

COMMENTARY ARTICLE

DIFFUSION PIPELINES: A NEW FRAMEWORK FOR PATENT LICENSING

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Abstract

The patent system is intended to incentivize research and development by granting inventors or patent holders exclusive rights for a limited amount of time in exchange for publicly disclosing information about their inventions. This has both advantages and disadvantages for the diffusion of the innovation process. Patent licensing is one of the tools that help to diffuse legal rights associated with patents. With the help of diffusion of innovations theory, variations of licensing agreements and network analysis, it is possible to create diffusion pipelines to maximize the diffusion of licensing rights while respecting interests of parties involved. Further research is needed however on various topics such as antitrust issues.

I. Introduction

A patent is a legal right given to the inventors to exclude others from practicing the patented invention for a limited period of time in exchange for disclosing the details of the invention to the public.¹ This exclusive right enables the inventor to control and commercialize the invention, such as through manufacturing, licensing, or selling the patented product or process. During the patent term, others are prohibited from making, using, selling, or importing the patented invention without the patent owner's permission. Once the patent expires, the invention becomes public domain, allowing anyone to use it without restriction.²

The patent system is set up in a way that is intended to encourage invention, innovation, and diffusion by giving the person behind the invention or innovation a competitive edge over imitators. In return for this, the inventor must publicly share information about the invention. There are pros and cons to the patent system, and many theories explain how the patent system affects innovation and economics. For example, some criticism of the patent system centers around the costs it imposes on society. This includes limitations on competition, monopolistic pricing, and high administrative and legal costs. There are also concerns that too many patents of low quality are granted in areas that hinder progress, such as in the software sector, and that the system is biased towards large companies in developed countries at the expense of small companies and developing nations. Critics argue that an overly strong patent system restricts not only static competition

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¹ AL Durham, *Patent Law Essentials: A Concise Guide* (Quorum Books 1999) 14 <<https://books.google.com.tr/books?id=nB82qr00DQ4C>>.

² AL Durham, *Patent Law Essentials: A Concise Guide* (Quorum Books 1999) 15 <<https://books.google.com.tr/books?id=nB82qr00DQ4C>>.

but also dynamic competition, which is competition based on innovation. While it is true that each individual patent right expires after 20 years, thereby lifting patent restrictions for third parties, the criticism is focused on the 20-year active period where such restrictions still apply.³

Diffusion of patent knowledge and rights should not have to be constrained to the information shared publicly by the inventor. Diffusion of innovations is important because industrial success in the long-term is affected by both static efficiency and the pace of technological advancements and because diffusion of innovations are a critical factor in determining the rate of technological progress. It provides economic incentives for research and development processes and increases the overall technological progress of the markets and society.⁴

The diffusion of patent knowledge and rights mainly occurs through three avenues: patent licensing, research joint ventures, and imitation. Patent licensing is a method of voluntarily spreading technology where the inventor benefits from increased usage of their invention which, in most cases, generates revenue. Research joint ventures allow for the sharing of research results prior to implementation, a form of pre-agreed licensing. Imitation is a way of diffusion that the patent holder has limited control over, where non-innovating companies appropriate some of the benefits of the invention.⁵

These avenues are certainly not the only possible avenues for diffusion of patent knowledge and rights. New tools and avenues, as well as combinations of old ones, could be created to diffuse innovations more efficiently. However, this cannot be done without getting help from other disciplines. Network analysis is one of those disciplines where legal scholars can take help from. Especially in diffusion studies, where relations between agents hold prime importance to quantify and observe diffusion process, network analysis helps scholars to understand the process of diffusion and it quantifies and visualizes the process itself.

This article examines various tools and systems used for diffusion of patent knowledge and rights with the help of network analysis. These tools and systems will be tested on an artificial group of vertices and edges, denoting a tiny market ecosystem and compared against the algorithms specific to the graph theory to see their mathematical efficiency.

