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The Role of Auctions in University Intellectual Property Transactions

Daniel R. Cahoy*
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ABSTRACT

Reflecting the trend in the business community, universities are increasingly investing in intellectual property rights. But they are often unsuccessful in realizing licensing revenues that provide adequate return on investment. This paper considers how auctions could potentially increase licensing efficiency and make university intellectual property transactions more productive. The paper begins by placing the auction in the universe of possible transaction forms and considers how well it aligns to the unique nature of university rights. Penn State’s recent patent auctions provide useful context. The paper then provides recommendations to modify the auction structure for maximum benefit in university intellectual property transactions.

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I. INTRODUCTION

For some time, universities have engaged in periodic auctioning of patent rights as a supplement to other forms of intellectual property (IP) transactions. The forum commonly used has been a third-party site, such as ICAP Patent Brokerage (formerly Ocean Tomo), which offers rights from private firms in addition to non-profit and government actors. But, in 2014, Penn State University changed the dynamic somewhat by offering assets from its patent portfolio on a university designed and administered auction site. A total of 183 patents were offered during two auction periods in April and December. Although there were a limited number of completed

transactions, the auction might be considered worthwhile from a certain perspective, at least as a proof of concept.\(^5\)

But why turn to auctions when simpler transaction forms exist? Auctions are intended to solve (or at least ameliorate) a common university technology transfer problem: the underutilization of most university patents. According to one source, nearly 95% of university-owned patents remain unlicensed.\(^6\) Often the prosecution and maintenance costs are sunk and become a net drain on technology transfer funding.\(^7\) This drain on funding causes most (84%, according to one estimate\(^8\)) university technology transfer offices to lose money.\(^9\)

This paper contributes to existing literature by conceptualizing the utility and design of auctions for selling and licensing university intellectual property. The focus will be on patents as the most prominent and economically important embodiment of university intellectual property.\(^10\) Part II begins with a discussion of the motivations behind university intellectual property transactions. This discussion provides the context for determining transaction success from the perspective of the parties. Part III considers the auction in the universe of possible transaction forms and how well it aligns to the unique nature of university rights. Part IV describes the system that Penn State utilized in its 2014 auctions. This section reviews the results and identifies limiting qualities. Finally, Part V makes recommendations for modifying the auction structure in order to maximize the potential benefits in university intellectual property transactions. This paper also strives to provide implementation guidance to other universities considering auctions in the future.

II. INTERESTS THAT MOTIVATE UNIVERSITY TRANSACTIONS

In the context of university-developed property, revenue realization is vital. Profit, however, is not the only goal in licensing transactions. Invention access for the economically disadvantaged and


\(^8\) Id.

\(^9\) Id.; see also Ledford, supra note 6, at 471–72.

\(^10\) But the discussion may apply to other types.
the desire to achieve broad social utility are among other interests inherent in these transactions. These interests are somewhat unique to transactions in which a non-profit institution is a party. Importantly, interests vary depending on the embodiment of intellectual property. The social interest in federally funded medical research, for example, is very different than that for enterprise software tools. Parties seek to balance these interests, and an appreciation of what is most important for any particular piece of IP is essential for understanding whether an owner will likely transact or dedicate information to the public domain.

A. University Interests

By virtue of the fact that the university is an intellectual property owning entity, there exists some insight into university motivations. In particular, patent perfection is not required. Indeed, patent perfection involves a considerable expense of time and money, and a university’s choice to carve out property rights, rather than dedicate a particular invention to the public, suggests that it seeks a property-related benefit. Nevertheless, the ability to profit from exclusivity may give way to a university’s more nuanced goals.

1. Return on Research Investment and New Revenue Sources

Most universities are looking for some economic benefit at least in excess of the cost of securing intellectual property rights like patents. Not unlike a private firm, universities do not need to obtain substantial revenue on each patent.11 The baseline goal is simply to gain enough revenue to support portfolio expenses and technology transfer personnel.12 If more profit can be obtained, it may be allocated for other education-related uses and split with the inventor(s).

However, as noted above, universities are often unsuccessful in realizing patent profits. The fact that most technology transfer offices are money losers provides a strong motivation to improve the financials. Taking deadweight property rights and turning them into cash of any kind can be extremely useful. Toward that end,
many university technology transfer offices are not only interested in identifying all potentially patentable inventions, but also finding efficient methods of connecting with potential licensees. Some technology transfer offices essentially “advertise” available patents in hopes of attracting licensees.

A university may avoid the difficulty of blindly funding research costs by engaging partner firms from the outset. Sponsored research can lead to guaranteed use of university intellectual property if the relationship is properly structured. However, these relationships may be destined to play a niche role because firms often wish to own the intellectual property in university collaborations. A university may find that corporate partners are difficult to secure without such a concession.

Finally, some universities may be successful in mining untapped intellectual property from units not accustomed to patenting. Science and engineering schools are frequently targeted from the outset, but agricultural and even business innovations may be potentially profitable, yet otherwise unused. An efficient technology transfer mechanism ensures that such IP mining endeavors are likely to be successful, rather than add to the pile of unlicensed rights and their attendant sunk costs.

