

Bindings to Business: A Look into Technical Transfer in the University Setting

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Abstract

Technology Transfer offers an opportunity for universities to commercialize IP generated on their campuses. This MQP examines a ski binding technology developed at WPI as a case study to understand the university tech transfer system from the perspective of the inventors, Tech Transfer Office, and university. Recommendations include increasing commercial focus, understanding opportunity cost of tech transfer, and improving communication between the inventors, Tech Transfer Office, and university in order to create a prosperous union of innovation between these stakeholders.

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Glossary

BOS: Blue Ocean Strategy.

CA: Customer Attributes are one of the parameters of Axiomatic Design that takes into account the end user.

DIN Scale: Deutsches Institut für Normung. A visual indicator scale for ski bindings based on a person's height, weight, boot size and type, and skill level.

DP: Design Parameters, are another parameter of Axiomatic Design that explain how each aspect of the design will be achieved.

FR: Function Requirements are parameters of Axiomatic design that display what the design needs to do in order to be successful.

IP: Intellectual Property.

IPI Office: Intellectual Property and Innovation Office. The Tech Transfer Office at WPI.

Mass MEP: The Mass MEP (Manufacturing Extension Partnership) an organization that promotes manufacturing and business growth in Massachusetts.

MIT: Massachusetts Institute of Technology

MQP: Major Qualifying Project, typically completed by seniors as the major intensive project that is a mandatory requirement for graduation.

PV: Process Variables are a parameter of Axiomatic Design that detail the manufacturing process of the design.

SIA: SnowSports Industries of America: The national not-for-profit, North American member-owned trade association representing the winter sports industry.

STEM: Science, Technology, Engineering, and Math fields.

TAN: Tech Advisors Network is a network that provides advising and networking services in order to support innovators and entrepreneurs.

Tech Transfer: Technical Transfer is the process by which intellectual property become commercialized.

TVM: Time Value of Money: The visual of monetary values graphed over time to show the length of time before a return on investment.

USPTO: United States Patent and Trademark Office. The government office in charge of Intellectual Property protection and documentation.

WPI: Worcester Polytechnic Institute.

Chapter 1: Introduction to Tech Transfer

1.1: The Tech Transfer Process

The Tech Transfer system at WPI is the process by which Intellectual Property (IP) from a student and/or faculty member follows from an idea to commercialization. There are two primary stakeholders in this process, the inventors and the WPI Intellectual Property and Innovation Office (IPI). For this MQP, it is assumed that inventors can be students, professors, or a combination of the two.

According to current IPI policy, any inventor that uses WPI resources (i.e. labs, internet, faculty advisement, or software) is mandated to go through the IPI Office in order to commercialize their IP. This is how initial contact between the inventors and the office is made, and a partnership is formed.

The IPI Office works together with WPI and any member of the WPI community who wishes commercialize their IP. The commercialization of IP can result in different avenues, such as a copyright or creating a startup, but for this project, it is assumed that the intent of the technology going through the Tech Transfer system is to result in a patent. A patent, as defined by the United States Patent Office (USPTO), is “the grant of property right to the inventor, issued by the USPTO. The right conferred by the patent grant is, "the right to exclude others from making, using, offering for sale, selling the invention in the United States, or “importing” the invention into the United States. What is granted is not the right to make, use, offer for sale, sell or import, but the right to exclude others from making, using, offering for sale, selling or importing the invention.” These patents are filed in collaboration with the IPI Office through the USPTO in order to gain intellectual property protection, as well as to receive assistance

commercializing and monetizing their products (Keiller, 2014). In order for the inventors to gain this protection and assistance, they must go through a number of steps in order to officially gain a patent through WPI.

1.1.1: The Patent Process

Before any of the Tech Transfer process begins, it is important that the inventors perform prior research on both their personal IP, called a prior art search, and the industry in which they want to commercialize. It is important that the inventors come to the Tech Transfer Office with a rough idea of what their potential business plan is, and an idea of how their IP can be commercialized. This information better inform the IPI Office and allow them to more effectively begin the commercialization process.

The next step is to have the inventors fill out a public disclosure form in order to make their idea available to WPI. After the idea has been publicly disclosed to the university, the office will then immediately file for a provisional utility patent (also known as a provisional patent). This immediate filing is due to the change of U.S. Patent Law from first to invent to first to file. A provisional patent is meant to be an inexpensive way for inventors to establish a U.S. filing date for their invention. This provisional patent will act as a “placeholder” for a non-provisional utility patent (also known as a utility patent). The provisional patent has a pendency lasting up to one year from the date it is filed, and under no circumstances can this pendency be extended beyond the one year time period. This would allow the office and inventors time to pull together the necessary materials needed to file for the utility patent. The cost the IPI Office incurs for filing a provisional patent is approximately \$650 dollars, which is filed through partnerships they have with one of four different law firms (Keiller, 2014).

In its present version, the IP policy in the WPI IPI Office is dependent on whether or not WPI resources were used. For an invention made by students, on their own timeline, with their own facilities and resources, the student must sign an agreement providing the student will give 10% of net future gains of the patent to WPI, provided they will absorb all costs of pursuing the patent. Alternatively, if the student wishes for WPI to absorb costs of pursuing the patent, the inventors and WPI will split royalties based on a 40%:60% basis. For an invention made by students while employed on a WPI sponsored project, the invention is owned by WPI, subject to other agreements, and they will share royalties on a 50%:50% basis (Intellectual Property Policy, 1996).

Upon filing the provisional patent, the IPI Office will then perform a prior art search to see if there are currently any patents in circulation that might resemble the one the inventors are trying to file. If there are any filed patents that resemble this patent idea, the inventors will have to make alterations so that it does not infringe upon any filed patents. In some situations this may also lead to abandoning the filing process altogether, if it is discovered that the technology cannot be accomplished without infringing on a prior patent. If there are no patents that resemble the current patent idea, then the inventors can elect to move forward with the office and file a utility patent.

A utility patent is the full-length patent that will be reviewed by an official patent examiner from the USPTO. This examiner will determine whether the IP meets the requirements of being issued as a legitimate patent. This type of patent is more complex and extensive than the provisional patent and costs approximately \$10-12 thousand dollars. Upon the approval of a utility patent, the IPI Office and inventors must decide whether it is worthwhile to file for patent protection in different countries. This can be a very time consuming and costly endeavor. Filing

for a patent in other countries requires that the patent be translated into different languages, which can cost upwards of \$200 thousand dollars (Provisional Application for Patent, 2014). However, depending on the potential for commercialization, patenting in other countries may be critical to the success of the venture.

1.1.2: Post Patent Process

Once the patent filing process is complete, it is time for the office and inventors to begin the Technology Transfer (A.K.A. Tech Transfer) portion of the process. The first step is to decide on the optimal business model to commercialize their idea. These business models could include a startup, license, joint venture, etc. However, in most cases universities really make a push to have technology licensed or inventors join a joint venture, as it involves no creation of infrastructure. Universities generally do not have the resources available to pursue or “spin-off” a product or service into a startup, and therefore are typically risk averse to startups.

If they choose to license or seek a joint venture for the technology, then the logical next step is to try and find a company that will be willing to partner with the school and inventors. This is going to involve networking and establishing relationships with various companies. Once relationships are established, the inventors and the office will have to convince the company that the technology is worth investing in. On the other hand, if the inventors decides they want to form a startup from their technology, then the rational next step for them and the office will be to try and establish what is needed to prepare that startup.

1.2: The Ski Binding Technology

1.2.1: Ski Bindings

The Oxford Dictionaries (2014) define a ski binding as “a mechanical device fixed to a ski to grip a ski boot used for downhill skiing that holds the toe and heel of the boot and releases

it automatically in a fall”. The function and purpose of a ski binding is to redirect all movements and pressures placed on the ski boots directly to the skis. Ski bindings are meant to serve as the primary, and major safety feature on skis themselves, and protect against lower body injuries that can happen to skiers. There are many different types of bindings, the step-in option being most common, all of which are meant to detach the skier from their skis in the event of a fall.

The way that bindings are intended to work is when a predetermined amount of force is reached on the ski binding, the toe and heel will be released from the binding, causing the ski to detach from the skier, in order to prevent injury. Typically, the toe allows for sideways release, while the heel allows upward release. A visual indicator scale predetermines the amount of force necessary for the binding to release. The most commonly used scale is the German standard, known as the Deutsches Institut für Normung, or DIN scale. This DIN scale, like other visual indicator scales, is determined by the person’s height, weight, boot length and type, and skill level. Although there are similar American standards for ski binding release scales, the German market is the largest, and therefore used most commonly when purchasing ski bindings (Brown, 2014 & ABC-of-Skiing, 2012).



Figure 1: Example of a Ski Binding Releasing from the Ski Binding Plate

The primary reason that ski bindings release the ski from the boot is to prevent injury to the skier. When forces that exceed the predetermined levels allowed by the ski binding occur, the binding will release. These forces typically occur when there is a twisting or rotation of the ski boot out of alignment with the toe of the ski. The release of the ski from the boot is needed when the skier falls to prevent injury. However, when the forces on the binding exceed the predetermined threshold due to normal ski motions that mimic potentially injurious ones, the ski binding can release. This undesirable release of the ski from the ski boot is known as an “inadvertent release”. Inadvertent releases are a common problem encountered by both experienced and competitive skiers. This premature release has caused many injuries, as it causes the skier to fall while they were still in control. It is not an uncommon practice for experienced skiers to try to increase the binding release forces, in order to try to avoid this unwanted release (Madura, 2014 & Brown & Madura, 2013).

1.2.2: Ski Binding Heel

The ski binding technology referenced in this MQP report was invented by Professor Christopher Brown and his student Mr. John Madura. The technology, which is referred to as the

ski-binding heel, is an auxiliary technology that was designed with the intent to decrease the chances of inadvertent release (Madura, 2014).

What the ski binding heel technology developed by Brown and Madura does to prevent inadvertent release, is absorb some of the forces, known as “chattering”, caused by rough or icy terrain with a spring located towards the heel of the boot. This binding, like traditional ski bindings, has a predetermined threshold of permissible forces. If that threshold were exceeded, the binding will release. However, with this new ski-binding heel, a spring will allow the threshold to be higher without being dangerous to the skier (Brown & Madura, 2013).