II. Patent Law and Licensing

The four main justifications for having patents are fairness to the inventor, rewarding their innovations through exclusive property rights, providing an incentive for innovation, and fulfilling a social contract where the inventor is granted exclusive rights but must also publicly disclose the invention.⁶ These justifications have remained largely unchanged since the introduction of patents in the 19th century. The first justification is based on the idea that it is fair for the inventor to be rewarded for their work. The second justification, which is related to the first, is based on John Locke's theory of labor or natural rights. The third justification is to encourage innovation through incentives. Finally, the fourth justification is based on the idea that patent

³ Toshiko Takenaka, *Patent Law and Theory: A Handbook of Contemporary Research* (2009) 68.

⁴ Carl Shapiro, 'Patent Licensing and R & D Rivalry' (1985) 75 *The American Economic Review* 25, 1.

⁵ *ibid.*

⁶ Estelle Derclaye, 'Patent Law's Role in the Protection of the Environment: Re-Assessing Patent Law and Its Justifications in the 21st Century' (2009) 40 *International Review of Intellectual Property and Competition Law* 2.

law serves an informative function, with the inventor obtaining exclusive rights in exchange for publicly disclosing the invention in a way that can be understood and replicated by those skilled in the field.⁷

For the context of this article, Machlup & Penrose have two arguments that support aforementioned justifications.

These arguments for having patents center around the idea that industrial progress is desirable for society and that inventions and their exploitation are necessary to achieve this progress. To incentivize inventors and capitalists to invest their time and money, they need to have hope that their efforts will yield profits. Granting exclusive patent rights in inventions is the simplest, cheapest, and most effective way to hold out these incentives. At the same time, society also benefits from the public disclosure of new inventions so that they become widely known and part of the technology of society. This can be achieved by granting exclusive patent rights to the inventor in exchange for public disclosure of their invention. By doing so, society is able to prevent the loss of new technological ideas when an inventor keeps their invention secret and it dies with them.⁸

It could be argued, from a diffusion perspective, that the traditional patent system helps diffusion of patent knowledge. Information for patents is public so any researcher could easily reach the information that patents contain. However, it is necessary to commercially use the patents to see their effects and acquire feedback to solve many problems that could arise from the product that is patented which results in new innovation. Acquiring knowledge about patents while not having any right to commercially exercise said knowledge does little for this commercial feedback process.

Within the traditional patenting system however, there are tools such as various types of licensing agreements that could help the diffusion of the rights of the patent. Such diffusion could help the commercial feedback process to trigger new innovations.

Licensors, or those who own Intellectual Property Rights (IPR), may transfer certain rights to a licensee (buyer) through a licensing agreement. This agreement allows the licensee to make use of the IPR without the risk of infringing on the underlying IPR. The licensor has control over which rights are transferred and to what extent, and they can choose to grant exclusive or nonexclusive rights. Furthermore, they can decide whether or not the licensee has the right to sublicense the IPR to other parties. Licensing is a way for the licensor to benefit from the use of their IPR, while also maintaining control over its use, diffusion, and distribution.⁹

This should be done in a way that protects the interests of both the owner of the patent and the inventor, considering there are cases in which a person could be the inventor but not the owner of the patent. The process of diffusion of innovations through patent licensing should not become a zero-sum game where a profit for one party necessitates a loss for the other party. The rights and interests of the licensor should not be sacrificed in order to maximally diffuse the patent rights.

⁷ Estelle Derclaye, 'Patent Law's Role in the Protection of the Environment: Re-Assessing Patent Law and Its Justifications in the 21st Century' (2009) 40 *International Review of Intellectual Property and Competition Law* 3.

⁸ *ibid* 5.

⁹ Marcel Bogers, Rudi Bekkers and Ove Granstrand, 'Intellectual Property and Licensing Strategies in Open Collaborative Innovation' [2012] *Open Innovation in Firms and Public Administrations: Technologies for Value Creation* 41.

There are various types of licensing agreements that try to ensure diffusion of the specific patent's rights and try to create a consensus between parties in each particular situation.

