Bioengineers as Patent Attorneys: Analysis of Bioengineer Involvement in the Patent Writing Process

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Abstract: This research focuses on the patent application as a medium for writing within the field of bioengineering. Patent applications are essential for bioengineers to protect their intellectual property, and the problem initially motivating this research is whether or not the University of California, Berkeley is sufficiently preparing bioengineering students to produce patent applications. Following a series of interviews, the topic of focus shifts towards whether or not the university *should* be preparing bioengineering students to write patent applications. Following further research through articles and other materials, it is concluded that, although engineers are not directly involved in the patent application process, classes should be incorporated into the curriculum to instruct students about the patent application writing process, among other subjects, so that there will be a mutual benefit for both bioengineers and patent lawyers.

Keywords: bioengineering, intellectual property, patent application, education system, university

1. Statement of Purpose

The purpose of this research report is to investigate the patent application process for bioengineers, determine how the education system at the University of California, Berkeley is currently preparing bioengineering students to produce patent documents, and discuss how the university can better prepare students for these endeavors.

2. Introduction

Patent applications are integral components of engineering because they allow engineers to prevent competing organizations from manufacturing and selling the engineer's patented product to the public.

However, there is a fundamental problem with patent applications and the way that they are taught to students at a university level. The problem that this research aims to address is the relative failure of the University of California, Berkeley education system to prepare bioengineering students to write patent applications during and following involvement at the university.

3. Rationale

This research was inspired by Bioengineering 10, a class offered by the University of California, Berkeley for bioengineers and those that are interested in learning more about the field of bioengineering. One topic of discussion that was emphasized in the progression of the class is the patent, which is a form of protection of intellectual property. The professor discussed the patent and some of its components, which spurred this research on the importance of patents and whether or not the education system at Berkeley is adequately preparing students to write patent applications within and beyond the university level.

The following research has a strong significance in the field of bioengineering because intellectual property and patents have a significant influence over the lives of bioengineers, granting them the right to exclude competing firms from the production and distribution of patented devices and bioengineered products. The protection an engineer has on their intellectual property can shape the way it is received by the public. As a result, being involved in the process of

writing the patent application can be beneficial to bioengineers, and discovering whether or not the university is providing students with the resources to produce patent applications is important to recognize.

4. Hypothesis

One hypothesis for this research suggests that the University of California, Berkeley, is inadequately preparing students to enter the industry and file patent applications, and that the university can implement a technical writing program to provide students with adequate instruction on how to write and file a patent application, among other documents.

5. Limitations

Despite the relatively straightforward nature of research on this topic, there are multiple limitations that accompany the following research:

First, the solution suggested by the research is by no means the only solution to this complex problem. Because each solution to the problem presented has different strengths and weaknesses, there is no correct answer and there are multiple interpretations of the research set forth in this document.

Second, the opinions of the interviewees in the interviews conducted do not necessarily reflect the attitudes or opinions of the bioengineering community. The wide variety of opinions people possess on the subject at hand implies that the opinions of the interviewees should not and do not represent the opinions of all bioengineers, which may slightly bias the research in a certain direction.

Additionally, the following research has been conducted from an outside perspective, meaning that the process of research has been performed without direct knowledge or involvement in research or industry thus far. Therefore, the results that are gathered might be slightly biased because the only insider perspectives reflected in this research are those of the interviewees and the article authors.

Finally, the attitudes and opinions presented by authors of journal articles referenced don't necessarily reflect the opinions of all practitioners within the field. Because the nature of the problem can produce many polarized perspectives and attitudes, this research may become slightly biased as a result.

6. Definitions

Intellectual property is an invention or creation based on a collection of original ideas, which can be protected through official documentation. There are four different documents that protect intellectual property, including patents, copyright, trademarks, and trade secrets. The research that follows focuses primarily on patents (Caseiro, 2000).

Patents are documents that provide the patent owner with the right to prevent other organizations from producing, marketing, and distributing their invention to the public. This right is provided for them by the United States Patent and Trademark Office, or USPTO, following an extensive application process, and the patent lasts for twenty years before generic versions of the device can be produced and sold to the public (Caseiro, 2000).