There are three possible ways that this binding can be manufactured. Firstly, it can have a tensioned appliance for the spring. Secondly, the spring-loaded member may pivot away from the boot heel on an axis perpendicular to the boot heel movement. Lastly, the configuration could include a guide pin and receptacle so the movement of the spring can be focused along the axis of the guide pin (Madura, 2014 & Brown & Madura, 2013).

1.3: Overview of the Situation

This invention was filed for a provisional patent through the WPI IPI Office in December of 2013. Due to the University’s policy and the fact that Mr. Madura used WPI resources and was aided by Professor Brown, this technology per WPI IP policy had to be patented through the IPI Office. Per the agreement with the office, WPI owns 60%, Professor Brown owns 20%, and Mr. John Madura owns 20% of the patent (Madura, 2014).

The main goal of the two inventors of this technology had always been to license it to a ski-binding manufacturer. Some possible commercial license options include Atomic Snow Sports, Tyrollia Bindings, Marker Bindings, Howell Ski Bindings, Look Ski Bindings, Line Ski Bindings, and Salomon Ski Bindings. The reason that it would make more sense to license this

technology, as opposed to starting its own company, is that this technology is an add-on to an existing binding design. Due to the fact that it is an addition, it cannot stand-alone in the market, and therefore licensing this technology would be the optimal option (Brown & Madura, 2013).

1.3.1: Obstacles Faced

If introduced to market, the ski binding heel technology would be an add-on to current bindings that would reduce injury due to inadvertent release. There is currently nothing quite like this technology in the market, and it can be used across the Alpine Ski sector. Even though advanced skiers or those who race would most likely use it, the ski-binding heel technology can also be useful to the average skier. However, the chance of a big-name ski manufacturer taking a financial risk on this technology seems unlikely. According to Professor Brown, “the ski companies of yesteryear were owned by the Vermont mountain man who made the equipment for the love of the sport. That is no longer the case. There has been a tremendous transformation from small companies appealing to a niche market, to larger, risk-averse corporate conglomerates that would rather spend \$1 million on advertising than on the R&D required to create new technology” (Madura, 2014 & Brown, 2014).

An example of the SnowSports Market appearing risk averse to innovations is the case of Dodge Ski Boots. This Ski Boot is unlike any other in the market, as it takes advantage of the new material, carbon fiber, which allows the same flex, no matter the temperature, and also allows the skier to glide back and forth with ease and an ultra-lightweight feel. Yet, despite going to trade shows and even having celebrity racer endorsements, Dodge has been unable to find a company to invest. Dodge is currently located in Vermont, and manufacturers their carbon fiber boots in small batches to sell over the internet. (Brown, 2014 & Dodge Carbon Fiber Ski Boots, 2014)

1.4: Current State of the IP

Currently, this technology has come to an impasse. The university's decision on the technology is that it will not look to file a utility patent on this technology because they believe that it will ultimately not be a beneficial venture. In the one year provisional patent time period, the IPI Office has contacted at least one manufacturer about this technology. However, no partnerships were established and there was no significant progress made to form a license (Madura, 2014 & Brown, 2014). In December of 2014, the provisional patent expired, and there was no utility patent filed. The right to the technology was handed back to the inventors at that time, and they are now no longer legally tied to the university for this IP (Keiller, 2014).

1.5: Could the Outcome Have Been Different?

In our project, various aspects surrounding technology transfer and commercialization of IP were explored. The considerations of the inventors and external forces could have, in retrospect, had a different impact and brought about different results or decisions made. Many of the issues that led to stalls in the process come down to simple miscommunication, or misunderstanding of the responsibilities between the inventors and the IPI Office. Issues in these realms were greatly brought upon by a "dual mystification". This is the idea that both parties felt that the other party was doing, or not doing certain things, and neither followed up with the other to monitor any progress.

Additionally, the nature of current patent law encourages inventors and financiers alike to jump into patents and litigation, hoping to protect their IP before someone else files the same idea (General Information Concerning patents, 2014). However, in a university setting this sometimes means that the inventors do not have adequate time to fully develop the business venture and assess its commercial potential. It would be ideal to have clearer goals and aims for the university's pursuits and deeper considerations into the market potential, the barriers to entry,

the strategy to monetize IP, and the competition that will be encountered before the filing process occurs.

WPI has made a commitment to becoming a premier innovation and entrepreneurship university in the country. The aim of this MQP, through interviews and research, is to assist WPI in this endeavor by outlining and indicating particular findings and improvements to better equip students, faculty, and the WPI community to commercialize their ideas through WPI Tech Transfer.

Chapter 2: Tech Transfer in University Setting

2.1: Tech Transfer at WPI

In Chapter 1, Tech Transfer and the general steps that must be taken in order to commercialize technology in a university setting were outlined. In this chapter, the Tech Transfer process at WPI is further outlined and described through the use of a flowchart and Porter’s Five Forces Models. Additionally, this chapter highlights Tech Transfer in other university settings in order to try and compare how different universities handle the commercialization of university IP.

2.1.1: Tech Transfer Flowchart

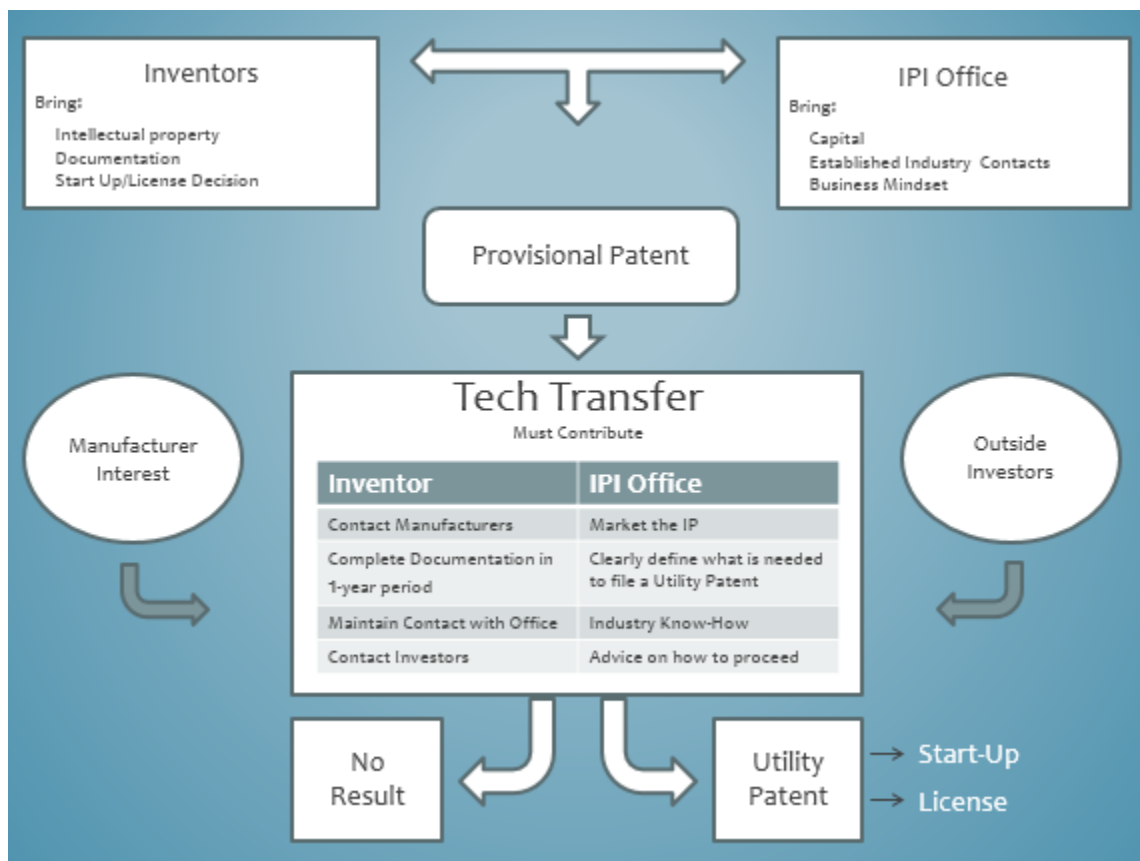


Figure 2: WPI Technical Transfer Flow Chart

Figure 2 is a flowchart that depicts the WPI Tech Transfer process. According to the observations of this MQP, it was determined that the WPI Tech Transfer process starts with a partnership between the IPI Office and the inventors. This partnership could be formed either when the IPI Office reaches out to a project team, or when the inventors reach out to the IPI Office. Once this partnership is formed, and the decision is made to move forward with the Tech Transfer process, a provisional patent is immediately filed. During the one-year period between filing for a provisional patent and filing for a utility patent, both parties are expected to be working towards the common goal of commercialization.

As outlined in Figure 2 above, the inventor is expected to contact manufacturers, complete all necessary documentation, contact investors, and keep in regular contact with the IPI Office. The IPI Office is expected to market the IP, clearly define what is needed for a utility patent, have industry know-how, and provide advice and guidance to the inventors throughout the process (Keiller, 2014).

When the one-year period is coming to an end, the inventors must talk seriously with the IPI Office about if the IP will go on to be filed for a utility patent (Keiller, 2014). Influences that can affect this decision are manufacturer interest and the interests of outside investors, among others. In order for the IPI Office to make the calculated decision to finance a utility patent, it must have confidence that the IP will return a profit. If a manufacturer is interested in the IP, or if an Angel is willing to fund the endeavor, then WPI would be likely to continue towards a utility patent. However, if the IPI Office is not confident in the projects likelihood of returning a profit, then the IP is likely to be fully turned over to the inventors and the IPI Office will virtually cut ties with the endeavor.

If the route for obtaining a utility patent is taken, the office will work towards marketing the idea and working out agreements with the inventors that will lay the foundation for how the venture will move forward. This will focus primarily on a business plan, assessing the market, marketing ventures. These steps typically involve the non-technical side of advancing the product to ultimately being commercialized.