The majority of licenses can be thought of as "modules" of individual licenses that can be put together to create more complex licensing structures. In the context of licensing, it is possible to benefit beyond the base case if the owner of the Intellectual Property Rights (IPR) allows the licensor to receive compensation from the licensee. Typically, this compensation is in the form of royalties, which is a fee for the licensee to use the licensor's knowledge in accordance with the licensing agreement. Depending on the situation, the licensor can grant an exclusive license to only one licensee, or alternatively grant a license to multiple licensees. These options can have significant implications for both the negotiations and the expected compensation. Possible restrictions that can be included in the agreement are prohibiting the licensee from sub-licensing, reselling, and/or limiting the geographical area, field of application, or mode of commercialization. In addition, an exclusive right may be given for a limited period of time.¹⁰

Two parties that are interested in each other's knowledge and have IPRs portfolios of interest to one another may agree to a cross-license arrangement. This agreement involves each party granting the other a package or bundle of licenses as compensation. An important strategic decision in this context is whether the licensee is allowed to sub-license, meaning they can grant licenses (to the licensed technology) to third parties. This decision is based on what the licensor wishes to achieve. For example, if the owner of an IPR is not able to fully exploit a technology, they may grant an exclusive license to a licensee that will commercialize the technology. In order for the licensee to appropriately exploit the technology, sub-licensing may be part of the agreement. This strategic decision enables the main licensor to benefit from their technology even if they do not have the resources to internally commercialize it.¹¹

It is important to realize that, as shown above; patent licensing is not a static, unchangeable agreement type. Notions of exclusivity, sub-licensing being allowed or not, cross-licensing, patent pooling and so on could be used in a variety of combinations that would suit the aim of the parties. One can assume that diffusion of innovations benefit companies and indirectly, society as a whole. From that assumption, one can build licensing structures that satisfy the interests of the parties of a contract. In this context, innovation is represented by patent rights and knowledge. Efficiency here could be explained with the highest number of corporate entities.

Before quantifying this process, it is important to explain what exactly the "diffusion of innovations" means in detail and try to explain what patents mean from the lenses of diffusion of innovations theory.

III. Diffusion of Innovations

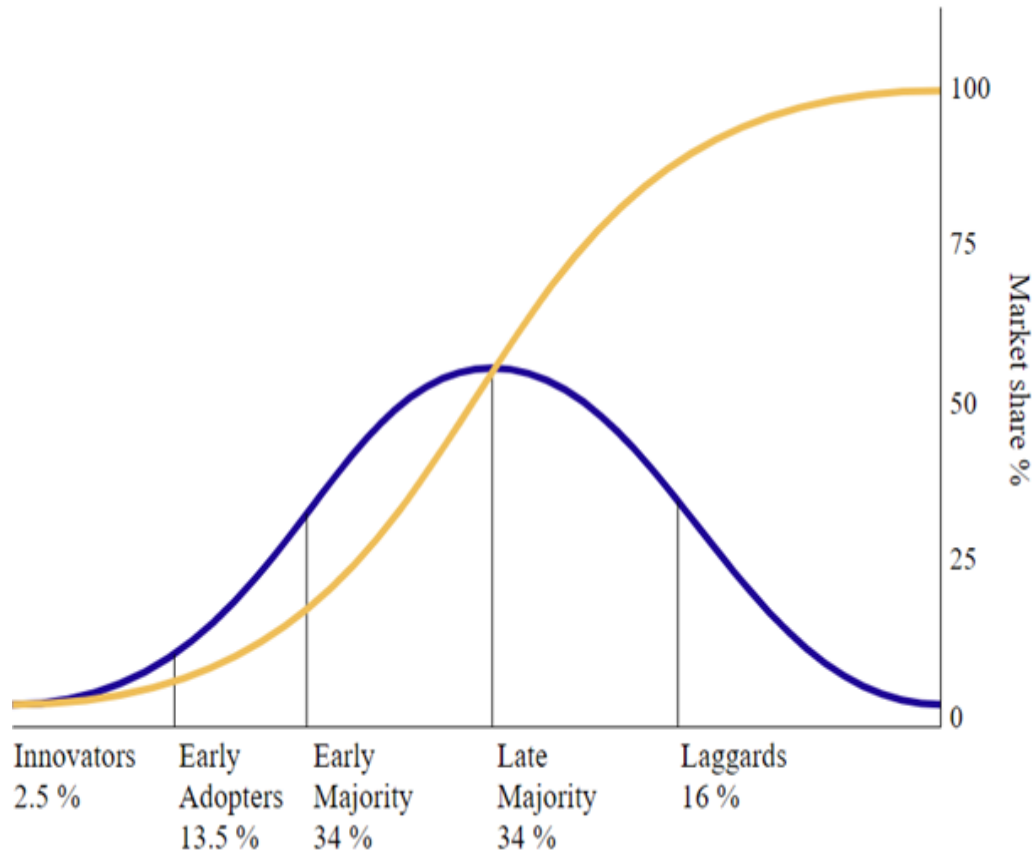
An innovation refers to an idea, a way of doing things, or a physical object, that is seen as novel by individuals or groups. Diffusion is the way that this innovation is spread through various communication channels over time among members of a social group. This type of communication is unique because it involves the sharing of a new idea or a concept. As a result, there is a certain degree of uncertainty and perceived risk involved in the diffusion process. However, by obtaining information, individuals can reduce this uncertainty. In this