7. Background

The patent application process is very extensive and incorporates multiple steps, from the invention's inception to its incorporation as a patent.

Among the four forms of intellectual property, patents possess the most complex and wide-ranging systems to date. The types of inventions that can be patented include a procedure and a mechanism or apparatus that performs a certain function, among other patentable inventions. After determining the type of patent that can

apply to the invention, specifically utility, design, or plant patent, the first step is to file a provisional patent application to ensure that your intellectual property is not stolen by another organization looking to compete with yours. Filing a non-provisional patent application should occur within a year of filing the provisional patent application, because the provisional application expires if nothing is done after a year of its filing. The patent rights can be sold or traded to another organization if the inventor of the product so desires, but in general it is important to file the provisional patent application so as to ensure that the idea is not taken by a competing organization (Jacob, 2016).

There are some fundamental differences between the patent systems of the United States and those of other countries. The United States bases their patent system on the first-to-invent basis, which grants the rights of production and distribution to the organization or firm that originally invented the device. Most other countries have patent systems based on the first-to-file system, which grants production and distribution rights to the organization that is the first to file the patent application (Halford, 2005). Although the United States patent system is based on a first-to-invent basis, mistakes are made, and often times those that are first-to-invent are not the people that receive the rights to exclusion in the United States.

As an engineer, it is very important to take advantage of the patent application opportunities provided, as patents are often the main form of intellectual property protection against competing firms and organizations. According to research performed by Mark Crawford, which he adapted from researcher Russell J. Genet, the top two reasons why engineers fail to maintain the safety of their intellectual property are that they fail to look for patent protection for their idea or they reveal the patentable product to the public before they are able to even file a provisional patent application (Crawford, 2012). Crawford's research emphasizes the competitiveness of the field and the immense competition that bioengineers within the field are forced to deal with, and these reveal a fundamental problem within the patent system: are bioengineers at Berkeley being adequately taught how to produce patent applications in their field by the university so as to obtain a patent before competition can steal their ideas?

This problem that arises as a result of the competitiveness of the field of bioengineering is the problem that this research plans to address.

8. Methodology

The main source for the research performed was through interviews; specifically, with two esteemed interviewees: a bioengineering professor with some patent experience and a patent attorney with a background in both law and engineering. The results gathered from these sources provide the main foundation for analysis in the discussion.

The other sources that were utilized throughout the research process are journal articles from major engineering and law journals. A wide variety of material was gathered from these sources and used to support the discussion and the conclusion that is drawn.

In a select instance, a webcasted lecture given by the patent attorney being interviewed was used to provide background and context to the problem. The lecture not only solidifies this patent attorney's presence as a field practitioner, but it also provides an exclusive look into the perspective that the attorney has on patent applications in engineering.

9. Results

Two members of the engineering community agreed to meet and be interviewed regarding the

patent application process and the role of the engineer in this process (see APPENDIX I).

The first interviewee is Terry Johnson, a member of the University of California, Berkeley community and an associate teaching professor in bioengineering. The interview was conducted on December 6, 2017 at 3:30 pm in his personal office.

Professor Johnson has basic experience working with patents. He has worked with teams of engineers, scientists, and inventors to produce the research presented in patent applications.

The second interviewee is Shiraun Jacob, an electrical engineer and patent attorney under the Antero, Torrey & Petrin Intellectual Property Lawyers, based in San Francisco. The interview was conducted over the phone on December 9, 2017 at 6:30 pm. A personal interview could not be conducted because he was overseas on a personal trip.

Jacob has direct experience with patent applications, being that he is a patent lawyer and has both a degree in electrical engineering and a law degree, as well as a license to practice law.

The first question both interviewees were asked to answer was: how important are patents in the field of bioengineering? Both Johnson and Jacob responded that patents are very important in bioengineering because they provide protection for your intellectual property, which allows you to prevent others from producing and distributing your invention. Jacob further argued for their importance by describing how the field is centered around creating products to make the lives of others easier. He argued that the field of bioengineering has major potential for patentable content because it is a relatively new field and is filled with many unanswered questions.