2.1.2: Porters Five Forces

While it is important to understand the Tech Transfer process when trying to successfully commercialize IP, it is also important to understand what outside forces are impacting the success of Tech Transfer. To outline the forces on the WPI Tech Transfer process, Porter's Five Forces models were developed. A Porters Five Forces model, according to the book *Competitive Strategy* by Michael Porter, is an industry structure embodied in five competitive forces (threat of new entrants, bargaining power of the seller, bargaining power of the buyer, threat of substitute products, and the industry itself) that provide a way to think about how value is created and divided among existing and potential industry participants (Porter, 1980).

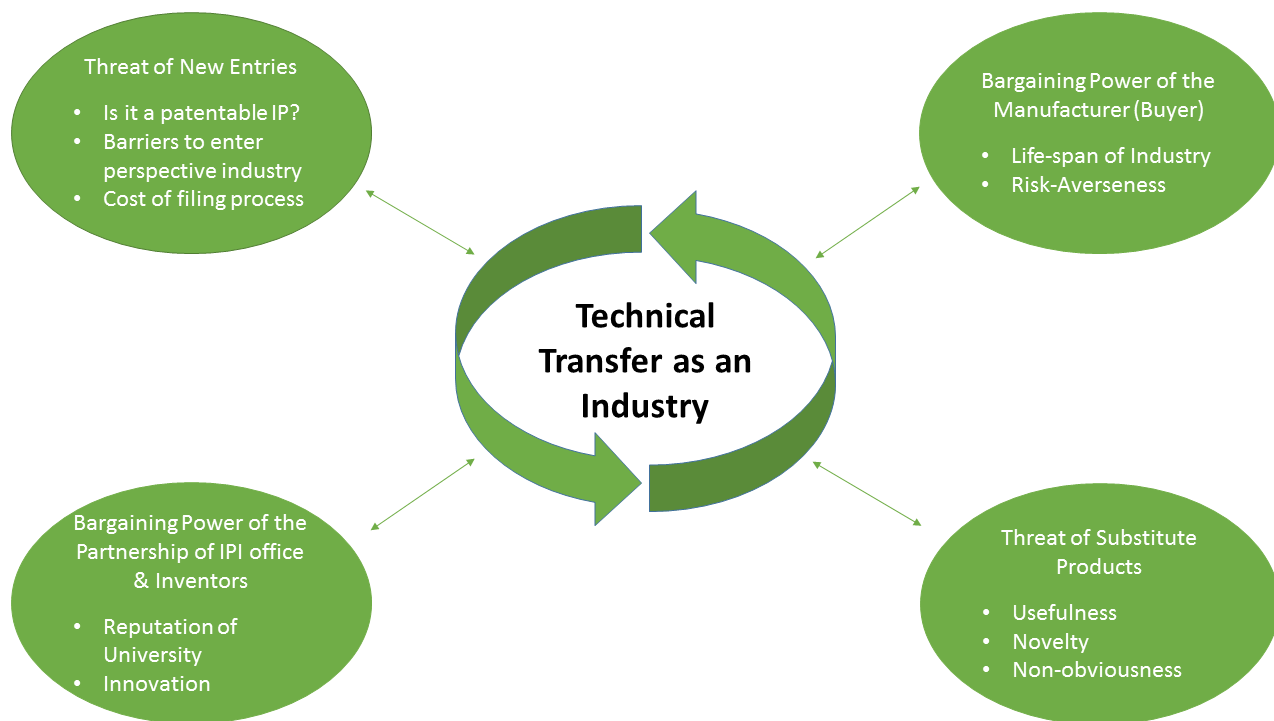


Figure 3: Porters Five Forces Model of Technical Transfer (Partnership)

Figure 3 shows a Porter’s Five Forces Model that outlines the relationship between industry and the partnership of inventors and the IPI Office, who work together to commercialize IP. The bargaining power held by the pair is their ability to leverage reputation of past successes, as well as the potentially disruptive new technology that has been developed and validated by the aforementioned institution. The threat of new entrant’s component of the market addresses the competition aspect of innovation, and the consideration of other similar IP that may be in the process of commercialization by someone else. It also outlines the barriers of entry to a particular industry versus the competitors already in the market, and how to distinguish the IP from the rest. An additional barrier to entering a new market is the cost of the filing process and other upfront expenses that pose challenges to the process.

The bargaining power of the manufacturer relates to the leverage held by the buyer. In this case, this is the leverage that manufacturer or outside investor has over the university partnership. This leverage is generally based upon the lifespan of the industry, the higher the barrier to entry, the longer the product life cycle, and the more potential for profitability. Additionally, the manufacturer or outside partner knows that the university is typically risk averse. As a result, the manufacturer taking on the risk of commercializing the IP could negotiate a better deal as the university needs an outside partner.

The threat of substitute products is best summarized as the concept of the best-designed product, or the best priced solution. This competition is described by the usefulness, novelty, and non-obviousness of the product developed (USPTO, 2015). The product must provide enough value added to the customer that an alternative product is not as appealing, and the switching costs from a competitive product are justifiable to the customer.

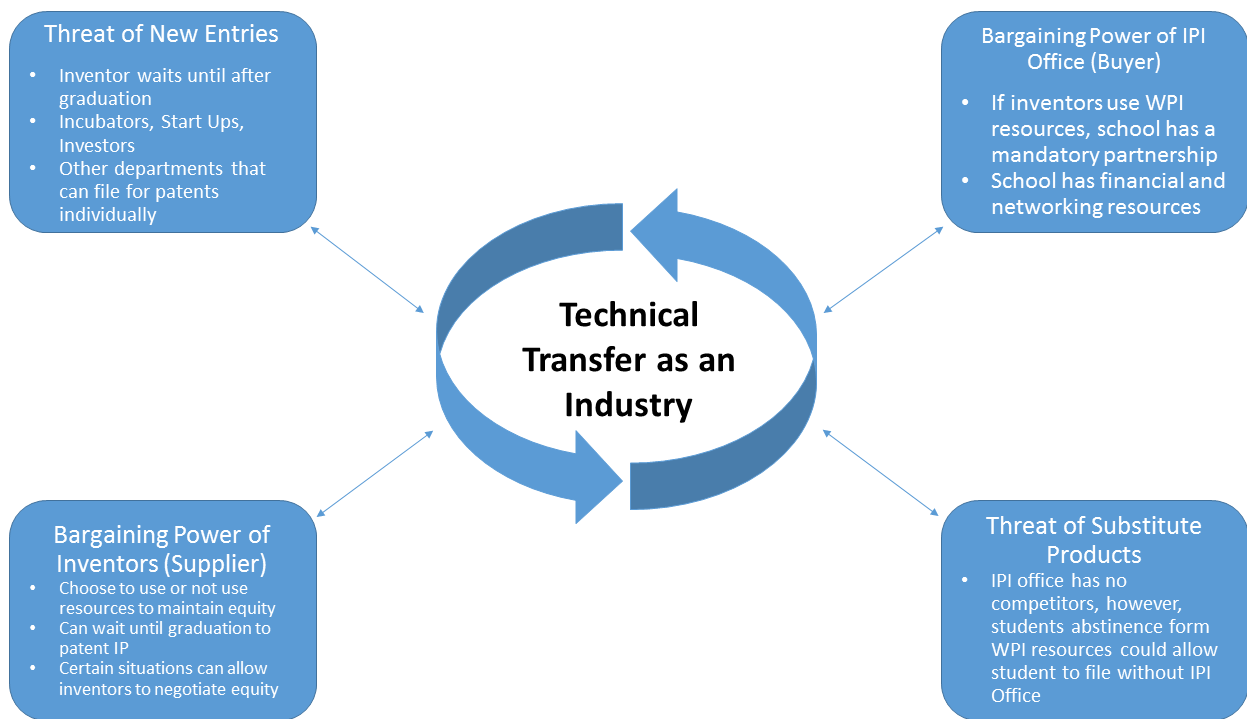


Figure 4: Porter's Five Forces Model of Technical Transfer (Inventors)

Figure 4 is different than Figure 3 as it outlines the relationship of the inventor as the supplier and the IPI Office as the buyer. In some instances, the inventors have to “sell” their technology to the IPI Office in order for the office to invest in them. In this case, the inventor has the option to not use university resources, wait until they graduate, and forgo the IPI process altogether. However, if the inventors forgo the process altogether, then the university will lose the potential royalty of the IP if it were ever to go to market.

In the above model, the bargaining power of the supplier considers the leverage that the inventors have over the IPI Office. The inventors can choose to utilize the Tech Transfer department, or not use them and wait until graduation, depending on the usage of WPI resources. Generally, the inventors must work with the university, but in certain scenarios the inventors have the added ability to negotiate better equity for themselves.

The threat of new entrants is best described as the consideration of limited time that the university has to capitalize on the inventors. If the inventors were to leave the university, then the university could no longer lay claim to the inventor's IP. Additionally, the Tech Transfer department faces competition for partnership with the inventors from incubators and other forms of venture capital to commercialize IP.

The bargaining power of the buyer, in this case the Tech Transfer Office, is the understanding that the inventors are legally obligated to give WPI a share of what they create if they use any university resources, or are affiliated with the university on a course credited project. Added leverage of the IPI Office is the support network and capital resources that are offered to commercialize the product.

Finally, the threat of substitute products considers the inventor's ability to circumvent the Tech Transfer process by simply avoiding the use of resources the university can provide. If no resources are used the inventor can abstain from using the university as a partner, and thus keep the equity of the venture to themselves.

2.3: Tech Transfer at Other Universities

While Tech Transfer is practiced at most universities, there is no one "right way" of doing it. Often different institutions have their own methods to accomplish IP protection and commercialization. For this MQP, Tech Transfer representatives from MIT, Northeastern, and Tufts were interviewed to gain a professional perspective of how different universities perform Tech Transfer, and find out what each institution feels are "best practices" for commercializing IP.

2.3.1: Tech Transfer at MIT

The MIT commercialization process is arguably one of the more recognizable and successful processes in the nation. MIT has determined how to best leverage their brand, alumni network, faculty, and students to consistently produce and establish a wealth of commercially viable technologies across a broad spectrum of fields. However, the process MIT employs to commercialize university IP is unlike the traditional Tech Transfer process, outlined in the first chapter.