2. Access to University Innovation

Universities also have a strong interest in ensuring access to their innovations. This interest can arguably contrast with some of the basic principles of intellectual property. If IP is a market exclusion device, universities are essentially limiting the population that can freely use innovation by locking it up with intellectual property. However, it is also understood that many innovations require some investment in commercialization. Production facilities must be built, materials secured, employees hired, etc. Private parties are also unlikely to engage in such investment without some guarantee that others will not be able to compete as free riders. Capturing
intellectual property may represent the difference between an idea sitting fallow or a firm having the incentive to bring it to market.\(^\text{15}\)

However, it is also true that a fully firm-oriented perspective on IP may lead to some inventions being underutilized or even buried.\(^\text{16}\) Additionally, acquiring or licensing firms may use patent rights to charge supra-optimal prices that ensure vulnerable populations cannot access the innovation. Thus, universities have a parallel interest in ensuring broader access that is stronger than a typical firm. Funders, taxpayers, and other university supporters who view the non-profit mission of the university as requiring substantial access will likely require a position of broader access. Key elements of the law (see Figure 2, infra) support this more expansive view of access.\(^\text{17}\)

3. Avoiding Patent Trolls

Some believe that university IP should not be used to interfere unfairly with the market, particularly if it impacts current employers and producers. To the extent that patent trolls create issues in this regard, universities have taken notice.\(^\text{18}\) Patent trolls are usually defined as non-practicing entities that utilize the inefficiencies and information asymmetries in the market to extort market participants.\(^\text{19}\) Patent trolls may own weak patents or rights that cover only a small part of a product or service, but use the expense and complexity of patent litigation to coerce a settlement.\(^\text{20}\) Universities can inadvertently facilitate trolling behavior by selling or licensing patent rights to an entity with the sole interest of suing and extorting legitimate firms. The fact that universities must dispose of

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\(^{15}\) This may be referred to as the “commercialization theory” of intellectual property. See Mark A. Lemley, IP in a World Without Scarcity, 90 N.Y.U. L. REV. 460, 463–64 (2015).

\(^{16}\) See Brian J. Love, Do University Patents Pay Off? Evidence from a Survey of University Inventors in Computer Science and Electrical Engineering, 16 YALE J.L. & TECH. 285, 320 (2014) (considering evidence of research suppression from university patents in a survey of 269 university inventors in the field of computer engineering and computer science).


\(^{20}\) Id.
rights to realize any profit on inventions opens them up to trolls more frequently than a typical company.\textsuperscript{21} Of course, if profits were realized, why would universities care about access as a goal? The answer is the public service mission of higher education in the United States. The advantages that such institutions retain depend, to some extent, on being perceived as more benevolent than a private firm.\textsuperscript{22} To preserve such a perception, universities must present themselves in a manner that demonstrates the continued right to profit from federal research funding and maintain tax advantages. For that reason, universities are sensitive to the accusation that they are actually creating market failures. A consortium of prominent research universities has gone on record to oppose transactions with patent trolls and advocate licensing practices that limit trolling influence.\textsuperscript{23}

\textbf{B. Licensee Interests}

The other side of the transaction equation is of course just as important as the university’s interest. Firms have unique needs in dealing with universities, in part because the firms usually will never fully own the invention, but also because they may not participate in the genesis of the work. A successful strategy must take these needs into account.

1. \textit{Market Exclusivity Versus Access to a Standard}

A firm may desire market exclusivity if the product involved will require significant investment to commercialize. This is particularly true if that investment relates to prototyping, market analysis, or other activities that can be easily copied by competitors. Even federally regulated arrangements can convey this power if a university offers exclusive licenses. Although federal law allows the government to use the invention and allows march-in rights, these uses rarely pose a competitive challenge.\textsuperscript{24} In addition, it is common for universities to retain their own rights to use the invention. However, these rights generally impact research only and also do not pose a competitive issue.

\begin{itemize}
  \item \textsuperscript{22} DEREK BOK, \textit{BEYOND THE IVORY TOWER} 61–66 (1982) (noting the relationship between public support and the public service mission of the college or university).
  \item \textsuperscript{24} 35 U.S.C. §§ 202, 203.
\end{itemize}
Somewhat less recognized is the fact that a firm may not have a problem with a non-exclusive license and may even favor this arrangement in some cases. For example, if an invention could become an industry standard or generally accepted procedure or process, it may be advantageous to ensure that competitors are using it. In addition, non-exclusive licenses are generally less expensive, and therefore, are lower risk. Basic scientific research tools may provide one of the best examples. One of the most successful university patents of all time covers the Cohen–Boyer process for cell cloning. This process was widely adopted and licensed at a relatively low rate to any interested party. The licensees were concerned solely with access to the technology because it provided the basis for other inventions that could be commercialized exclusively.

It is important to note that the option of exclusivity versus non-exclusivity is not binary. The nature of intellectual property, along with its broad exemptions from antitrust laws, provides options that do not exist in other business arrangements. Licensing arrangements can encompass multiple firms who avoid direct competition by taking only part of the property owner’s so-called "bundle of rights." For example, licenses can be split geographically or by industry segment and allocated to different parties for different uses.

26. See Kesan, supra note 12, at 2173–74 (describing the licensing model of the Cohen–Boyer patent).
27. Id.
28. For a variety of options, see ASSN OF AM. UNIV., supra note 23, at 12–13.
30. JOHN W. SCHLICHER, PATENT LAW: LEGAL AND ECONOMIC PRINCIPLES § 11.34 (2d ed. 2003) ("Field of Use Restrictions").
Unfortunately, it may be difficult from the outset to know whether firms prefer exclusive or non-exclusive arrangements. Therefore, licensors tend to set the terms by default. Alternatively, licensors may choose to condition exclusivity on certain events or milestones, which may permit a licensee to reveal its preferences. Figure 1 provides a basic menu of licensing options in decreasing exclusivity from which licensors may choose.

2. Licensing Revenue

Some firms obtain rights for the purpose of acting as an intermediary to others’ use of the invention. These middle-parties can take many forms and have positive or negative market impacts depending on their enforcement strategy. The primary focus of such firms is often royalty income. For example, patent trolls fall into a royalty-focused category, seeking to compel existing firms to license in order to continue their business. However, a venture cap-

31. BRIAN G. BRUSVOLD ET AL., DRAFTING PATENT LICENSE AGREEMENTS § 4.03.E.2 (7th ed. 2012). These requirements, which may be pitched as “best efforts” clauses or something more specific, ensure that a non-productive, exclusive licensee does not lock up the invention. See JOHN GLADSTON MILLS III ET AL., PATENT LAW FUNDAMENTALS § 19:20 (2d ed. 2007) (describing the utility of inserting a working requirement into a license).