The two interviewees' answers began to diverge when asked about when the patent application should be filed. Professor Johnson detailed that the time the patent application should be filed depends on the device that has been produced; it should be immediately filed if the device is being produced on a competitive plane and should have a patent pending status, whereas it should never be filed if the organization creating the device wants to maintain control over the production and distribution of the product for more than twenty years and keep it as a trade secret.

On the other hand, Jacob argued that the patent application should be filed immediately once the patentable device has been invented. He suggested that a provisional patent application is the route to follow in order to ensure that the inventor of the product has an opportunity to file a non-provisional patent application without the fear of idea-theft by a competing organization. He argued that this is especially important in bioengineering, given the competitive nature and novelty of the field.

The final question Professor Johnson was asked was: do you believe that, outside of a surface introduction to patents in Bioengineering 10, Berkeley is properly teaching students how to file a patent upon entering industry after graduation? His response shifted the foundation upon which this research was built. He stated that the field of bioengineering rarely overlaps with the field of law. As a result, most bioengineers are not and shouldn't necessarily be taught how to write a patent application, because the goal of patent writing is not to know how to write a patent, but rather, how to assemble a team and know what a patent actually is. In fact, he stated that most bioengineers and, in general, most people don't actually write and file their own patents; that is a job performed by patent lawyers and practitioners.

Based off of Professor Johnson's response to this question, Jacob was given a different set of questions to answer; specifically, how involved are engineers in the process of filing a patent application, and how could engineers become more involved in the process of filing a patent application?

In response to these questions, Jacob stated that the patent attorney working with the engineer on the patent application has extensive experience in engineering; as a result, they have a general knowledge of engineering and its different components. In the current system, the engineer explains to the patent attorney what the invention is, and the patent attorney is given an opportunity to ask the inventor a set of questions about the patentable invention. The inventor then gets to review the patent application once it is drafted by the patent attorney, and following this process, the document is filed for review. In terms of becoming more involved in this process, Jacob said that engineers should not get involved much beyond what he described because it is a very complicated process and the people that have been trained in patent applications should handle the majority of the work.

10. Discussion

From Professor Johnson's response to the final question, it can be inferred that bioengineers and engineers in general are not involved much in the process of writing the patent application. In fact, engineers are not directly involved at all in the process of writing the patent application, as they are the ones actually producing prototypes and performing research on the invention itself. Rather, it is the patent lawyer that takes the information provided to them by the engineer or inventor and synthesizes it into the patent application. In this respect, the engineer does not have any direct involvement in the production of the patent application, and the majority of the work is performed by the patent lawyer or patent attorney. This claim is also supported by the response from Jacob, in which he argued that the engineer works with the patent attorney or patent lawyer but the engineer is not directly involved in the process of writing the patent application. Further research into the role of the patent lawyer reveals that professional patent practitioners such as patent attorneys and patent lawyers have existed since the introduction of the patent examiner role in the USPTO, and these professional patent practitioners have been performing their job this way since their inception (Swanson, 2009).

This discovery completely alters the nature of this research because it is mainly concerned with analyzing *how well* the education system at the University of California, Berkeley is preparing Bioengineering students to produce patent applications both during and after involvement in the university, as well as what steps can be taken to improve this education system to incorporate these elements. However, based on the responses received from Professor Terry Johnson and Shiraun Jacob, engineers are not very involved in the patent application writing process. This claim can be further supported by research; Cathal Lane in his article "Intellectual property – why it matters to engineers" argues that an effective solution to protect an engineer's intellectual property is to enlist the help of a patent lawyer and sign a nondisclosure agreement to protect the patentable invention, rather than attempting to complete all the details of the patent application alone (Lane, 2014).

As a result, the research shifts from focusing on *how* the education system at the University of California, Berkeley is and could be preparing bioengineering students to produce patent applications to whether or not the university *should* be preparing students to produce patent applications during and after their involvement with the university. This shift in focus reflects the fickle nature of research and how research can shift in an instant.

To address the new focus of research, the first form of evidence presented are the direct words of both interviewees. Professor Johnson argues that bioengineering students should not be taught how to produce a patent application because Bioengineers are not law students and should focus on the research aspect of the invention rather than the legal aspect.