According to Catherine Ives, a representative in the MIT Tech Transfer department, the first advice that any student is given by a Tech Transfer rep at MIT is to “explore other resources” on campus before they decide to go through the Tech Transfer Office. MIT has a very strong alumni network that will often partner with and fund students who have commercially viable IP. Additionally, there are a handful of entrepreneurial clubs and organizations on campus that can help a student commercialize IP on their own. However, if the student is unable to move forward with their IP by using a secondary campus resource, then they are introduced to the Tech Transfer department and their processes (Ives, 2014).

The first step that must occur in the MIT Tech Transfer process is the inventors must agree to release the IP to MIT and undergo a prior art search. This is where the bulk of proposals end, due to patents already existing for the IP. However, if the idea is still viable following the prior art search, then a patent is filed for, and the inventor must decide what kind of business model they would like to pursue. If the decision is to begin a startup, then the student is put in charge and assumes responsibility for running the business (Ives, 2014).

According to Ives, MIT alumni have been responsible for the starting of 25,800 businesses and nearly 2 trillion dollars in revenue as of a 2009 study administered by the

Coughlin Foundation. While MIT has had a lot of success commercializing university IP, they have also faced challenges that are often associated with Tech Transfer. One of these challenges is the marketing of university IP to external business entities. Often IP fails to be commercialized not because it is not commercially viable, but rather companies and external business partners are not aware of the commercial potential due to ineffective marketing efforts by the inventors and university. With better marketing efforts by both parties, more external business partners are likely to pursue university IP, thus leading to a higher likelihood of commercial success (Ives, 2014).

Despite the challenges of Tech Transfer, MIT continues to have one of the more successful Tech Transfer systems in the U.S. higher education system. Catherine Ives believes this differentiation is due to the rich entrepreneurial atmosphere within the university, the experience gained through performing Tech Transfer since WWII, the approach of allowing a student to try going into business on their own, and having 18% of its R&D sponsored by external companies (Ives, 2014).

2.3.2: Tech Transfer at Northeastern University

Another university with a successful Tech Transfer department is Northeastern University. What differentiates the Tech Transfer process at Northeastern is the “spinoff” system and tech into venture program. According to Joel Bresler, a Technology Portfolio Director at Northeastern University, any technology using “substantial” university resources is required to go through the university Tech Transfer process. This entails the inventors filling out a contract with the university, known as a term sheet, to either agree to a spinoff, or attempt to form their own startup. A spinoff is the attempt to license the product through the university. Once the

university has permission to access the IP, whether to attempt a spinoff or startup, the university will take responsibility to patent and protect the IP.

If the inventors agreed to attempt a spinoff, then they will work together with the university to find potential business partners interested in licensing. However, if the inventors choose to attempt a startup, then the commercialization is solely up to the inventors themselves. “The university protects the IP and the students start the business,” said Joel Bresler, talking about the responsibilities of Northeastern in their Tech Transfer process. While the university will provide guidance and encourage them to use resources, the founding of the business is ultimately up to the inventors.

In order to advertise and make individuals in the Northeastern community aware of their Tech Transfer process, Bresler explained how they lean on professors to advertise the process in their classes and refer students to the office when necessary. The Tech Transfer Office also performs informative talks in various ecosystems on campus, which include capstone classes, entrepreneurial clubs, and other venture driven programs.

If the IP achieves commercialization, the returns will be split up with the student receiving 30% of all revenues, the university department from which the IP developed receiving 30%, and the university receiving the remaining 40%. According to Bresler, one of the obstacles that prevent the IP from being commercialized is the challenging decisions and barriers to starting a business. “Northeastern is not the bottleneck,” says Bresler, “Starting the business is up to [the inventors].” Currently Northeastern has a handful of successful ventures, including two that focus on robotics and a wind energy system (Bresler, 2014).

2.3.3: Tech Transfer at Tufts University

The final university Tech Transfer department that was contacted was that of Tufts University. Tufts has a unique approach to Tech Transfer as they employ what they call a, “cradle to grave” approach. According to Martin Son, an Associate Director in Tufts Tech Transfer department, the “cradle to grave” approach is when one case manager from the Tech Transfer department handles an IP commercialization project from start to finish (i.e. cradle to grave). Son says this is the more “traditional way” of doing Tech Transfer, and allows Tufts to be more personal with their inventors, which to them is extremely important (Son, 2014).

The first step in Tufts Tech Transfer process is for the inventors to disclose the idea to the university. Once this occurs the university will review the IP and perform an initial assessment of its validity, which includes a prior art search and conversations with both the inventors and patent attorneys. Once the patent application has been placed, the university will work together with the inventor to begin realizing the commercial opportunity of the IP. The opportunity of the IP can be realized through working with and researching potential companies, competitors, and specific contacts in the industry in question. Following the commercial validation, the university and inventor will then begin a marketing campaign and ultimately begin the decision making process for what the final commercial outcome for the IP should be (Son, 2014).

Tufts outlines who fall under the jurisdiction of this process in their university IP policy. According to the policy, “University personnel are covered [by the IP policy] when their creative work involves the use of University resources, such as space, facilities, equipment, staff, or funds.” (Intellectual Property, 2014).

Currently Tufts is averaging 75-100 IP disclosures per year and its most successful venture is a Biomaterial platform, which has led to the founding of 10 startup companies. Tufts

Tech Transfer continues to overcome limited resources and consistently commercialize their university IP (Son, 2014).

2.4: The Value of Tech Transfer in University Setting

To understand the importance of performing successful Tech Transfer, it is necessary to know what value Tech Transfer can provide to its stakeholders, which include inventors, the IPI Office, and the university. The value that is brought to these stakeholders can come in the form of monetary, educational, and accreditation value and each one of these can mean something different to each stakeholder.

2.4.1: Value to the Inventor

Tech Transfer offers a tremendous opportunity to the faculty and students at a university who have the opportunity to take their project ideas, and perhaps turn them into commercialized products. This opportunity is the result of the IPI Office and university providing them access to a financing partner, in order to help them get off the ground. Opportunities like this are valuable because they not only provide commercialization assistance and possibilities of monetary gain, but also an important educational experience outside of the classroom by learning more about commercialization, patents, and possibly even obtaining a patent themselves.

The Tech Transfer program at WPI also allows a way for inventors to network with various advisors and experts available through their ties to the university, which could prove important relationships to have in terms of both the IP and life after WPI. Furthermore, if the technology were to ever become commercially successful, then it would bring with it recognition for the inventors involved in the project, the IPI Office, and the university as a whole.

2.4.2: Value to IPI Office

Tech Transfer is beneficial to the IPI Office because it makes the office responsible for bringing in revenue to the university. As a result, the office and university bring monetary value and recognition of launching a successful commercial venture. This recognition could eventually result in the office featuring an array of technologies within their Tech Transfer portfolio, which is important because it would influence both inventors and outside entities to perform Tech Transfer with the office due to their notable successes.

2.4.3: Value to the University

Tech Transfer often requires large investments of capital and resources from the university. Therefore, it is very important that the technology proposed by the inventors is deemed commercially viable. A university that partakes in Tech Transfer has the opportunity to develop an expansive and diverse array of IP for its portfolio, while also empowering and inspiring inventors to pursue innovation and inventions that will change the world. Offering Tech Transfer in this sense becomes an opportunity for investment rather than an expense.

If the technologies pursued were to succeed, then the recognition brought about by the successes would not only attract students, but also inspire the incumbent population to create new things and bring about new research and external funding. Also, successful Tech Transfer programs create the possibility of bringing in more revenue to the university, as a result of royalties and other revenues from successful technologies.

2.5: Rationale of Tech Transfer

Due to the emphasis WPI places on projects and innovation in their current curriculum, the likelihood of IP generation is arguably higher. Therefore, it is important to have a successful

Tech Transfer Office that is able to protect IP and assist in its commercialization, which has the potential to impact the WPI community.

Additionally, new generations of students have goals that are much different than those of prior generations. Where earlier students felt a need for stability, the new youth movement now seeks to do things on their own and carve out something for themselves. This industrial and entrepreneurial spirit can be converted into far greater returns for not only themselves, but also the university as a whole. This can be accomplished with an effective Tech Transfer Office that handles patent related issues and assists in the commercialization of university generated IP.

Chapter 3: Approach to Commercializing University IP

3.1: Blue Ocean Strategy

Blue Ocean Strategy (BOS) is a business strategy concept created by W. Chan Kim, and Renée Mauborgne. The concept is discussed in their book, *Blue Ocean Strategy* published in 2005. The book centers on the concept of opportunities in business competition. According to Kim and Mauborgne, there are companies that compete in “red oceans” where competition level is high, and companies that seek opportunities to discover “blue oceans”, where there is little to no competition. “Blue Oceans denote all the industries not in existence today- the unknown market space, untainted by competition.” (Kim et al, 2015).

BOS focuses on doing business where there are few competitors. BOS seeks to create new opportunities, instead of dividing up existing business. “Focusing on the “red” ocean means accepting the key constraining factors of war- limited terrain and the need to beat an enemy to succeed” (Kim et al, 2015). Learning to identify and position in potential “blue ocean” markets could offer a great deal of promise to inventors and Tech Transfer alike at WPI. This chapter of the MQP will seek to explore ways to expand the current WPI method of commercializing IP.

3.2: Blue Ocean Strategy within University Tech Transfer

In university Tech Transfer, the best application of BOS can come in the initial plan for how and to whom the IP will be marketed. Finding applications for technology is as important a feat as designing it in the first place. “Companies that create blue oceans typically reap the benefits for ten to 15 years, as was the case with Cirque de Soleil, Home Depot, Federal Express, Southwest Airlines, and CNN...” (Kim et al, 2015). Two segments of BOS that can be particularly relevant to the way Tech Transfer is performed with a BOS mindset are Value Innovation and Four Actions Framework.

3.2.1: Value Innovation

Per BOS, the ideas that should receive the most attention are those that have a cost structure that can be kept low, or produced lower than anticipated competitors while also providing a superior value to the customer. This idea is known as Value Innovation and is depicted in the graph below (Value Innovation, 2015).