33. Id. at 165–66.

34. Id. at 165 (noting that intermediaries “focus on connecting parties that wish to monetize existing patent rights”).

ital aggregator, focused on putting together the pieces of a new technology entity,\textsuperscript{36} is also an intermediary with no intent on practicing the invention.

Initially, one might ask why a university would see a benefit in licensing to a third party, who will then sublicense to others, when the university could fill that same role. Intermediaries, however, can play an important administrative role in identifying relevant technology and collecting royalties, both of which are outside of the typical university’s expertise. In addition, intermediaries may enable a more complex exchange of rights than what can be achieved by a non-profit educational institution with a different primary mission. In some contexts, the more efficient route is to permit the intermediary to make the relevant connections and better spread the use of the invention.

3. **Inventor or Creator Access**

Perhaps more important to licensees in the university context is the possibility of working with the technology inventors. Licensees may wish to additionally obtain non-patented know-how, which could facilitate future invention development.\textsuperscript{37} Such intellectual capital is not always available when licensing from private entities as a result of competitive concerns. Nevertheless, as noted above, universities are not generally market players, and inventors are free to serve as a rich source of information for product development and even participation in the licensing firm.

III. **THE AUCTION AS AN OPTION FOR LICENSING UNIVERSITY IP**

Assuming the interests align and parties elect to engage in an intellectual property transaction, what form is best? As a class of property rights, intellectual property can be sold or licensed in a variety of ways. Perhaps the most common transaction form is the arms-length, one-on-one negotiation.\textsuperscript{38} Such transactions have the advantage of facilitating deeper discovery of the nature of the rights. If know-how is to be included, a licensee may have a better opportunity to interview the creators. Negotiated transactions can also be personalized. In particular, the terms may be structured to

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\textsuperscript{36} See generally Wang, supra note 32.

\textsuperscript{37} Notably, non-patented rights may be handled separately to avoid antitrust restrictions on patent licenses. See Kimble v. Marvel Entm’t, LLC, 135 S. Ct. 2401, 2408 (2015) (citing Brulotte v. Thys Co., 379 U.S. 29 (1964)).

\textsuperscript{38} This may also be referred to as a “bilateral negotiation.” John Jarosz, et al., *Patent Auctions: How Far Have We Come?*, 45 LES NOUVELLES 11, 11 (2010).
fit the specific interests of the parties. Some disadvantages of negotiated transactions, however, are the costs associated with identifying parties and assets, as well as the barriers to reducing information asymmetries.\footnote{39}{Id. at 12.}

A second form of intellectual property transactions is the exchange or clearinghouse.\footnote{40}{F. Russell Denton & Paul J. Heald, Random Walks, Non-Cooperative Games, and the Complex Mathematics of Patent Pricing, 55 Rutgers L. Rev. 1175, 1249 (2003) (describing patent license clearinghouses as an “attempt to lower the cost of identifying inventions that are available to be licensed.”).} In this iteration, large groups of buyers and sellers come together in a forum that attempts to match interests.\footnote{41}{See, e.g., WIPO Green – The Marketplace for Sustainable Technology, WORLD INTELL. PROP. ORG., https://www3.wipo.int/wipogreen/en/aboutus/ (last visited Oct. 21, 2015) (“an interactive marketplace that connects owners of new technologies with individuals or companies looking to commercialize, license or otherwise access or distribute a green technology”).} The exchange owner may serve as an active intermediary, facilitating the connection between buyer and seller (or licensor and licensee).\footnote{42}{See, e.g., Patent Sales, RATIONAL PATENT (RPX), https://www.rpxcorp.com/rpx-services/rpx-patent-sales/ (last visited Oct. 21, 2015) (describing the firm’s role as a patent purchaser that then connects individual rights and portfolios with interested licensees).} In general, exchanges are a starting point for future discussions that are comparable to a standard negotiation.\footnote{43}{Id.} But the exposure to multiple parties presents the possibility of lower information asymmetries and better matching in terms of portfolio offerings. Somewhat related, but often more limited in scope, are patent pools with attendant rules for access and use.\footnote{44}{Richard J. Gilbert, Ties That Bind: Policies to Promote (Good) Patent Pools, 77 ANTITRUST L.J. 1, 5–6, 18–21 (2010) (noting that patent pools are often formed to facilitate the adoption of a technology standard and describing the business strategy and goals of patent pooling).}

Auctions present another level of abstraction from one-on-one negotiations or exchanges.\footnote{45}{Jarosz et al., supra note 38, at 12–13.} There are a variety of forms, but the familiar English option appears to be the default.\footnote{46}{Paul Milgrom, Auctions and Bidding: A Primer, 3 J. ECON. PERSP. 3, 13 (1989).} After the property is offered (with or without a reserve price) bids are placed usually for a fixed, upfront payment. Bids may be accepted only one time (a sealed bid) or bidders may have the opportunity to increase their bids dynamically (an ascending auction). An auction can be for a single transaction across a wide field or consist of multiple bidding opportunities. At the end of the auction, the right is typically assigned to the single bidder with the highest bid. Although alternate
pricing arrangements are available and might entail strategic advantages, the winner typically pays his or her bid for the auctioned right.

A. Is University IP uniquely suited to Auctions?

Is there some reason that university intellectual property would particularly benefit from auctions, as compared to other forms of transferring rights? While the legal boundaries are the same, there are a variety of ownership restrictions and business practicalities that make university IP unique. The distinctions are most striking in the context of patents. Many of these properties are the product of federal law and are the result of a policy-based push to commercialize university innovation. Auctions may be a particularly useful transaction structure in this environment.

1. The Bayh–Dole Act Places Restrictions on Sale and Profit

When one thinks about auctions, one imagines property being sold at the final drop of a gavel. The relationship between buyer and seller is brief, and the pressure of bidding is enhanced by the notion of finality. But it is exactly this state that cannot exist in most university patent transactions. If federal funding is involved, a license will be the only possible outcome.