¹⁰ *ibid* 42.

¹¹ *ibid* 43.

context, information is defined as a change in energy or matter that impacts our level of uncertainty when faced with a decision between various options.¹²

Figure 1: Diffusion of Innovations (Rogers, 2003)



Diffusion of innovations theory assumes that a population can be divided into five segments based on their willingness to adopt new innovations. These segments include innovators, early adopters, early majority, late majority, and laggards, each having a distinct attitude towards the specific innovation at hand. It's important to note that individuals do not shift from one segment to another in this formula. Successful diffusion of an innovation can be measured by how well it responds to feedback from each group.

Rogers identified several key characteristics of innovators and early adopters. Innovators are described as venturesome individuals who have a desire for risk-taking, control over substantial financial resources, the ability to understand and apply complex technical knowledge, and the capacity to handle high levels of uncertainty. Early adopters, on the other hand, are well-integrated members of the local social system and are viewed as opinion leaders, serving as role models for others. They are also respected by their peers and are considered to be successful. These characteristics play an important role in determining the likelihood of individuals in these segments adopting new innovations.¹³

¹²EM Rogers, *Diffusion of Innovations, 5th Edition* (Free Press 2003) 41 <<https://books.google.com.tr/books?id=9U1K5LjUOwEC>>.

¹³ Marianne S Horner and W Emerson, 'Diffusion of Innovation Theory' (1998) 20 Retrieved January 2012, 2.

In the patent licensing framework, licensors generally fall in the early adopter category. As they have the ownership of the patent and in most cases registered the patent themselves. Patent application and patent registration processes are time and money consuming. Therefore, they require some sort of investment from the applicant. So all of the patent applicants, disregarding the success of the application process, are either innovators who created the innovation or the business owner who was willing to trust in the product of employee innovators to invest resources to apply for patent registration.

According to Rogers, the early majority interacts frequently with peers and does not hold positions of opinion leadership. This segment constitutes one-third of the population and is the largest among the adopter categories. The early majority tends to deliberate before adopting new ideas.

On the other hand, the late majority, also one-third of the population, adopts new innovations under pressure from peers or out of economic necessity. This segment is generally skeptical and cautious in their approach to new ideas. The laggards, who possess no opinion leadership and tend to isolate themselves, have a point of reference in the past and are suspicious of innovations. The process of adopting new ideas is lengthy for this segment, and they typically have limited resources. These characteristics are key to understanding the behavior and likelihood of individuals in each of these adopter categories to adopt new innovations.¹⁴

These groups of people are mostly non-existent at innovation schemes altogether. In order to get into a negotiation about patent licensing or some sort of other patent related relationship, one should be more “open” to the innovation related to the patent in question. Therefore, it could be said that laggards and the late majority do not get involved in patent licensing. It is very likely that by the time the late majority is pressured to get involved in the said technology, patent rights would expire and the said patent would be open to public use.