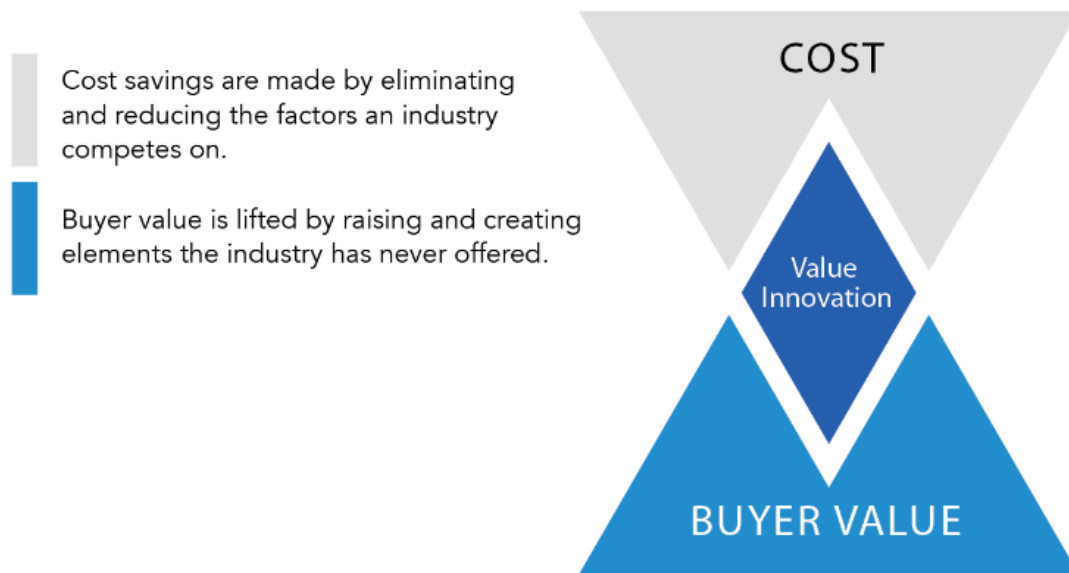


Figure 5: Value Innovation Diagram

“Value Innovation, the cornerstone of BOS, is the simultaneous pursuit of differentiation and low cost, creating a leap in value for both buyers and the company. Because value to buyers comes from the offering’s utility minus its price, and because value to the company is generated from the offering’s price minus its cost, value innovation is achieved only when the whole system of utility, price, and cost is aligned” (Value Innovation, 2015).

3.2.2: Four Actions Framework

The Four Actions Framework takes into consideration areas of value and cost in order to create a new value curve. “To break the trade-off between differentiation and low cost and to

create a new value curve, the framework poses four key questions, shown in the diagram, to challenge an industry's strategic logic" (4 Actions Framework, 2015).

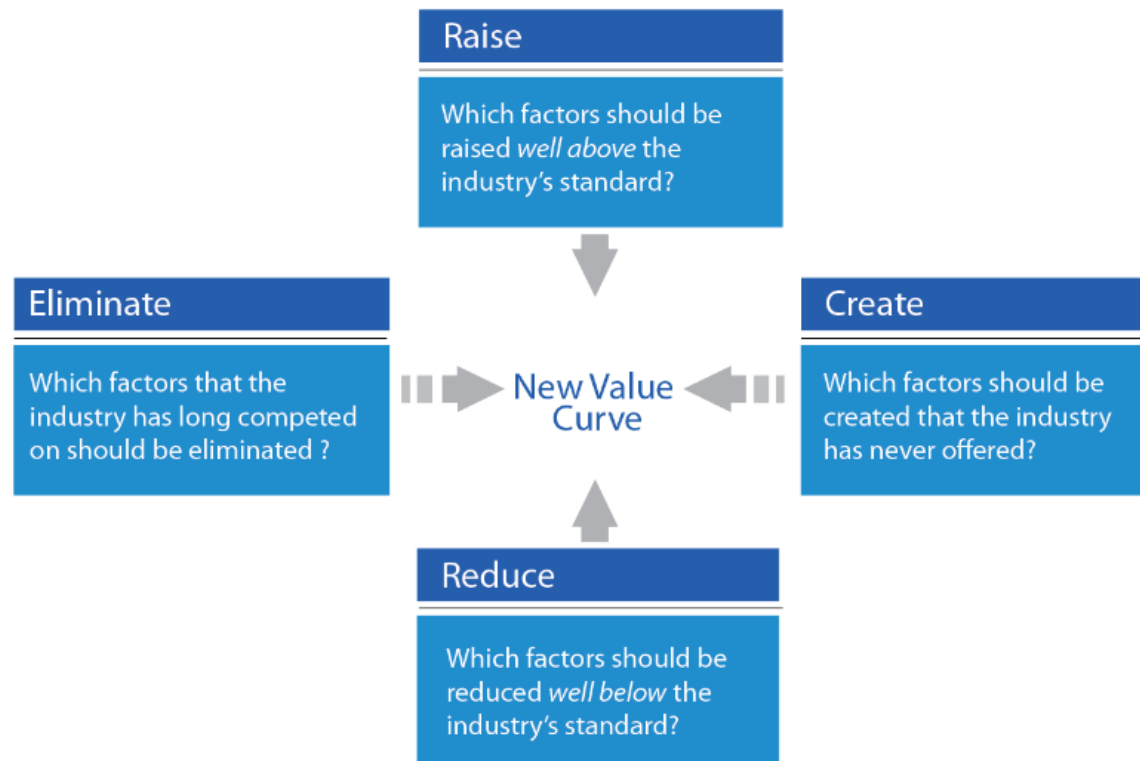


Figure 6: Four Actions Framework

In applying this concept to business and determining if it follows BOS, actions must be taken in order to evaluate the New Value Curve. In order to come to this curve, the company must ask important questions that fall under the categories of Reduce, Eliminate, Raise, and Create. These are actions that must be taken in order to implement a new “blue ocean” from an existing “red ocean.” By identifying the opportunities for improvement, a new approach to business can be taken that capitalizes on all of the areas of opportunity and improvement in an existing industry.

3.2.3: Industry Continuum

After identifying where the proposed IP falls in terms of Value Innovation and Four Actions Framework, the next important step in commercializing IP is to identify the barriers of entry for the proposed industry. According to Investopedia, barriers to entry are defined as, “the existence of high start-up costs or other obstacles that prevent new competitors from easily entering an industry or area of business” (Barriers to Entry, 2015). Industries within business are fundamentally different and therefore the barriers to entry will differ and require dissimilar amounts of time, energy, and capital to establish a commercially viable venture.

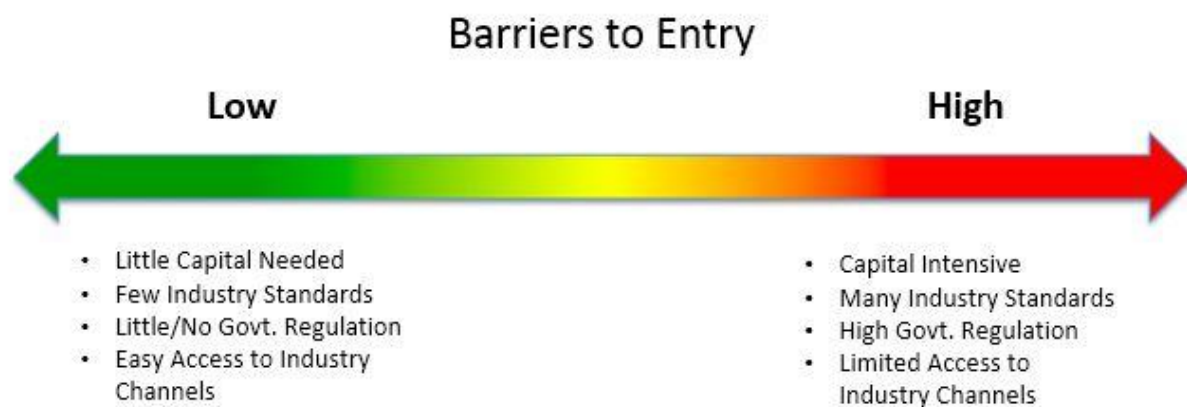


Figure 7: The Industry Continuum

Above is a diagram that outlines a continuum, which displays how barriers of entry will vary depending on the industry. If the industry in question has relatively low barriers to entry, then it would go toward the left side of the spectrum, and industries that possess relatively high barriers to entry would go toward the right side of the spectrum (Sweeney, 2015).

An example of a low barrier to entry industry would be a phone app or restaurant venture, where the necessary income and requirements to enter the industry are relatively low. These are deemed low on the continuum because of the cost, product life cycle, and the market

opportunities. The market for phone apps is one that requires relatively small amounts of capital to launch and maintain. The industry also has a lot of competitors, none of whom dominate the market, and a plethora of people willing to purchase new and innovative technologies. This market has a relatively short product life cycle, meaning that products only create income for a limited time before the next big thing captures the markets attention (Sweeney, 2015).

On the other hand, an example of a high barrier to entry industry would be a biotech/pharmaceutical venture, where the necessary income and requirements to enter the industry are relatively high. The capital that goes into many years of research, development, and testing of pharmaceuticals is tremendous. However, if a product in this industry makes it to market, then the product will more likely have a life span of a decade, or even more. That being said, the pharmaceutical industry is comprised of a few key players that dominate the market. Especially because of the enormous upfront costs to commercialize a product in this market, the number of successful startup companies in this industry are few (Sweeney, 2015).

Knowing where IP falls on the industry continuum will shed light on the expectations inventors could anticipate when trying to commercialize IP. These expectations could come in terms of monetary, time, informational, or legal factors and all have an effect on how the IP will be commercialized. At the beginning of this MQP, the focus was primarily on commercializing a ski binding technology invented by Professor Christopher Brown and his student John Madura. The binding was developed to address an issue known as "inadvertent release" found by many skiers regardless of skill level brought about by another issue known as "chattering." To understand the market where this technology would be commercialized, a more in depth look at the SnowSports industry and market was undertaken.