University research is largely funded by federal dollars. This has been the case since the ramp up of federal funding after World War II. But the commercialization of federally funded research was often lacking, partly because of the inability of firms to secure proprietary rights. Federally funded research was always patentable, but the right to patent was generally controlled by the funding agency. With no consistent policy on patenting or licensing, such research often sat idly on the shelf. This changed in the 1980s, as a result of the Bayh–Dole Act. The law permitted universities to

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51. Id. at 397–402.
52. Id.
file, own, and license patents that were the product of federal research dollars.\textsuperscript{54} As a result of the Bayh–Dole Act, university patenting skyrocketed.\textsuperscript{55}

To ensure that universities did not simply become low-cost, no-risk generators of intellectual property for industry, some restrictions were set on commercialization. Most important is the restriction on selling patent rights without the explicit permission of the funding agency.\textsuperscript{56} Without such permission, universities have only the option to license the patent rights.\textsuperscript{57} The general perception is that agencies rarely agree to such sales, and approval of blanket rights to sell portfolios are particularly uncommon.

\textbf{Figure 2: Unique Characteristics of Bayh–Dole Patent Agreements}\textsuperscript{58}

- Federal government retains right to practice invention (§ 202)
- Federal government can require report of invention (§ 202)
- Preference for licensing to small business firms
- No assignment (sale) without permission. License is default (§ 202)
- Federal government can license another if university and licenses do not commercialize within reasonable time period (§ 203)
- Products embodying licensed invention will be manufactured in United States (§ 204)

University patent licenses can be structured as either running royalties or lump sum payments. For other types of IP licenses, such as trademarks or trade secrets, the royalty can be spaced out to allow for initial low-cost development and increased payments as

\begin{itemize}
\item[57.] \textit{Id}.
\item[58.] 35 U.S.C. §§ 202–204.
\end{itemize}
the market matures. But due to clear (though some might say misguided) Supreme Court precedent,\(^5^9\) no payments can be made for use of an invention after the patent expires. Thus, the patent term sets somewhat of a limit on how much revenue a patent license can elicit.

Another important Bayh–Dole oriented restriction is the requirement that inventors share in the revenue from sales or licenses.\(^6^0\) The statute sets no specific percentage, but a common university rate is 25%–33% of profits.\(^6^1\) Colleges or departments within a university may benefit from additional revenue sharing on top of that. In addition, because patents are licensed and not sold, inventors will commonly receive payments only if the invention is commercialized.

The net result of these Bayh–Dole restrictions is to increase pressure on universities to identify the best licensee for the short-term nature of the transaction.

### 2. University Direct Use Is Rare

Despite the common restriction on the sale of university patent rights, some transaction with a third party is generally required for the institution to realize revenue. The obvious reason is that universities rarely commercialize their own property. This is partially due to the educational mission of universities, but it is also related to the risks inherent in commercialization. Very few universities would be eager to take on the responsibility of managing manufacturing and the attendant risks of product liability, particularly in addition to the burden of caring for the safety of student populations. Even in the case of trademarked goods that are specifically linked to universities, licensed firms generally handle the actual manufacturing and distribution.\(^6^2\) For innovations, out-licensing or selling is the only realistic option for profit in most cases.

The inability to commercialize independently creates particular pressure on universities. First, this inability creates a need to partner with third parties relatively quickly in order to recoup sunk

\(^5^9\) See Kimble, 135 S. Ct. at 2415 (affirming the rule prohibiting patent payments after expiration, originally articulated in Brulotte v. Thys, 379 U.S. 29 (1964)).

\(^6^0\) 35 U.S.C. § 202(c)(7)(B).

\(^6^1\) ALAN S. GUTTERMAN, BUSINESS TRANSACTIONS SOLUTIONS § 209:24 (2014).

\(^6^2\) Jacob H. Rooksby, 27 HARV. J.L. & TECH. 349, 359 (2014) ("Collegiate licensing entails institutions of higher education licensing the use of their trademarked names, logos, and insignia to companies that produce consumption products . . . ").
costs. Every day without return—after prosecution costs are allocated, licensing officers are paid, and buildings are maintained—puts a drag on university finances. Because technology transfer offices have traditionally been viewed as profit centers, they have a strong incentive to move property to the marketplace or move on. One positive aspect of this compulsion is that universities may have a greater incentive to form relationships with the business community. In an ideal world, incubators are created and, eventually, true university–firm partnerships develop that provide funding and local employment beneficial to the university community.

In addition, in a time of tightening economics—particularly for state universities—there is a push to find revenue from new sources. University intellectual property is a common area of interest for administrators looking to address such budget shortfalls. The success stories, particularly from the pharmaceutical field, feed this desire—though many in the tech transfer community believe that luck is a significant factor. Still, to the extent that any revenue can be generated from rights sitting on the shelf, facilitating intellectual property transactions makes sense.

Finally, the lack of direct university commercialization actually creates advantages for universities to the extent that it reduces the potential for marketplace retaliation. When companies operate in a market filled with enough overlapping rights to foster patent litigation, a danger exists. There is always the possibility that two firms’ patents will read on each other’s products and a battle of patent rights may ensue. But universities have no such concerns because when only one firm is in the market, competition is eliminated. To be able to license, sell or litigate without fear of another’s conflicting rights is freeing. Arguably, it is the primary incentive

64. See Kesan, supra note 12, at 2179–80 (stating that TTOs often assess success based on licensing revenue).
66. Vicki Loise & Ashley J. Stevens, The Bayh–Dole Act Turns 30, 45 LES NOUVELLES 185, 188 (2010). Northwestern University has earned hundreds of millions of dollars from its patents licensed to Pfizer to produce Lyrica. Id.
67. See VALDIVIA, supra note 7, at 10 (describing how universities compete for license revenue prestige and noting the lucky universities that owned high-profit patents).
underlying patent trolling behavior. Some have even gone as far as to accuse universities of sometimes acting as patent trolls.68