There are many topics to explain within the diffusion of innovations studies. While not all of them are within the scope of this article, some shall be explained below. Licensing is a dynamic method of allocating a specific legal right from one agent to another, without exhausting the rights of the former (though it could be limited as explained before). Therefore, licensing diffuses the object of the agreement. The characteristics of an object can impact the structure of licensing agreements and the diffusion process. One such characteristic is tangibility, which can play a significant role in shaping licensing agreements and determining the most effective strategies for diffusion.

One of the main advantages of intellectual property over tangible property is that tangible property, as it is an actual object within space and time, is limited. It has a limited energy and matter to be spent and it is subject to entropy overtime.

However, intellectual property is an abstraction of the “thing” that is aimed to be protected. The recorder is not subject to intellectual property but the music is. Same example could be given to the paper, markers and the drawing as well. Intellectual property could be copied and used ad-infinitum theoretically. Of course, there are advantages and disadvantages to this feature.

¹⁴ ibid 3.

Still, it could be said that this feature helps the diffusion of intellectual properties. One specific patent, with licensing, could be diffused *ad infinitum*. Such is the case for open licensing. But it is impossible to do that with a television for example. Even if the perfect conditions were ensured, entropy itself would render the television useless in time. In conclusion, this specific feature of intellectual properties makes them very open to various possibilities of them being diffused through particular networks. If one would prepare the ripe conditions for an intellectual property right to diffuse, namely specific network conditions that are crafted to ensure diffusion, one would not have to care for the problems of logistics one normally cares for with any tangible property.

IV. Network Analysis of Patent Licensing

Network analysis in legal studies is certainly not new.¹⁵ There have been many attempts to graphically represent various topics within intellectual property law.¹⁶ So this author can – and should – say that he is “standing on the shoulders of giants”.¹⁷

Patent licensing is an ideal domain for network analysis and graph representations, given the intricate relationships that exist between patent owners, licensees, and sub-licensees. These relationships can be visualized and analyzed through graph representation, enabling a comprehensive view of the flow of licenses and sub-licenses. This approach sheds light on the patterns and connections in the licensing network, such as the key players, the concentration of licenses in specific regions, and the transfer of licenses between actors. Additionally, network analysis affords a deeper understanding of the dynamics of the licensing market and the consequences of licensing decisions on the wider innovation system. Thus, patent licensing presents a rich domain for network analysis and graph representations, offering a valuable tool for comprehending the complex relationships and dynamics at play in this market.