3.3: SnowSports Market

To determine where the ski binding heel technology would fall on the continuum, market research for the industry in question is necessary. The industry that the ski-binding heel would enter is known as the SnowSports industry. The market research for the past two years is outlined below.

SnowSports Industries of America (SIA) is the national not-for-profit, North American member-owned trade association representing the winter sports industry. Established in 1954, the SIA is the top research database for SnowSports in the United States. Membership for this organization averages at approximately 700 SnowSports companies, and produces an annual report before the start of each season. This was the primary source of market research for this MQP (SIA 2013 & 2014).

3.3.1: Market Overview

MARKET OVERVIEW

Dollars Sold By Channel In All Snow Sports Shops: 2010/2011 – 2013/2014

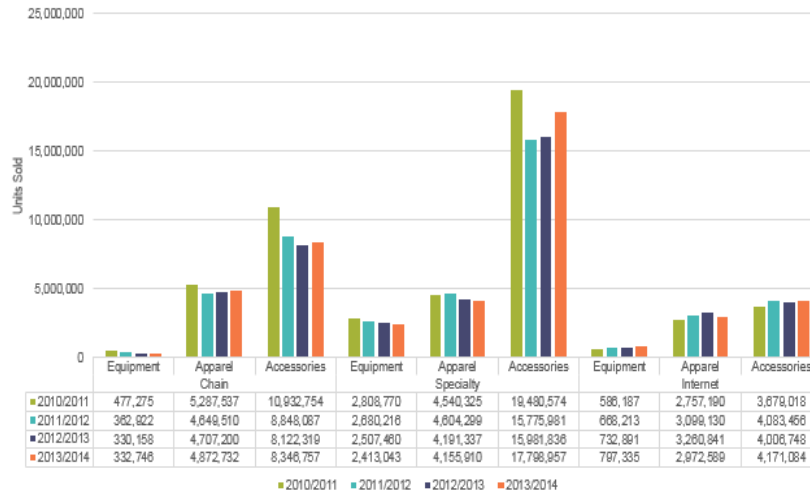


Source: SIA RetailTRAK™ Data produced by Leisure Trends, a NPD Group Company, carryover not included.

Figure 8: Dollars Sold By Channel in All Snow Sports Shops

MARKET OVERVIEW

Units Sold By Channel In All Snow Sports Shops: 2010/2011 – 2013/2014



Source: SIA RetailTRAK™ Data produced by Leisure Trends, a NPD Group Company, carryover not included.

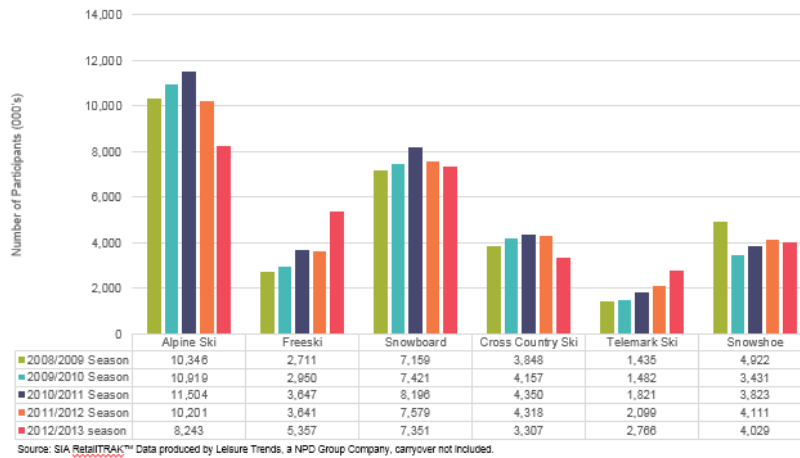
Figure 9: Units Sold By Channel in All Snow Sports Shops

The 2013/2014 SnowSports season was record-breaking with \$3.6B in total sales, an increase of 4% in units and an increase of 7% in dollars (SIA, 2014).

3.3.2: Alpine Ski

SNOW SPORTS PARTICIPATION

By Discipline



Source: SIA RetailTRAK™ Data produced by Leisure Trends, a NPD Group Company, carryover not included.

Figure 10: Snow Sports Participation

The Ski Binding Heel technology would fall under the Alpine Ski Equipment Sector of the SnowSport market. This is the largest sector of the market and brought in \$496M dollars sold during the 2013/2014 winter season, which is -2% in units and flat on sales from the 2012/2013 winter season. The drop in Alpine skiing is caused by a large increase of people who consider themselves free skiers. Free skiing is defined as park/slope style skiing. It can include anything from natural features in un-groomed terrain to skiing rails in schoolyards, as well as traditional resort park and pipe features.

Some segments that the Alpine Ski Market is broken down into are Alpine Skis (-8% in units, -6% in dollars), Alpine Boots (+1% in units, +6% in dollars), Alpine Bindings (+7% in units, +9% in dollars), and Alpine Poles (-3% in units, +1% in dollars). Carryover sales, products sold at or below retail cost, brought in \$51M (+28% in units, +33% in dollars) in the 2013/2014 winter season (SIA 2013 & 2014).

ALPINE SKI PARTICIPANT PROFILE

*Total Alpine Ski Participation	8,243,000 (▼19.2%)
Median Age of Alpine Skiers	24% are ages 8-17, 57% are between 18-44, 16% are 45-64 and 2% are 65+
Gender of Alpine Skiers	60% Male, 40% Female
% with Household Income >\$75K	63%
% of Core Alpine Skiers with Household Incomes >\$100K	46%
Bachelor's Degree or Higher	56%
States with the Most Alpine Ski Participants	CA, NY, CO, TX, MN
% of Alpine Skiers that also Ride a Snowboard	17%
Avg. Price paid for adult, in-season Flat Skis (bindings sold separately) at a Specialty Shop	\$483.08
Avg. Price paid for adult, in-season Ski Systems at a Specialty Shop	\$480.30
Avg. Price paid for adult, in-season Alpine Boots at a Specialty Shop	\$369.43
Avg. Number of Days Alpine Skiing in 2012/2013	7.6

Note: The above participation numbers used in the following slides are in reference to the 2012/2013 snow sports season.

Source: SIA/Physical Activity Council 2013 Snow Sports Participant Study.

Table 1: Alpine Ski Participant Profile

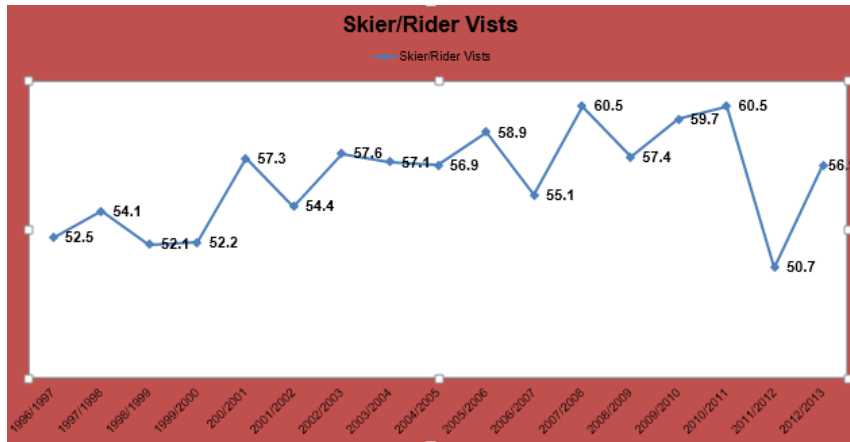


Figure 11: Skier/Rider Vists

In the 2013/2014 winter season, there were 8.2 Million Alpine Ski participants. This participant profile indicates that the majority of skiers are between the ages of 18 and 44, and their annual income is more than \$75K. The average number of days of Alpine skiing in 2012/2013 winter season was 7.6 days. It was also noted that in the 2012/2013 season, 1/3 of Alpine Ski participants say they are cutting back in non-essential equipment purchases due to economic concerns. This information is useful because it can be used to target an audience within a segment that will be profitable to the technology (SIA 2013 & 2014).

ALPINE SKI EQUIPMENT

Dollar Sales In All Snow Sports Shops: 2010/2011 – 2013/2014

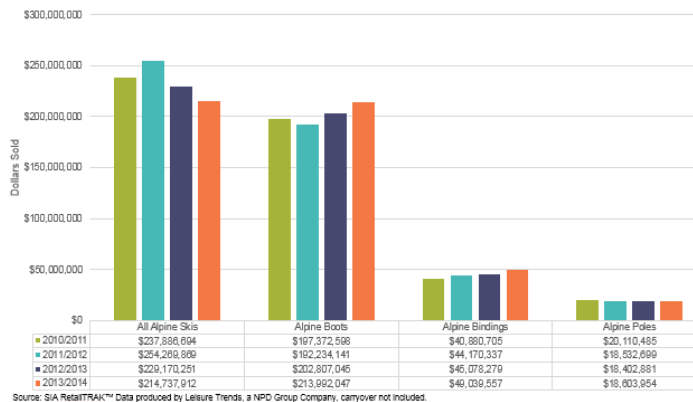


Figure 12: Dollar Sales in All Snow Sports Shops

ALPINE SKI EQUIPMENT

Unit Sales In All Snow Sports Shops: 2010/2011 – 2013/2014

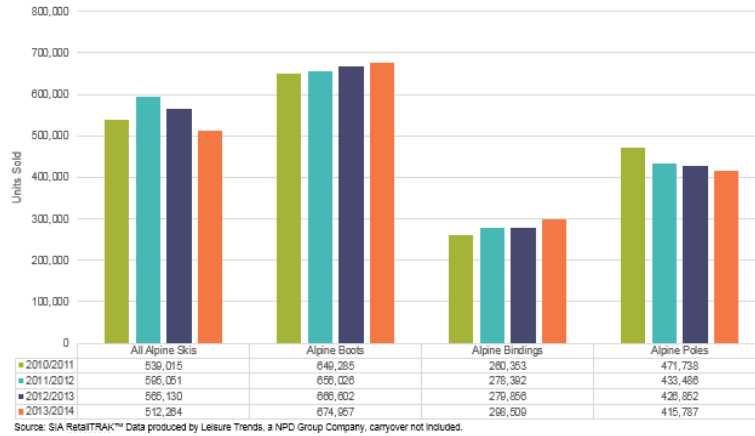


Figure 13: Unit Sales in All Snow Sports Shops

Alpine equipment sales are at a five-year high and skier/rider visits are up 11% from last season. This has a lot to do with the heavy snowfall and good weather conditions in the later part of the season. As shown in the above graphs, the Alpine Binding equipment sector has grown both in units and in dollars in the past few years. This indicates that it would be a market favorable to new entrants because it sees constant growth (SIA 2014).