The freedom of non-commercialization, in the case of state universities, is coupled with the immunity from federal intellectual property litigation based in the Eleventh Amendment.69 Even if a state university acted in a way to infringe another’s patent rights (i.e., the laboratory use of a research tool), no lawsuit could be threatened seeking anything beyond a future injunction.70

3. University Patents Are Not Subject to Prior Use Defense

As a result of the America Invents Act of 2011 (“AIA”), a limited defense exists for firms that engage in secret, prior use of an invention before another patents it.71 While public prior use or sale would invalidate another’s patent application, the Patent and Trademark Office cannot evaluate secret prior use. The prior use defense was introduced to avoid litigation on a long-term use that predates another’s invention.72

The prior use defense weakens patents to some extent. A prior user can essentially ignore the time and money another spends in diligently securing a patent right because the patent is ineffective. Such a firm will have no interest in clearing rights or securing a license. However, there is some debate as to how often the prior use defense is likely to be raised.73

Regardless of how often the prior-use defense arises, universities are not subject to it. The revised § 273 of the AIA clearly exempts universities and inventors obligated to assign to universities.74 The language of the exception states that it vests “at the time the invention was made,” and is not eliminated by subsequent licensing and transfer.75 This exception, therefore, provides some additional power to university patent rights, and makes them more attractive as licensing properties.

69. Id.; U.S. CONST. amend. XI.
72. Technically, it was expanded from a business method, patent-only exemption that had existed prior to the AIA.
75. Id.
B. Are Auctions Uniquely Suited to University IP?

While the auction format is the least common format for transacting university intellectual property, it may offer a number of advantages to the alternative mechanisms. An auction that awards the object to the highest bidder and sets an appropriate non-trivial reserve price will maximize a seller’s expected revenue when (1) there is a single, indivisible item for sale by a monopolistic seller and (2) a fixed set of bidders have private information about their own personal valuation of the item. In other words, auctions can theoretically bring in the greatest revenue under these conditions. Furthermore, due to the famous Revenue Equivalence Theorem, many auction designs will not impact expected auction performance for the seller. Thus, a university does not have to be concerned with picking the perfect auction mechanism. Because university intellectual property makes the university the sole seller of a unique item, and it is likely that potential acquirers have proprietary and differing use values for the rights, it seems that university intellectual property fits the auction model well. In times of limited university budgets, such an opportunity to maximize revenue streams cannot be ignored. Furthermore, subject to meeting the reserve price, the auction tends to allocate the object to the bidder with the highest expected use value. Thus, the auction might also allow the university to further its mission to serve the public interest.

It is also no coincidence that the proliferation of auctions in other domains, such as procurement, consumer goods, and collectibles, has occurred simultaneously with the growth of the Internet. Auctions achieve high seller revenues by maximizing competition between bidders; therefore, identifying as many realistic bidders as possible is important. The ability of university intellectual property auctions to identify new, interested parties via an Internet-enabled auction is also appealing. A second advantage of improvements in technology is that auctions, with their well-defined rules and shorter duration, may significantly lower administrative costs compared to transactions by negotiation.


77. Id. at 65–66. The Revenue Equivalence Theorem states that any auction, which assigns the object to bidders with the same probability (possibly depending upon their value), will always engender strategic behavior such that the expected revenue for the seller is the same. See John H. Kagel, Auctions: A Survey of Experimental Research, in THE HANDBOOK OF EXPERIMENTAL ECONOMICS 501, 503–04 (John H. Kagel & Alvin E. Roth eds., 1995).

Why, then, have auctions not become more popular for university intellectual property? There are many reasons, including simple institutional resistance, yielding the fear that auctions might not function as well as expected in the university IP setting. There are at least four potential limitations of the auction mechanism.

First, the highly uncertain nature of the value of university intellectual property might severely limit the number of potential bidders. While auctions usually function well when the value of the object for sale has a clear, tangible use value, auctions face more challenges when the future value is uncertain. A well-known example of these challenges is the winner’s curse, whereby the winning bidder places overly high bids due to an optimistic assessment of the value of the IP. The result is that the winner loses money and is often reluctant to bid in future auctions. Given that only a very small percentage of university intellectual property is expected to yield large profits, it is likely that many bidders will realize losses due to the auction result. This risk of loss might reduce competition and, therefore, limit the auction’s ability to raise substantial revenue.

Second, a related limitation of the auction setting is its tendency to limit competition to one dimension of the contractual agreement between the university and the acquirer of the intellectual property. The Penn State IP auctions discussed in the next section, for example, set an upfront flat fee as the sole bidding dimension in the auction. The use of the upfront flat fee might exacerbate the issues of realized losses for bidders because they must bear all the risk of an eventual low commercial value of the purchased IP. This is especially problematic if bidders are small and risk-averse. In contrast, a negotiation allows for risk sharing through royalty payments and the amendment of other contractual details that might make the sale of the IP more attractive to both sides.

A third fear that must always be considered is the auction’s susceptibility to bidder collusion. Since an auction can severely limit bidder profits by fostering greater competition, bidders have a strong incentive to collude in order to counteract this impact. Col-

80. Meeting with Dr. Ron Huss, supra note 4.
lusion has long been recognized as a common phenomenon in auctions.\textsuperscript{81} Various changes to the auction design can impact the prevalence of collusive outcomes.\textsuperscript{82} Certain features indicate a greater susceptibility of the particular domain to low revenue and collusive outcomes. These features include a small number of bidders, bidder familiarity, and multiple items for sale. Because university IP auctions often occur for related groups of IP with a relatively limited number of interested parties, the potential for collusion cannot be ignored.

Finally, policy makers have worried that university IP auctions might serve as an open door for patent trolls to obtain licenses in order to conduct frivolous litigation.\textsuperscript{83} If patent trolls are able to obtain university IP, the university will not necessarily be serving the public, and might have to deal with a negative public perception.