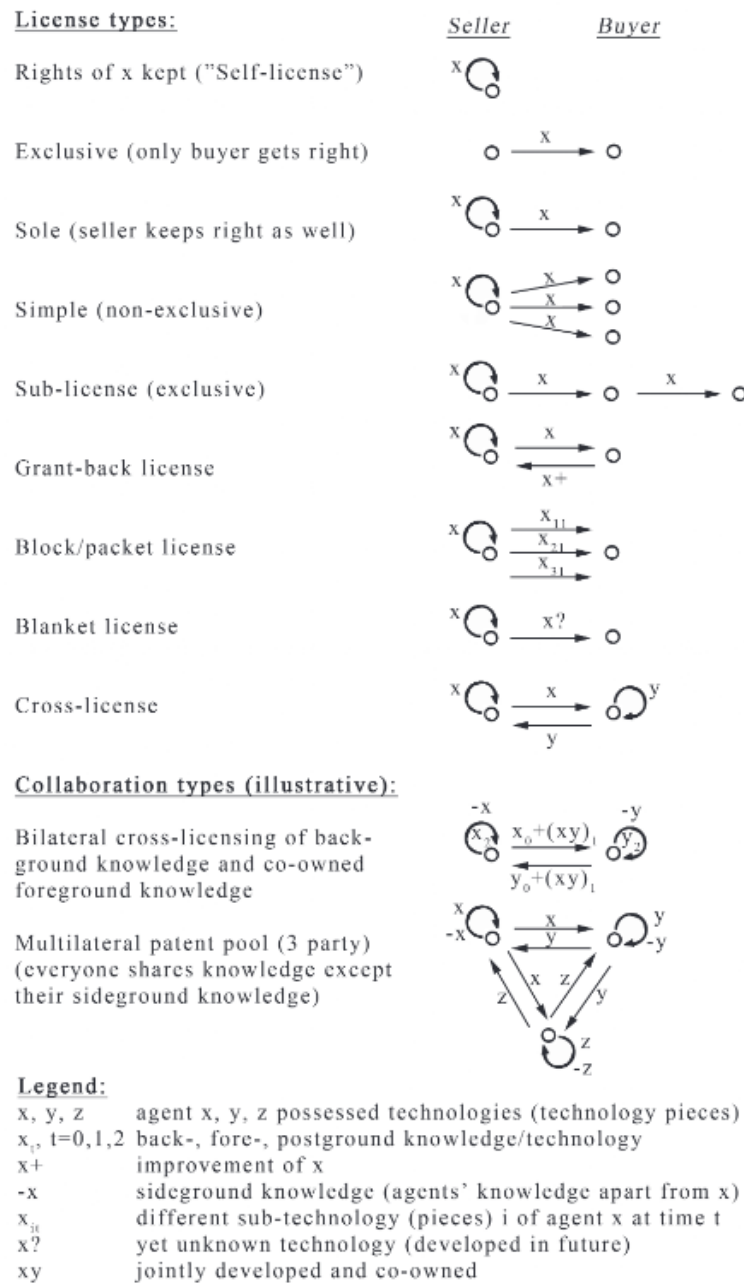
One of the main points the author aims to convey to the reader is that, as mentioned above, one should not think of different licensing agreements and strategies as static agreements that are unchangeable in their elements. Rather, they are building blocks for establishing diffusion “pipelines” for licensing of patents or relevant intellectual property rights to various actors while respecting the interests and intellectual property rights of parties involved. This may seem like a daunting task but nevertheless it could be done. But in order to create diffusion pipelines for intellectual property rights, one should understand the building blocks, the traditional licensing agreements which could be visualized and represented as follows:

¹⁵ Daniel Katz and Derek Stafford, ‘Hustle and Flow: A Social Network Analysis of the American Federal Judiciary’ (2008) 71 Ohio State Law J.; Daniel Katz and others, ‘Reproduction of Hierarchy? A Social Network Analysis of the American Law Professoriate’ (2009) 61 Journal of Legal Education; Rupali Wagh and D Anand, *Application of Citation Network Analysis for Improved Similarity Index Estimation of Legal Case Documents : A Study* (2017).

¹⁶ Shinto Teramoto and Paulius Jurcys, ‘Intermediaries, Trust and Efficiency of Communication: A Social Network Perspective’; Shinto Teramoto, Desrezka Larasati and Paulius Jurcys, ‘Diversity of Distributed Music and Modern Telecommunication Technologies: A Network Perspective’ (2014) 4 Kyushu University Legal Research Bulletin.

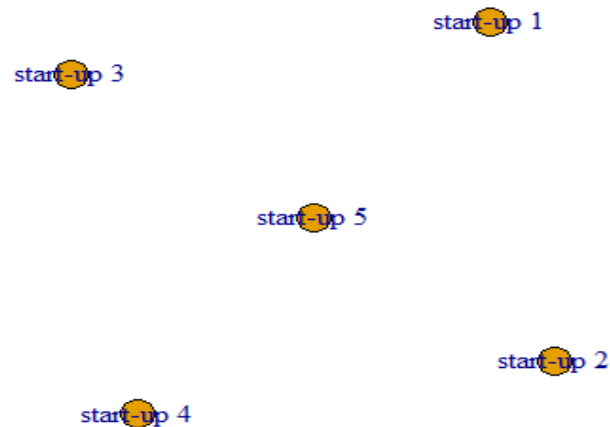
¹⁷ See Isaac Newton’s letter to Robert Hooke

