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On-demand IP licensing for the digital economy

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Abstract

The rise of the digital economy is causing a surge in Intellectual Property (IP) licensing as more and more IP assets are being incorporated into products and product service systems (PSS). Today's IP licensing models possess rigid structures that put incumbent licensing parties at an advantage and imply large barriers to entry for innovative enterprises. This paper contrasts the traditional, predominantly lump-sum licensing models with fairer and more flexible models that could be enabled by automated licensing management systems. Thereby, we take a first step towards leveraging the potential of flexible IP licensing models to reduce the complexities, inefficiencies and trust issues inherent in IP licensing today. We discuss three different fixed and usage-based IP licensing models that we plan to test in a successive simulation study to more closely explore the economic implications of fixed versus usage-based IP licensing for the involved stakeholders.

Keywords: On-demand IP Licensing, Pay-Per-Use, Royalties, DLT

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Introduction

In light of the growing number of Intellectual Property (IP) assets incorporated by single devices[1,2] and the rise of IP in- and out-licensing[3], the management and payment of IP licenses is becoming increasingly complex and mission-critical for both licensors (IP owners) and licensees (e.g. OEMs), not only for IoT technologies. Due to the complexity inherent in IP licensing agreements, ensuring contract compliance is close to impossible[4]. On top of that, thanks to the power of incumbent licensees, licensors often reap only part of the value that should be attributed to them. On the other end, the common *lump sum* or *percentage of sales* royalties are often passed downstream to the final customer by being added to a product's purchase price. As a result of these hefty upfront costs in product development and commercialisation, new industries (e.g. Internet of Things (IoT)[5], smart mobility, communications technology and consumer electronics) are preventing innovations as new companies face large barriers to market entry.

As a first step towards improving licensor value attribution and reducing the barrier to market entry in upcoming industries, this paper proposes fairer and more flexible pricing schemes for IP licensing. In these schemes, lump sum payments are substituted or complemented by usage-based components that comprise arbitrarily complex variables and rules. Usage-based licensing refers to the practice of charging based on some measure that is related to the usage of the concerned IP. Every time that the IP is used, its usage (count or duration) increases marginally. The size of the payment is determined by a supporting system that tracks the usage metric and sends the information on a certain schedule for the royalty payment to be executed. In order to ensure compliance with these yet more complex terms, we propose that IP licensing contracts should be automatically tracked and executed as smart contracts (SC) in a DLT-based Automated Licensing Payment System (ALPS) (Tietze & Granstrand, 2019).

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[1] A modern smartphone is expected to incorporate more than 250,000 active patents, RPX Corp., Registration Statement (Form S-1), 59 (Sept. 2, 2011), available at http://www.sec.gov/Archives/edgar/data/1509432/000119312511240287/0001193125-11-240287-index.htm (last accessed Aug. 18, 2020).

[2] over 75 billion IoT devices to be projected by 2025, available at https://www.statista.com/statistics/471264/iot-number-of-connected-devices-worldwide (last accessed Aug. 18, 2020)

[3]https://www.aranca.com/knowledge-library/blogs-and-opinions/ip-research/ip-licensing-strategy-to-ensure-growth-in-adversities-3

[4] Ensuring licensing contract compliance comes potentially with substantial transaction costs due to the potential complexity of the data collection task (Tietze & Granstrand, 2019, p. 351)

[5] IoT refers to multi-technology devices that can transfer data and make decisions autonomously based on the shared information. (Atzori et al., 2010) (last accessed Oct. 15, 2020).

We put forward three different IP licensing models comprising fixed and usage-based components to take a first step towards understanding and thus leveraging the potential of nonlinear IP licensing models. These models are to be tested and evaluated in a consecutive study. Beyond the world of connected devices and the IoT, this licensing model may even find its way into various other industries such as big data and open source software licensing (Tietze, 2020).