On a similar note, Jacob argues that engineers should not be directly involved in the process of writing the patent application, which directly implies that bioengineers and engineers in general do not and therefore should not need to learn how to produce a patent application or get more involved in the patent application process. He even argues that engineers should produce the research and leave the legal and writing portion of the patent application to those that are trained to work with them.

Evidently, some practitioners in the fields of bioengineering, electrical engineering, and patent law agree that bioengineering students should not necessarily have to learn how to produce a patent application. Of course, the opinions of those interviewed do not reflect the opinions of all field practitioners, but in general, these opinions can be applied to a large portion of this population.

However, further investigation into the subject of patents in bioengineering and biotechnology potentially constructs an opposing argument. According to Richard Levin in his article "A Patent System for the 21st Century", the United States patent system is experiencing great degrees of stress from the advent of biotechnology, a relatively new field. Levin argues that biotechnology, a component of bioengineering, is contributing to an imbalance in the number of patent applications being received and reviewed, as new innovation within the field causes new patent application submissions every day. He maintains that improving the adaptability of the patent system, allotting more resources for the USPTO, and unbiasing the system could provide the beginnings for a reformation of the current patent system (Levin, 2004).

Furthermore, Levin's point is supported by claims made by Sarah Chan and John Sulston in her article "Patents in synthetic biology may hinder future research and restrict access to innovation". Chan argues that the patent system is flawed in that it prevents communication between individuals within the creative workspace. Chan also argues that having too broad a scope when addressing the patent claims can inhibit progress, which is a direct result of patent application writing (Chan et al., 2010).

According to both interviewees, bioengineering students should not have to be taught how to produce patent applications because they are engineers and are not expected to know how to perform a patent lawyer's work. However, according to Levin and Chan, the current patent system is flawed and the advent of biotechnology is causing dramatic changes to the face of patent applications. Essentially, they are arguing that innovation in biotechnology, a new field in bioengineering, are catalyzing a shift in the current patent system and facilitating a need for a change in how patent applications are written and reviewed. This change in patent application writing and reviewing could also reflect a shift in the roles that engineers play when being involved in writing the patent application.

Based on the conflicting views presented by both the interviewees and field practitioners through interviews and articles, whether or not bioengineers and engineers in general should receive instruction on how to participate in the patent application process from university courses is very polarized. However, one solution to this contrast in opinion is an idea theorized by Professor Terry Johnson and extended in this research. He argued in his response to the final

question that, although bioengineering students should not necessarily be learning how to produce their own patent applications, they should at least have a basic knowledge of what a patent application is.

As a result, it can be determined that, although they should not be required to have a complete knowledge of how to produce a patent application, bioengineers should at least have a basic knowledge of what they are and what the different components are. One solution that can be drawn based on this conclusion is to incorporate one to two classes on technical writing and writing in industry into the Berkeley bioengineering curriculum, where the patent application could be discussed among other topics. The introduction of these classes would benefit engineers by allowing them to understand more about protecting their intellectual property. The classes would further benefit patent lawyers and patent attorneys by reducing the amount of work placed on them to explain the patent application process to engineers. The mutual benefit that both groups would receive could improve the patent system as a result. As a disclaimer, the classes above apply to the University of California, Berkeley, not necessarily to other universities.

11. Conclusion

Patent applications are essential documents for bioengineers, both during and after receiving an education. They are the first step to receiving the right to prevent other organizations from producing, marketing, or distributing the patented product to the public.

However, based on the results gathered from interviews, engineers are not directly involved in the process of producing the patent application, which completely shifted the focus of the research to analyzing whether or not the education system at the University of California, Berkeley *should* be preparing students to produce patent applications both during and after university education. The conclusion drawn is that bioengineering students at Berkeley should have at least a basic understanding of the patent application and its components, and one solution based on this conclusion is to incorporate one to two technology and industry writing classes into the Berkeley bioengineering curriculum to teach students the value of protecting intellectual property with patents, among other subjects.