ALPINE BINDINGS

Dollar Sales In All Snow Sports Shops: 2010/2011 – 2013/2014

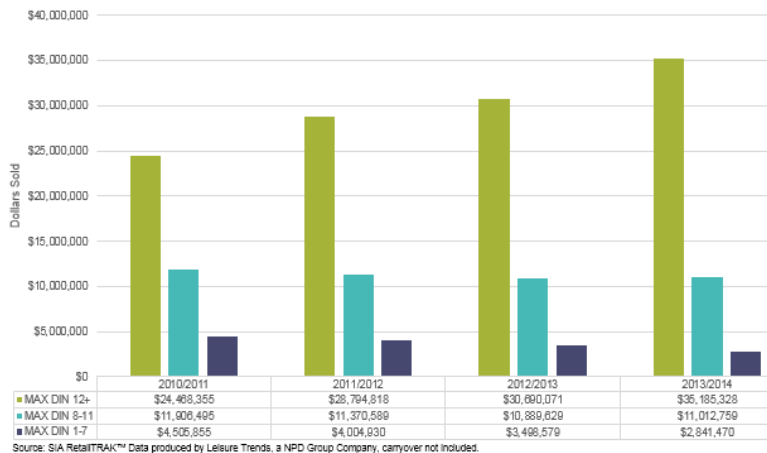


Figure 14: Dollar Sales of Alpine Bindings

3.3.3: Ski Bindings

ALPINE BINDINGS

Unit Sales In All Snow Sports Shops: 2010/2011 – 2013/2014

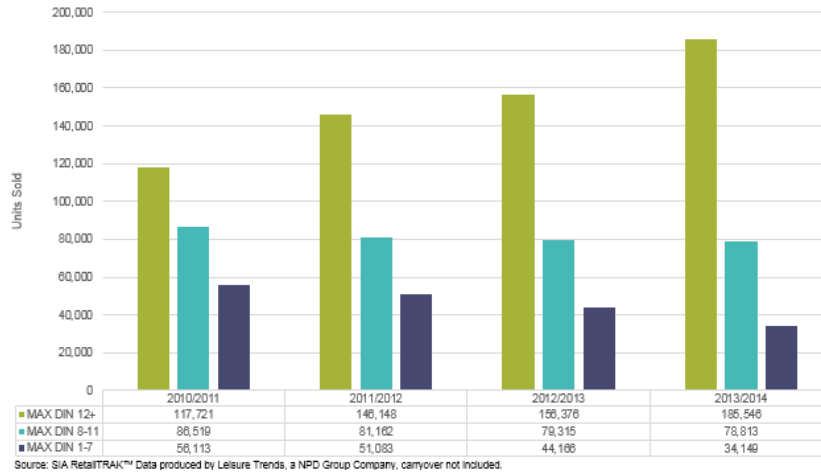


Figure 15: Unit Sales of Alpine Bindings

ALPINE BINDINGS AVERAGE RETAIL PRICES

Average Retail Price for ADULT product (carryover excluded)		2009/2010	2010/2011	2011/2012	2012/2013
Chain	MAX DIN 12+	\$186.51	\$185.57	\$198.51	\$176.41
	MAX DIN 8-11	\$104.72	\$122.87	\$146.55	\$147.83
	MAX DIN 1-7	\$0.00	\$0.00	\$101.11	\$68.45
	Alpine Bindings	\$145.53	\$150.21	\$178.49	\$163.95
Internet	MAX DIN 12+	\$161.96	\$195.77	\$196.66	\$201.90
	MAX DIN 8-11	\$101.64	\$120.02	\$142.59	\$123.53
	MAX DIN 1-7	\$63.32	\$73.15	\$53.37	\$61.11
	Alpine Bindings	\$150.81	\$171.68	\$180.56	\$178.14
Specialty	MAX DIN 12+	\$209.33	\$212.46	\$197.36	\$196.73
	MAX DIN 8-11	\$130.41	\$144.91	\$141.95	\$141.84
	MAX DIN 1-7	\$75.12	\$81.89	\$83.53	\$78.09
	Alpine Bindings	\$175.78	\$184.48	\$177.82	\$179.00

Source: SIA Snow Sports RetailTRAK™ Data Produced by Leisure Trends – Adult only, Carryover Excluded.

Table 2: Alpine Bindings Average Retail Prices

Looking more closely at the ski-binding sector, it is clear to see an increase in customer interest in higher DIN bindings. There are many speculations that one can make from this

information. This data could affirm the previous idea that skiers are moving away from bindings with low DIN settings to avoid inadvertent release from the binding. This data could also merely be due to the fact that more experienced or racing skiers are the ones who tend to buy ski bindings more often, and therefore need higher DIN settings because of their rougher terrain. This increase in higher DIN settings can also have something to do with the shift to backcountry skiing. Backcountry skiing is the skiing on non-groomed terrains, and therefore the terrain would be rougher, hence the need for higher DIN settings (SIA 2013 & 2014).

3.3.4: Skiing Industry Continuum

Using the SnowSport industry as an example for the industry continuum, it was determined, based on market research and personal interviews; the industry is found to be more risk averse. Therefore, according to the information collected, the SnowSports industry would fall closer to the high barrier to entry end of the spectrum.

What this means for Mr. Madura, Professor Brown, and the IPI Office is that the binding IP will be relatively more difficult to commercialize. Companies that are willing to invest in this IP are going to be scarce and expenses for each of the ventures are likely to be high. As an inventor or stakeholder, it is important to know the industry and the risk it can propose when attempting to commercialize IP.

3.4: Probabilistic Model

In the pursuit to define and discover what makes a successful Tech Transfer Office, this MQP consulted with WPI Professor Jerome Schaufeld. Professor Schaufeld has been working on an upcoming publication dealing with university Tech Transfer Offices and entrepreneurship in academia, called Commercializing Innovation: Turning Technology Breakthroughs into Products. Jerome Schaufeld's experience in entrepreneurship, operations, and general

management of technology-based companies made him an essential part of this MQP's research, and the conversations had with him, paired with resources that were provided, resulted in the creation of a decision matrix that laid the groundwork for a Time Value of Money analysis, which is included in this report.

Professor Schaufeld created a probabilistic model on the technical transfer process, which was developed in order to differentiate commercial viable product ideas from the non-commercial viable ones. This model has four phases; source of the product, opportunity recognition, feasibility analysis, and the optimal decision to pursue a successful venture. The model also outlines that throughout the process, those involved must have an overarching vision in order to recognize opportunities and avoid pitfalls. The model can be seen in the figure below (Schaufeld, 2014).

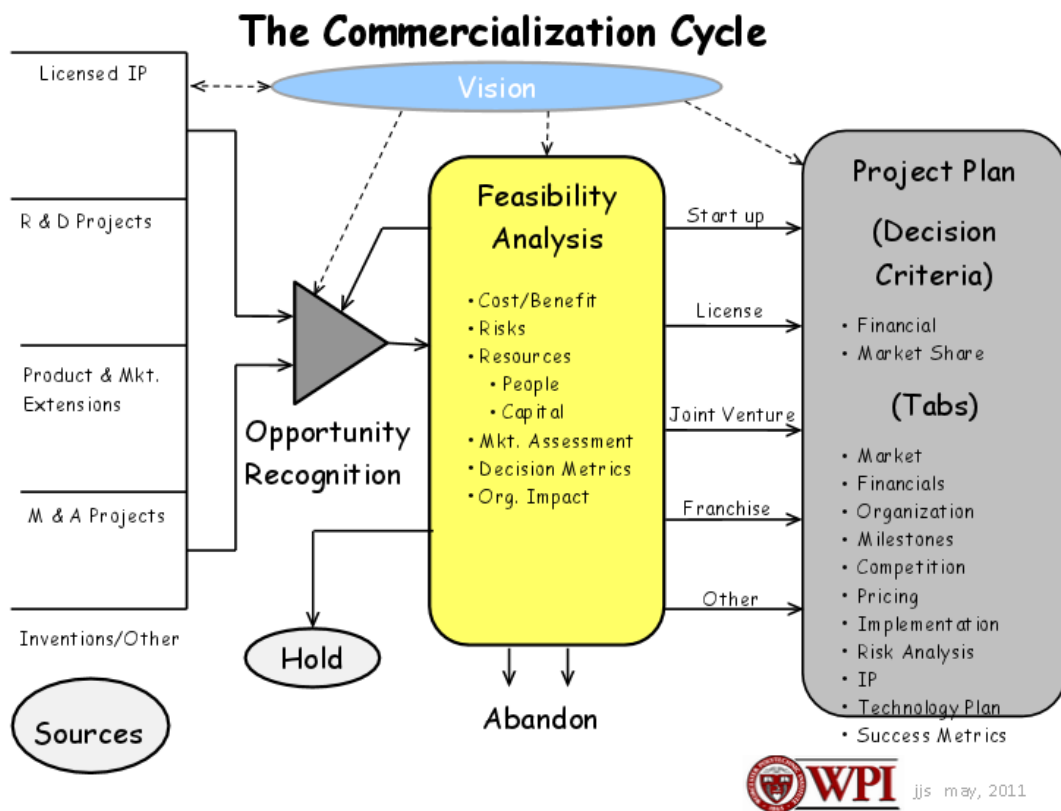


Figure 16: The Commercialization Cycle

After identifying the product in which the inventor wants to pursue commercialization, they must then go through the process of opportunity recognition. Opportunity recognition is the process of identifying unique commercialization points (i.e. is it better, safer, or more affordable than current products?). If no unique points are identified, the opportunity for commercialization is unlikely.