IV. THE STRUCTURE OF THE PENN STATE UNIVERSITY PATENT AUCTION

Given an understanding of transacting parties’ motivations and the objective utility of the auction mechanism, it is useful to consider the real life example of Penn State. To what extent did the university fulfill the interests of the parties? And how might the structure be improved to generate increased revenue while preserving the non-profit mission of educational institutions? Of course, such an analysis must acknowledge that Penn State was treading rather new ground and was unlikely to have a perfect model from the outset.

To assess the performance of Penn State’s auctions, we sent out a survey through Qualtrics (a third-party provided, online survey tool) to prior participants. To incentivize participation, prior participants were invited via email and informed that one respondent would be randomly selected to receive a $100 Amazon gift card. Moreover, they were assured anonymity to their responses. In total, 23 out of 109 non-university-related participants with an active email address responded. The results of this survey are presented alongside the description below.\textsuperscript{84}

\textsuperscript{81} RALPH CASSADY, JR., AUCTIONS AND AUCTIONEERING 216 (1967).
\textsuperscript{83} See, e.g., Brown & Clements, supra note 18.
\textsuperscript{84} Survey questions and a sample survey invitation email are available upon request.
In April of 2014, Penn State offered 73 issued patents for license in the first university-run auction.\(^{85}\) The patents were primarily related to engineering technologies.\(^{86}\) In general, these rights had been available for license for some time, but the university’s technology transfer office made no sales.\(^{87}\) One perspective, then, is that the Penn State patent auction consisted of leftover patents that no one wanted. On the other hand, it is perfectly reasonable to assume that the patents had value and simply needed the right marketing and distribution structure to engage interested clients. Moreover, as noted above, the potential to make connections with industry and generate interest in Penn State research was clearly an aspect of the process.

In December of 2014, Penn State conducted a second auction.\(^{88}\) In this offering, licenses to 110 patents were on the table.\(^{89}\) The technologies offered were relatively broader, spreading into fields such as biotechnology, agriculture, and materials science.\(^{90}\) However, the offerings were similar to the first auction in that they were old technologies, likely to be abandoned eventually.\(^{91}\) Notably, a couple of survey respondents that participated in this auction held their bids because the available technologies did not match their needs or interests. Another respondent commented specifically on the limited value of old, issued patents as a drawback.

Both auctions utilized a similar structure.\(^{92}\) For a period of two weeks interested parties could bid on an online website (https://patents.psu.edu/) for exclusive licenses for any or all of the patents.\(^{93}\) Only one survey respondent said that they ran out of time to digest the amount of intellectual property present and decide on whether to bid. The starting (reserve) price was either $5,000 or $10,000, depending on how much time was left in the patent term.\(^{94}\) In some cases, patents were only offered as bundles of related technologies.\(^{95}\) In addition to the upfront exclusive license payment, licensees

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85. Meeting with Dr. Ron Huss, supra note 4.
86. Id.
87. Id.
88. Id.
89. Id.
90. Id.
91. Meeting with Dr. Ron Huss, supra note 4.
92. Id.
93. Id.
94. Id.
95. Id.
would be responsible for paying all future maintenance fees.\textsuperscript{96} Interestingly, 21% of the survey respondents thought that these starting prices were too high.

Both auctions, however, achieved some measure of success. The April auction resulted in the license of a bundle of two patents for the minimum bid of $10,000.\textsuperscript{97} The December auction resulted in licensing to two different companies, a single patent and a bundle of two patents, for the respective minimum bids of $5,000 and $10,000.\textsuperscript{98} Again, for rights that were likely to be abandoned, the auction managed to generate some funding—likely significantly more than needed to account for the cost of administration.

Fortuitously, the three successful licensees responded to our survey. All three produce yearly revenues between $1 and $10 million; one licensee operates in the machinery industry, while another operates in the electronic equipment industry. Two of the successful licensees indicated that they submitted bids simply because they found suitable issued patents at reasonable prices, but the third stated that the licensee took part in the auction to protect a related technology. All three respondents waited until the last minute to bid in order to postpone revealing their interest in the technology or to reduce the time others had to respond with a counter bid.

The strategic bidding behavior of these companies is probably not a significant deterrent of other bidders, as these nascent auctions are barely gaining recognition.\textsuperscript{99} Most survey respondents were simply curious about Penn State’s auction structure and chose to observe either one or both auctions with no intention of placing a bid. Many participants were familiarizing themselves with the system Penn State used. One participant commented that he or she subscribed to the auction to observe how the site worked and to browse through the available issued patents. Another respondent wanted to determine whether Penn State’s auction structure would be applicable to the technologies available at his or her university.

Nevertheless, future participation among the respondents seems promising. Out of all the survey respondents, 74% said that they are likely to participate in future licensing auctions. Of those who were initially curious about the auction, but did not bid, 64% stated

\textsuperscript{96} Id.
\textsuperscript{97} Meeting with Dr. Ron Huss, supra note 4.
\textsuperscript{98} Id.
\textsuperscript{99} The majority of the survey respondents became aware of the auction though some form of official marketing and distribution vehicle such as news articles, Internet posts, and press releases. A third of the respondents, however, heard about the auction by word of the mouth.
that they would likely participate again. Out of all those who par-
ticipated to see if there was something interesting worth buying, 83% said that they would participate again. When asked what changes would motivate them more to participate in the future, of the 20 who responded to this question, 11 stated that they were inter-
terested in the availability of more promising, less senior patents; 5 wanted a lower minimum price; and 4 sought the ability to nego-
tiate/change other terms of the license contract.

There seems to be enthusiasm for the auction, as there are par-
ticipants who want to work with the university and see improve-
ments. One respondent, in particular, commented:

I am very interested in the patent auction, but the entry bid should be low and the market will take it to the level it needs to go. That said, there should be a path towards securing the patent and making it work. That would entail establishing a continuing relationship with Penn State to explore what fur-
ther can be done to make the patent viable.

A second respondent recommended creating access to the inven-
tor of the issued patent, as it may enhance the value of available patents.