The conclusions drawn by this research have great relevance to the education system of both the University of California, Berkeley and other universities across the nation. By incorporating these classes into the curriculum, both students and patent attorneys would mutually benefit and students in bioengineering would be more well-informed on the patent application process. Because patents and patent applications have a strong presence and importance in the lives of engineers, these classes could be a beneficial addition to the education system at any university.

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APPENDIX I: INTERVIEWS

Interviewee: Terry Johnson
Date of interview: 6 December 2017
Time of interview: 3:30 pm
Questions:

1. How important are patents in the field of bioengineering?
    a. Patents are very important in the field of bioengineering.
2. What experiences have you had dealing with patents, including writing and submission?
        i. Patent writing is a team process: you are one person on a team of engineers and inventors. You work with your team and the office of technology and licensing, and the faculty advisor does most of the work dealing with patents.
3. How soon should a patent be formed?
    a. How soon a patent should be disclosed depends on what the patent is for.
        i. Immediately: if you want to be put in a patent pending status (for example, to boost credibility), then immediately is the best option.
        ii. Never: if you want to maintain control over the process for more than 20 years, keeping the invention as a trade secret is the way to go.
        iii. Overall, when a patent application is filed depends on the goals for the invention and the strategies implemented.
4. Would you care to elaborate on those processes and how they are performed?
    a. One process that is performed when submitting a patent application is to show that the idea is functional.
    b. Making claims is a very important component of the process as well. Lawyers enter the stage at this point of the process, in order to make the claims as broad as possible so they overlap all the different forms the device can take, and not too narrow, in order to avoid people working their way around the patent itself to produce the same device.
5. Do you have any conventions or techniques that you implement to increase the likelihood of your patent being approved?
    a. Working with lawyers and working with people that know their way around patents is a good way to get the patent approved.
6. Do you believe that, outside of a surface introduction to what a patent is in Bioengineering 10, the University of California, Berkeley is properly teaching students how to file a patent upon entering industry after graduation?
    a. In terms of all disciplines, many people outside of the education system should know about copyrights and trademarks, not necessarily patents.
    b. However, because bioengineering is not law, most Bioengineers are not and should not necessarily be taught all the facets of patent writing.
    c. The goal of bioengineering and patent writing is not necessarily to know or teach how to write a patent, but rather to know when to assemble a team and to know what a patent actually is.
        i. Most people don't actually write their own patents.

Interview 2: Shiraun Jacob
Date of interview: 9 December 2017
Time of interview: 6:30 pm
Questions:

1. How important are patents in the field of bioengineering and engineering in general?
    a. Patents in bioengineering are very important; bioengineering is essentially creating products to make people's lives easier; some patents in certain types of engineering are more common than others.
    b. bioengineering has huge potential for patentability because it is much newer and is filled with many unanswered questions.
2. What is your personal experience with patents?
    a. He is a patent lawyer and possesses a license to practice law; he attended law school, and attained his degree in electrical engineering.
3. When should a patent application be filed following the production of the patentable device, process, etc.?
    a. First, it is good to file a provisional patent application, which is relatively inexpensive; it doesn't give you any rights, but gives you a chance to receive the patent.
    b. If you don't file within a year after that, you lose the rights to file the patent application.
    c. Therefore, it is good to file it as soon as you have a working prototype.
    d. If somebody files their patent before you even if you invented it, you lose that chance.
    e. Filing early is important in bioengineering because of the advent of biotechnology.
4. Are there any conventions that you or another person you know have implemented to better ensure that your patent is accepted by the USPTO?
    a. Could not be answered.
5. How involved are engineers in the process of filing a patent application?
    a. The patent attorney was also an engineer, and the company is the organization that works on the patent itself, not the engineer,
    b. The engineer explains the invention to the patent attorney, and the attorney will ask questions about the patent during the inventor interview
    c. The inventor reviews the patent application once it is drafted (with the figures that they have created). The inventor then gets to approve it or send it back to be rewritten.
6. How could engineers get more involved in the process of filing a patent application?
    a. Engineers should not get involved more than what has just been mentioned because it is too complicated to deal with.
    b. It is a better idea to have the people that have the training deal with the process.