEY, *University Spinoffs; What, Why, and How?*, in 4 *Technology Innovation Management Rev.*, 44 (2014).

[105] This was the case of Papst Motoren, a former manufacturer of computer fans and cooling systems, which since 1992 turned to the PAE business. See PAPST, above n. 73, at p. 95.

tent pool certain patents while asserting others [106]. Alternatively, defensive patent funds committed to never litigating their patents could also pursue patent infringement litigation, thanks to the anonymity provided by shell companies. Given this flexibility, any effort to explain the triple relationship between patent aggregation, innovation, and competition law should be made on a case-by-case basis, thus considering the peculiarities of the patent aggregation instance at hand.

In terms of what still needs to be done, further exploratory research should build upon the definition and taxonomy of patent aggregation in order to identify its empirical evidence in Europe. These data, as a means to an end, would ground the research in the real world and clarify to what extent and under what forms patent aggregation occurs. Indeed, if patent aggregation happens only to a negligible extent in Europe, competition law has a limited role in ensuring its consistency with innovation. If that is the case, a more comparative research angle with the United States, arguably the most innovative nation in electrical engineering, where empirical evidence of patent aggregation is already established, might investigate what differences in the American and European legal systems lead to its diffusion or not [107]. The impact of patent aggregation on innovation should then be determined, admitting divergent results depending on the specific patent aggregation combinations considered. Last, future research could formulate policy actions to ensure the positive relationship between patent aggregation and innovation. These measures would serve both if competition law could not remedy eventual anti-innovative patent aggregation activities and if Europe were short of pro-innovative ones. In this sense, the European Commission already shows a balanced approach. On the one hand, it endorses patent aggregation activities generally known for spurring technological development, such as patent pool licensing. On the other hand, it closely scrutinises controversial patent aggregation, such as dominant patentees' licensing and enforcement practices [108].

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[106] For example, see the experience of Sisvel at *http://www.sisvel.it/* (accessed 15 January 2019).

[107] For the innovation capacities of the United States see the 2017 Global Innovation Index by Cornell University, INSEAD and WIPO, available at *https://www.globalinnovationindex.org/* (accessed 15 January 2019). For the most recent and comprehensive evidence in patent aggregation activities in the US, see the Stanford NPE Litigation Dataset, available at *https://law.stanford.edu/projects/stanford-npe-litigation-dataset/* (accessed 15 January 2019).

[108] The European Commission favour towards patent pools has been recently stated at the end of 2017 in its communication "Setting out the EU approach to Standard Essential Patents", see Communication from the Commission to the European Parliament, the Council and the European Economic and Social Committee, COM(2017) 712 final, at 8.