The Digital Economy

With the boom of globalisation and technology trade across industries in the 1980s, the practice of IP licensing gained increased global economic importance. The resulting surge in patent applications and the strategic importance of patents facilitated the emergence of today's 'pro-licensing era' (Ove Granstrand, 2004). The digital economy (Krishnan & Chakravarti, 1997; Tapscott, 1996; Teece, 2012), open innovation (Chesbrough, 2003) and more recently, the IoT have contributed to this development (Atzori et al., 2010; Gubbi et al., 2013). In line with this trend, devices incorporate increasingly complex sets of technologies (e.g. software, sensors, data transmission and encryption technologies (Tietze & Granstrand, 2019). Since hardly any company is able to develop the required technology entirely in-house, finished products often include IP assets that are owned, operated and maintained by different companies (e.g. bluetooth patents, 4G patents or software IP for computational processes (O. Granstrand & Oskarsson, 1994; Tietze & Fletcher, n.d.; Tietze & Granstrand, 2019). As a result, the licensing interdependencies between licensees and licensors are gaining in volume and complexity along both the supply and value chain of digitally connected products and services.

Despite this development, the payment of IP licenses is often still processed semi-manually inducing substantial room for error, uncertainties and trust problems between licensees and licensors (Burns & Sandelin, 1998; Kiernan, 1998; Tietze & Granstrand, 2019).[6] On the one hand, licensees are particularly burdened with the task of managing multiple agreements for each of their manufactured products, by tracking and computing the correct amount to be paid as well as executing the payments to the respective licensors. On

[6] These problems may, for example, be caused by information asymmetries between the involved parties. Commonly, IP licensing fees are computed based on a product's sales figures. For large corporations determining exact sales figures semi-manually is both highly resource intensive and close to impossible. Similarly, commissioning external auditors to investigate incorrect payments is extremely expensive for licensors (Tietze & Granstrand, 2019).

the other hand, licensors have to trust the correctness of the royalties received from licensees or commission costly audits. Burns & Sandelin (1998) reported a well-known example involving Stanford University as a licensor that indicates the scale of the inherent trust problem. According to the authors, Stanford University received payments of $247,000 from its licensees shortly after announcing that the university was about to commission an external licensing audit.

Today's IP Licensing

IP licenses come in various forms and structures. At its foundation, every licensing agreement consists of contractual parties, the agreement's duration (or expiration date) and its payment logic. The payment logic can encompass any given number of parameters and conditions, such as a non-recurring *lump-sum payment* and/or a recurring *royalty payment*. Lump sum payments specify a particular amount payable in a given reference currency on a particular date. Recurring royalties ('R') are variable payments consisting of a royalty rate 'r' that is multiplied by a royalty base 'b' (Ove Granstrand, 2010; WIPO & ITC, 2010).

$$\text{(i) } R = r \times b$$

In today's linear IP licensing agreements, even though in theory all kind of royalty bases could be agreeable in contractual agreements, royalties mostly either do not exist or have simplistic royalty bases such as the *revenue* or *gross profit* of an IP-carrying device, which, as such, can appear quite difficult to determine, for instance in large multinational corporate settings. Royalty rates, in turn, are often fixed percentages. In theory, however, royalty bases may encompass any kind of quantifiable measure and form complex sets of rules together with the corresponding royalty rates. Besides, royalties may depend on further variables such as global maxima or minima, a due date and the frequency of recurrence (Ove Granstrand, 2010; WIPO & ITC, 2010). Exploiting this flexibility would allow for IP licensing agreements to be tailored more closely to the needs of individual licensees and licensors. The following example serves to illustrate a more customised and tailored IP licensing agreement:

> (i) for an IP component in an IoT device, a licensee pays 0.1 USD for each time the IP is used to the licensor, but pays 0.2 USD for each usage if the IP is EPC (European Patent Convention) or PCT (Patent Cooperation Treaty) approved, and pays an additional 0.05 USD for each usage if the manufacturer reaches more than 2m USD in capital. The total payment, however, is capped at 2000 USD.

The variables and parameters used in licensing agreements can be of arbitrary nature and may include exchange rates, a federal interest rate or other event-based characteristics. Thanks to this modular structure of parameters and rules and under the condition that it is possible to precisely track these parameters to correctly compute IP licensing payments, nonlinear IP licensing is possible.