V. IMPROVING AUCTION STRUCTURE

In the end, what is the place for auctions in university intellec-
tual property transfers? Can auctions such as Penn State’s serve as a model for other universities? Even if auctions will not substitu-
te for all, or even most, licensing transactions, perhaps they will provide an important supplement to one-on-one negotiations. Sig-
ificantly, even more could be achieved if patent auctions employ the latest developments from research and practice in other do-
 mains.

While fears associated with unsuccessful auction strategies can-
not be ignored, it is our view that further research and examination of new and novel auction designs may actually serve to create suc-
cessful auction experiences for university IP.

A. Include Royalty Options in Addition to Lump Sums

A primary problem associated with the risky nature of university IP is that bidding is generally concentrated on an upfront fee. More bidders may be willing to participate if other dimensions can be con-
sidered and risk sharing allowed via a royalty contract. This is not
an uncommon problem and has been addressed in other highly uncertain auction contexts, such as those for gas and mineral rights.\textsuperscript{100} In fact, there is literature demonstrating that auctions that consider these contingent payments may be preferred to those that do not.\textsuperscript{101} This problem is not dissimilar to the initial complaint of many in the procurement industry that variables other than price matter substantially. Thus, many procurement contracts were not amenable to auctioning. Chen-Ritzo and her co-authors show that ascending auctions can be designed which allow the procurer to simultaneously consider multiple, quantifiable dimensions, such as quality and lead time, along with price.\textsuperscript{102}

The inclusion of bidding in the royalty dimension requires the university to decide the appropriate tradeoff between certain up-front payments and highly uncertain royalty payments. However, once this determination is made, the auction can proceed normally, where bids are considered in both dimensions. This innovation might induce participation by smaller, risk-averse bidders, thereby increasing competition and limiting the opportunities for collusion, which should result in increased revenue.

B. Avoidance of Patent Trolls: Pre-Qualification Versus Post-Auction Restriction

An obvious approach to the problem of patent trolls is to eliminate them from the auction. While some might be easy to identify, other undesirable bidders might be more difficult to identify and come at the expense of limited competition in the auction. This issue is not unlike the problem faced in many procurement settings.\textsuperscript{103} The risk of a non-performing contractor is so great that the procurer needs to impose minimum guarantees to feel comfortable with the selection of contractor.\textsuperscript{104} This process is known as pre-
qualification and is utilized to ensure that only serious bidders are allowed in the auction.\textsuperscript{105}

It is entirely reasonable for universities to be concerned with the employment of their property by licensees. Given the use of government funding to create many patentable inventions, universities are appropriately concerned about potential backlash if a patent is used to limit the business activities of a sympathetic defendant. In addition, universities may wish to promote socially beneficial uses of their inventions without restriction. To the extent that a wide-open, fast-paced auction structure permits a transfer that interferes with these goals, a university may be reluctant to auction at all.

The traditional and simple solution is to pre-qualify participants to ensure that only desirable licensees have access to the property.\textsuperscript{106} Truly odious players can be cut out. But this process assumes that universities can reasonably separate the wheat from the chaff. Are all bad actors so clear that they can be identified with pre-qualification criteria? To answer that question, one must define the characteristics of a problematic licensee.

In a typical business licensing transaction, there are some concerns about competitors. But because universities are generally not market participants, competition is not an issue. This results in social policy issues, the most problematic of which is currently the patent troll issue. Unfortunately, it may not be so easy to identify a patent troll \textit{ex ante}. One might exclude a firm that has been listed as a patent troll by existing researchers. However, other firms may fall into the category of non-practicing entities and occasionally act as trolls. On the other hand, even a notorious patent assertion entity could theoretically engage in positive licensing that actually disseminates technology. This is particularly true if the licensing terms are appropriately restricted. In a given auction, an attempt to pursue social policy by carving out bad actors seems likely to lead to over and under inclusion that could still result in negative press and money left on the table.

An alternate tack is to pursue Penn State’s model of open participation with a highly restrictive license.\textsuperscript{107} As Figure 3 summarizes, Penn State requires licensees to abide by certain provisions. But again, this is likely to cut out financially beneficial and legitimate transactions. Some technologies are not as susceptible to trolling

\begin{footnotesize}
\begin{enumerate}
\item[105.] \textit{Id.}
\item[106.] \textit{Id.} at 934.
\item[107.] Penn State Research Foundation, \textit{License Agreement}, THE PENNSYLVANIA STATE UNIVERSITY https://patents.psu.edu/data/radUploads/documents/License%20Agreement.pdf (last visited June 4, 2015).
\end{enumerate}
\end{footnotesize}
as others, and applying the same terms across the board may be excessive. In addition, light restrictions may be entirely appropriate for some participants. Taking a belt and suspenders approach to licensing restrictions is likely to make the entire transaction overly unpalatable.

**Figure 3: Anti-Troll Provisions in Penn State License**

<table>
<thead>
<tr>
<th>Marketing Efforts</th>
<th>Licensee must bring licensed product to market as soon as practical and continue through licensing term. Failure is material breach.</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Art. IV)</td>
<td></td>
</tr>
<tr>
<td>Infringement and Other Action</td>
<td>Penn State shall exclusive right to prosecute any infringement or defend any patent challenge for six months. Afterward, licensee may bring action or defend. All settlements approved by Penn State.</td>
</tr>
<tr>
<td>(Art. VI)</td>
<td></td>
</tr>
<tr>
<td>Infringement Against Third Parties</td>
<td>Licensee may not threaten infringement action against start-up company or end-user unless direct competitor.</td>
</tr>
<tr>
<td>(Art. VI)</td>
<td></td>
</tr>
<tr>
<td>Marking</td>
<td>License products must be marked with patent number.</td>
</tr>
<tr>
<td>(Art. XIV)</td>
<td></td>
</tr>
</tbody>
</table>

The best process seems to be some combination of vetting and restriction. In its simplest form, a university may have a highly restrictive license for an open tier of participants. A less restrictive instrument, however, may be available for vetted and approved participants. For example, it makes sense for a strong anti-troll license to have both production and litigation controls, as those are the defining elements of the worst abusers of patent litigation. But what if a patent aggregator such as Google wished to purchase a license to ensure that the technology is available freely? The production

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108. Mark A. Lemley & A. Douglas Melamed, *Missing the Forest for the Trolls*, 113 COLUM. L. REV. 2117, 2129 (2013) (stating that “Patent trolls are particularly common in the software industry” and noting that software and Internet patents are ten times as likely to be asserted).

requirement would make such a transaction impossible. If this provision was excised, and the litigation restriction retained, an acceptable arrangement for both sides (as well as the public) could be established. Conversely, a producing licensee may have a legitimate interest in controlling litigation. It is unlikely that anyone would conclude that a market participant was simply engaging in trolling behavior, and the need for a fully restrictive license simply does not exist.