Figure 2: Types of licenses in open collaborative innovation (Bogers et al., 2012)



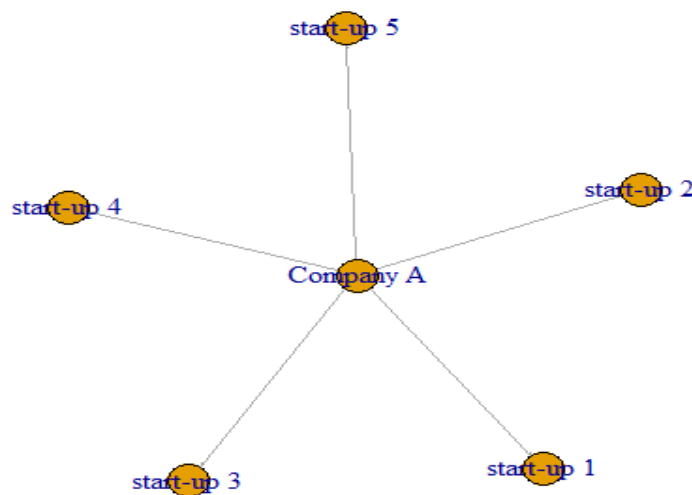
This example includes collaboration types too, which is not in the scope of this article. However, license types illustrated at the beginning gives a clear idea of what the author meant with building blocks. Nodes will be denoting actors such as buyers or sellers, within a particular cluster of actors. Directed edges will show the licensing activity from buyer to seller.

Suppose there exist five start-ups (start-up 1, start-up 2, start-up 3, start-up 4, start-up 5), all of them work on a related technology and every one of them needs the licensing right of the same patent to commercially use it in their products and to develop new products.



And there exists a company “Company A” who holds the licensing rights of the said patent. Suppose that you, the reader, are a lawyer that is tasked to establish communication channels with Company A to create a licensing agreement(s) that ensures the said patent is licensed to the five start-ups mentioned above.

Of all the license types mentioned above, non-exclusive licensing and sub-licensing seems to be the most suitable for the task at hand. In the case of non-exclusive licensing, if Company A licenses its patent to the start-ups, it could look like this:

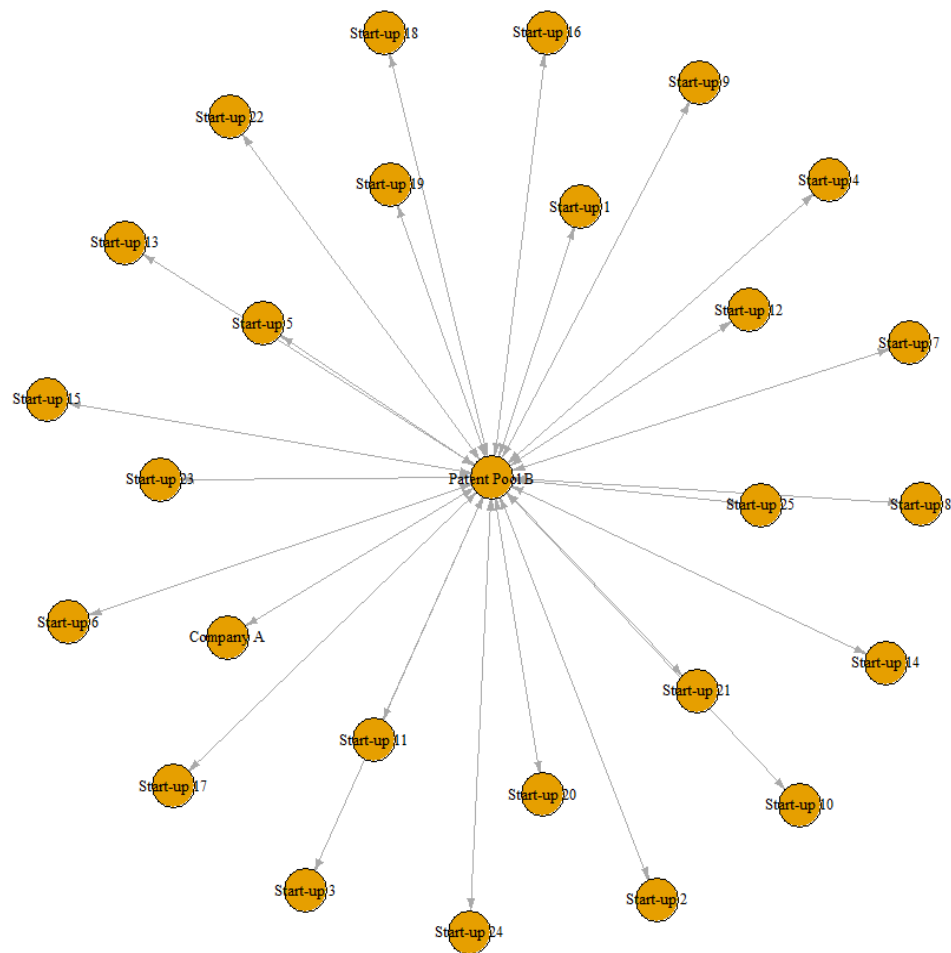


These examples are fairly simple and self-explanatory. But even in this example, there could be various complications. How could one craft such a contract that Company A would be willing to license its intellectual property, the patent, to five different enterprises that could compete with themselves in the future? Even if all the parties agree, what would this mean from the viewpoint of antitrust law?

In this example, assume that Company A is inefficient with the research and development process but has sufficient capital. And the start-ups are made up of brilliant individuals who have a track record of creating beneficial innovations for enterprises but lack the necessary licenses and capital in this case.

And what if there are twenty five enterprises instead of five? Surely handling the legal process with twenty five different enterprises would not be easy for Company A. In that case, a non-practicing entity, specializing as the legal intermediary and handling the legal processes between parties could take the role of patent pool. This entity would receive sub-licensing rights and it would sub-license the said patent to the enterprises and act within the borders of the contracts signed between all of the parties. Also, Company A is supposed to be inefficient with research and development. So Company A adds the clause that any patent produced from the patent that is licensed, as shown with citation to the original patent, must be licensed back to the company. In this way, start-ups are paying the price of the licensing with the resource they have in abundance: the ability to conduct research and development, not with actual capital which they lack compared to the established large enterprise such as Company A. Assume that this process is handled via Patent Pool B.

This relationship could be visualized as the following visualization:



These examples included only a few of the license types between a few types of actors. It is impossible to capture all of the possible relationships between different legal entities. Also, these examples should be accepted as proof-of-concept examples. Further research is needed on simulating more complex legal environments and researching the antitrust concerns of such diffusion pipelines.

V. Conclusion

Patent licensing and its sub-categories are suitable for network analysis as they include relational data. The current proof-of-concept models shown above demonstrate great potential for future studies. One could, for example, try to abstract the antitrust aspects of licensing agreements by denoting antitrust issues as centrality measures within a graph to detect the influence of certain nodes, companies, within a business ecosystem.

In many cases, antitrust issues accompany the patent licensing process. This will especially be true in diffusion pipelines as it includes multiple actors getting the license of the same patent. Diffusion pipelines will require careful considerations for antitrust issues, picking the relevant mathematical algorithm and crafting necessary contracts to satisfy parties involved. In this paradigm, licensing contracts will be merely building blocks for these pipelines. Lawyers who have acquainted themselves with mathematics will be needed to build these complex pipelines to ensure these systems will be efficient in helping various stakeholders to contribute to the innovation process.

Before concluding, the author would like to thank Prof. Shinto Teramoto for his guidance and contributions to the author's academic development.