Nonlinear IP Licensing

To reduce the inefficiencies inherent in today's suboptimal, predominantly lump-sum licensing models, we study and seek to apply nonlinear pricing of information goods to more closely tailor IP licensing payments to consumers' usage behaviours. In information-intensive markets, traditional selling strategies are gradually being complemented or substituted by recurring payment strategies (Lehmann & Buxmann, 2009). While traditional selling entitles customers with the perpetual right of use over a product or service, recurring payment strategies such as the royalty payments introduced before link payments, and possibly ownership, to a certain base measure such as time or performance.

Recurring payment models began to be commercially applied on a larger scale with the so-called *servitization,* i.e. the shifting focus that manufacturing companies were putting on the provision of services (Essig, Glas, Selviaridis & Roehrich; Lütjen, Schultz, Tietze & Urmetzer, 2019). Various kinds of recurring payment models have been designed as a result of this trend. Among the most prominent examples are the 'Power-by-the-Hour'[7] model introduced by Rolls-Royce Aerospace in 1962, Pay-per-Use and Subscription models (e.g. for carsharing services (Tietze, Schiederig & Herstatt, 2013)) as well as more recently the Software-as-a-Service scheme (Bala & Carr, 2010). In essence, these models aim to align the interest of the user or operator with the interest of the manufacturer by paying for products only if they continue to perform well[8].

A wide set of literature has emerged studying the pricing of information goods such as computer software under varying pricing regimes, multiple states of competition (i.e. monopoly, oligopoly, perfect competition) and taking into account a range of influencing factors (e.g. customers' utility-per-use, customers' usage frequency, transaction costs of

[7] Available at https://www.rolls-royce.com/media/press-releases-archive/yr-2012/121030-the-hour.aspx (last accessed Oct 15, 2020)
[8] Ibid.

monitoring usage) (Balasubramanian, Bhattacharya & Krishnan, 2015; Bala & Carr, 2010; Jia, Liao & Feng, 2018; Jiang, Chen & Mukhopadhyay, 2001; Sundararajan, 2004). Several key factors can be drawn from this research to study the conditions under which nonlinear IP licensing might be superior or inferior to other licensing schemes.

Firstly, the *transaction cost of payment processing* (TC_{pp}) influences the desirability of licensing models and is hence part of our analysis. The TC_{pp} mainly comprise costs to calculate and settle IP license payments. On top of that, it might include the cost of information asymmetry and lack of trust between licensing parties in case of error-prone payment processing as well as the costs of resolving disputes between those parties (Balasubramanian et al., 2015).

Secondly, the *transaction cost of administering usage* (TC_{au}) is a key factor and contains expenses to track and monitor usage (Balasubramanian et al., 2015; Varian, 2003; Cheng, Demirkan & Koehler, 2003). These costs are particularly relevant in information-intensive markets where the variable costs of digital (re-)production is close to zero. Thanks to advancements in digital technologies and automation, these costs have been reduced in recent decades. However, they persist and inhibit the profitability of pay-per-use models. The significance of the TC_{au} depends on the size of the resulting additional IP licensing fee. With a system that tracks and executes IP licenses, the TC_{au} would mostly consist of a one-off payment for installation at each participating entity. Thus, depending on the distribution of TC_{au} per entity and the number of IP licensing payments per entity, the resulting size of the added fee per IP licensing payment may be fairly low.

Thirdly, *customer heterogeneity* needs to be considered as it takes into account how customers vary in both usage (i.e. usage frequency) and in the perceived value (i.e. utility-per-use) of a given product (Balasubramanian et al., 2015). Scholars have found that customers with low usage patterns typically prefer pay-per-use systems (Balasubramanian et al., 2015). Concerning value perception, customers tend to undervalue the utility gained from products in the pay-per-use model due to the ticking meter effect (Balasubramanian et al., 2015). This psychological effect dampens the value of consuming a product because new payments recur continuously throughout its consumption. But below a certain usage threshold, the TC_{au} incurred (when split per usage) exceeds the value that customers gain per usage (Bala & Carr, 2010). This might be solvable with thresholds that distinguish linear from nonlinear pricing rules i.e. hybrid payment models.