Tiered participation will not necessarily interfere with an auction. In fact, different bidding rights and obligations are commonplace in government auctions. For example, small or rural businesses have received preferential bid credits in FCC license auctions.\textsuperscript{110} Interested parties could seek the appropriate status from the outset and reduce the likelihood of public backlash while preserving revenue generation.

C. Incorporate Non-Exclusivity as a Possible Outcome

The procurement literature has identified the fact that auctions that allow for multi-sourcing (i.e., more than one supplier is selected to supply the same product) can be effective in lowering supply chain costs.\textsuperscript{111} There are many reasons that multi-sourcing makes sense in procurement. For example, it mitigates the risk of a non-performing supplier and respects the long-term need to keep multiple suppliers viable. Auctions may even be used to dynamically determine whether it is profitable to multi-source. Interestingly, the literature in the IP licensing domain suggests that multi-licensing may be profitable for the IP holder because it fosters greater downstream competition.\textsuperscript{112} While the motivations may be different, it seems logical that auction designs might consider the possibility that the IP license be assigned to multiple parties. Further, this might help serve the motives of both the university (to provide access to innovation) and the licensee, if exclusivity is not a primary concern.


D. Other Design Changes to Consider

The previous points highlight some substantial changes that, although not typically associated with auctions, may make auctions more appropriate for university intellectual property assignment. This section briefly details a few other changes that may also be considered.

First, the auction reserve price is a critical variable in determining auction revenue. As some survey respondents suggested, Penn State’s choices may have been too high. That said, a word of caution is necessary: If revenue maximization is the primary objective of the university, then auction theory suggests that the reserve price must be set fairly high to counteract the impact of monopsony on the side of the bidder. Therefore, any changes to the reserve price must address whether such a change is likely to increase revenue. For example, if Penn State had lowered the reserve price to $1,000, rather than $5,000 or $10,000, would it have sold sufficiently more licenses at this lower price to increase revenue?

Second, Penn State chose to design an auction with a bidding structure similar to the most well-known consumer auction site, ebay.com, whereby all bidding ended at fixed times. This bidding structure is known as a hard close, and such a structure, while familiar and easy to implement, creates strong incentives for last minute bidding and may be revenue defeating. Notably, all bids placed in Penn State’s auction occurred very near the end of the auction. Almost all large value auctions prefer a soft close, which allows for the “going, going, gone” feature that is prevalent in live auction events. This simple change might have an impact on auction revenue by encouraging more bidding.

Third, the nature of patents is that some can be viewed as complements. For example, a single inventor or group of inventors may file many related patents. When this occurs, the licensee might seek to purchase the rights to all of these patents, and, if they fail, they may find any fraction of the full complement of patents less valuable. This is a well-known problem addressed in many domains such as electromagnetic spectrum, airport landing rights, and shipping. In order to maintain efficiency and revenue, an auction

113. Meeting with Dr. Ron Huss, supra note 4.
115. Meeting with Dr. Ron Huss, supra note 4.
known as a combinatorial auction may be necessary.\textsuperscript{117} Such auctions allow for bidding on packages of licenses.\textsuperscript{118} Substantial research has demonstrated the viability of such auctions.\textsuperscript{119} While Penn State did allow bidding on some groups of patents, participants did not have the freedom to group their own.\textsuperscript{120} Given the low-value nature of many of the patents auctioned, such a design may have been unnecessarily complex. However, as universities move to expand auctions to more attractive patents, combinatorial auctions may be worth considering.

VI. CONCLUSION

While the previous discussion has been largely theoretically based, it must be understood that, either due to the limitations of economic theory or the peculiarities of human behavior, there is much we cannot determine definitively about auctions and their subsequent performance. In these cases, it is important to look to experimental and empirical work to better understand how auctions for university intellectual property might perform. In this paper, for instance, we examined Penn State’s 2014 auctions for context. Further, since poorly performing auctions might result in substantial losses, bad publicity, and potential litigation, it is worthwhile to examine auction design issues before full implementation.\textsuperscript{121}

In short, the problems faced by auctions for university intellectual property are not substantially different than those dealt with in other domains. While university IP might require unique responses to some of these challenges, auctions should not be completely ruled out.

\textsuperscript{117} Id.
\textsuperscript{118} Id.
\textsuperscript{119} See, e.g., Peter Cramton et al., Introduction to Combinatorial Auctions, in COMBINATORIAL AUCTIONS 29, 30, 36 (Peter Cramton, Yoav Shoham & Richard Steinberg eds., 2006).
\textsuperscript{120} Meeting with Dr. Ron Huss, supra note 4.
\textsuperscript{121} To this end, the experimental economics laboratory is a useful bridge between abstract theories of auction performance and practical implementation; it allows interested parties to be more comfortable that the auction will perform as desired when actually put to the test. This approach has been particularly profitable in complex domains such as the Federal Communications Commission’s well-known electromagnetic spectrum auctions. See generally Charles R. Plott, Laboratory Experimental Testbeds: Application to the PCS Auction, 6 J. ECON. & MGMT. STRATEGY 605 (1997). Kagel and Roth provide a thorough (but dated) explanation of the many economics experiments related to auctions. Kagel, supra note 77, at 501–02.