Fourthly, the number of IP licenses owned by companies in a certain industry (i.e. licensed IPs per company) and the number of companies in an industry (i.e. company per industry) might impact the desirability of one or the other licensing model in different industries. Hence, these factors are to be taken into account in the model comparison in order to allow for differences across industries. Using these sets of criteria, we create three scenarios to test the conditions under which non-linear pricing might be superior to both licensees and licensors.

Three licensing model scenarios

Taking a first step towards evaluating the potential of nonlinear IP licensing models to reduce the inefficiencies inherent in today's IP licensing payment processes, this section discusses how different types of transaction costs affect IP licensing models under varying market conditions. To do so, we define the following three models: a (i) fixed percentage of sales model (base case scenario), a (ii) pay-per-use model and (iii) a hybrid model containing fixed and usage-based elements.

(i) The first model represents today's predominant IP licensing models and calculates royalty fees as '25% of gross profit' achieved from the sale of the licensed IP. In this model, the TC_{pp} is substantially large yet dependent on how error-prone the payment handling process is. The TC_{au} is zero as usage is not factored into the licensing fees. The *usage frequency* may differ across licensees but the usage frequency at which this model's utility exceeds the others is possibly fairly high because the TC_{pp} inhibits the utility of this model at a low *usage frequency*.

(ii) The second model is based on a degressive usage-based logic: *the licensee pays X USD for each unit sold to the licensor, but pays X*0.8 USD for each unit sold if the total usage count reaches Y*. This scheme requires recurring payments to be calculated and executed securely and correctly which comes with significant TC_{au}. But assuming substantial security and accuracy of the payment system, the TC_{pp} would be close to zero. This model grants potential benefits to licensees who cannot afford high upfront costs, and also to licensors whose customers have a low usage profile. However, due to the ticking meter effect, it might deter customers with high usage profiles who have solid finances to pay lump sum costs.

(iii) The hybrid model combines a fixed element and usage-based pricing as follows: *the licensee pays X USD for each unit sold to the licensor, but pays X*0.8 USD for each unit sold if the total usage count reaches Y. If the total usage count is below Y after k years from the date of contract ratification, the licensee pays an additional lump sum fee of Z USD.* Hybrid models may take multiple forms of arbitrary complexity to specifically reflect the needs and intentions of the contractual parties. This specific example is used because it prevents the fundamental problem that pay-per-use models have with low usage frequencies. Similarly to model (ii), this model would have a TC_{pp} that is close to zero and a TC_{au} that is fairly large. The more complex the contract conditions and the more dependent they are on external information (e.g. usage counts, dates, exchange rates), the more error-prone and hence costly a licensing model might be. This trade-off needs to be accounted for when designing hybrid IP licensing models. Nevertheless, Sundararajan (2004) pointed out that under certain market conditions and with a TC_{au} higher than zero, hybrid pricing models are optimal in information goods markets.

Conclusions, Future Research and Economic Implications

This paper contrasts traditional linear licensing models with non-linear models that could be enabled by automated licensing management systems, such as the ALPS technology. We discuss three different fixed and usage-based IP licensing models to take a first step towards understanding and thus leveraging the potential of nonlinear IP licensing models to reduce complexities, inefficiencies and trust issues inherent in upcoming IP-heavy industries. In succession to this piece we plan to test the three licensing models in a simulation study to more closely explore the economic implications of fixed versus usage-based IP licensing for the involved stakeholders.

Despite its potential benefits, usage-based IP licensing might also come with substantial challenges that we seek to contextualise with the help of the successive analyses. Exemplary challenges include estimating the price range at which a secure ALPS might be economically feasible and evaluating technical properties of DLT-based ALPS including synonymous transparency of business-related data and external interaction through Oracles.

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