After opportunities are recognized, there are three potential options. First, the inventors can hold the technology. This means the idea has potential, but the market isn't right for immediate action to be taken. The second choice is to abandon this technology. In this instance, through market research, among other factors, it is decided that this technology would not be a profitable venture. Lastly, after opportunity recognition, the inventors can decide to move forward with the idea, because the product has the potential to make a profit.

The next phase in this model is to determine whether or not the opportunity is feasible. This involves a feasibility analysis that includes performing cost/benefit analysis, risk analysis, market assessments, decision matrices, and recognizing the pool of resources. The results of this phase are the same as the opportunity phase (hold, abandon, or move forward), but the decision should have more weight due to the increased understanding of the financial and time ramifications of the project. This knowledge will prove crucial when making the ultimate decision of moving forward with the idea or not.

The model created by Professor Schaufeld in his research is innovative in this field, and gives insight as to how technical transfer can work to optimally make decisions that lead to successful ventures. His concept of commercialization simplifies and streamlines a process that, in many cases, is very complicated to both the inventors and university. The system he introduces allows inventors to understand the costs and benefits associated with the

commercialization process. It also directs the inventors to ask the right questions on a situational basis that allows them to be able to better conceive value, and understand which ideas can be monetized.

Due to the shift in legislation, patents are no longer awarded on first to invent, but rather the first to file, therefore protecting ideas is a much more of a concern causing people to rush to file. Professor Schaufeld posed an interesting point that unless the inventor can justify the yearlong period of some protection provided by a provisional patent, it is not a worthwhile investment to acquire one. Especially in the business of Tech Transfer where the conversion rate of provisional to utility patents is relatively low. He feels that the financier should not allocate the time or money on a provisional patent for something that is not deemed commercially viable.

Considerations must be made before investing in order to address the value of the proposition. To assess these considerations, the inventors and IPI Office must first ask questions such as: “Is this idea faster, better, or cheaper than existing products?” or “Is there a penetrable market for this product?” If the value proposition of the IP cannot answer such questions favorably, than it probably does not offer successful commercial opportunity. If the value proposition of the IP can answer such questions favorably, than it probably does offer successful commercial opportunity and decisions should be made as to how it will be commercialized.

3.5: Decision Tree

Once the IP has been protected and deemed a feasible commercial endeavor, the next step is to determine what decisions must be made in order to commercialize the IP. These decisions include, what kind of venture should be pursued, how the venture should be planned, how the product should be marketed, and how much time and money will it take to form this venture. It is

important to consider every decision equally and consider the impact each could have on a commercially un-established IP.

In order to keep track of these decisions and make sure everything is organized, a decision matrix should be used. A decision matrix is an organizational tool, which is crucial to making sure all decisions are weighed out, and the parties involved have a consistent train of thought when considering their options. A decision tree also allows for the tracking and calculating of decisions, in terms of both time and money. Every minute you spend trying to commercialize IP is a minute that could be spent making money doing something different. Therefore, it is important to keep track of what has been done, what needs to be done, and how much the process costs in terms of time and money.

For this project, a decision tree was established for a startup, joint venture, and licensing scenario. In each decision tree, the cost of the decision was weighed against the investment of time and money into a safer venture, such as a bank. In order to create these decision trees, a software called *Precision Tree*® was used. *Precision Tree*® is a decision tree software that allows users to keep track of what decisions cost and how long processes take. The tree also takes into account the inputs of each decision, in terms of time and money, and will display what decision is the “best” to make at each point in time given the return of each decision.

Below is an example of a decision tree created for John Madura’s commercial opportunity. This decision tree outlines a licensing scenario, and the complete tree can be found in Appendix C. As you can see, the first decision that must be made to start any business is deciding what kind of business should be pursued.

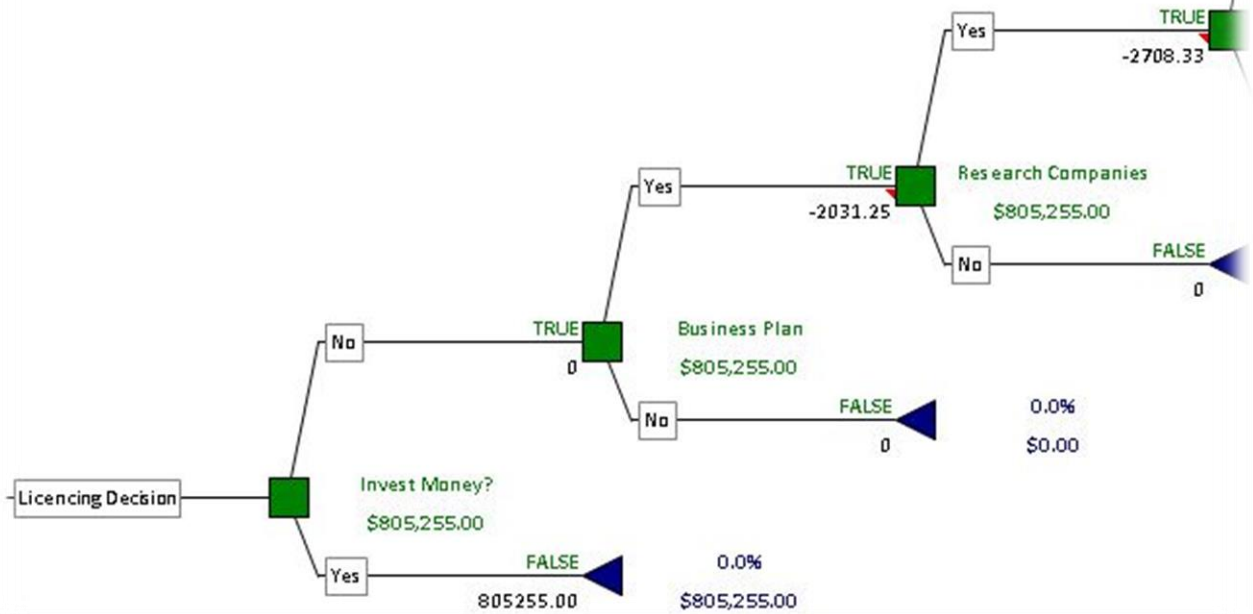


Figure 17: Decision Matrix

There are multiple types of ventures that can be pursued, all of which have positive and negative aspects to them. After performing a feasibility analysis, as outlined in the probabilistic model, it should start becoming clear what type of venture is the optimal route to pursue. In the case of John Madura’s ski binding technology, the logical business models to choose from are a startup, license, or joint venture.

Once a business model is chosen, the next step is to form a business plan. Regardless of what type of venture is pursued, it is important to have a strong business plan. A strong business plan provides the foundation for building a business and is the driving force towards commercialization. Once the type of venture has been established and a business plan has been formed, commercialization strategies change, depending on the decisions that have been previously made. These differences in strategy are caused by different ventures requiring different steps to form them. For example, a license will be centered about company research and

negotiations, whereas a startup will be more concerned with purchasing the necessary infrastructure and ensuring certain industry guidelines are met.

3.6: TVM Curves

After mapping out the process and necessary decisions for commercializing IP, the only decision left to make is whether to pursue the opportunity or not. This decision is influenced by a number of factors, but more often than not it boils down to how much money will the endeavor cost and if the risk “worth” taking. This valuation decision is often very difficult to understand and could result in even the most promising IP to be abandoned.

A way to further understand the monetary expectations of an IP decision is by creating a Time Value of Money (TVM) curve. A TVM curve is a visual of monetary values graphed over time to show the length of return on investment for IP commercialization projects. A TVM curve is created by what individuals can expect when investing in IP commercialization. These expectations can be derived from things such as the probabilistic model, BOS strategy, industry continuum, and decision tree(s), all of which were presented earlier in this chapter.

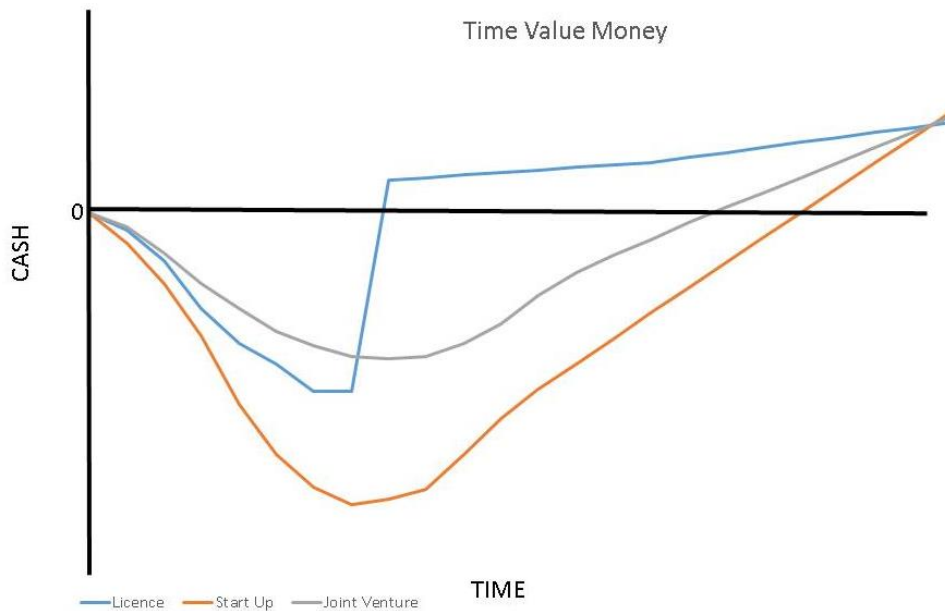


Figure 18: TVM Curves

Above is an example of what a TVM curve could look like. These curves were based on Mr. Madura and Professor Brown's IP and the research performed on the different commercial ventures that were probable. Each curve has its own distinctive shape. This is due to each venture requiring different decisions to be made based on the decision path. Additionally, each curve seems to start off trending in relatively the same direction before ultimately splitting off in their separate directions. This was determined to be the result of the decision-making process inventors go about when trying to commercialize IP. Based on the paths of the curves, it was approximated that there are three different zones a TVM curve can pass through.

Zone one is a stage early on in the decision making process when inventors are deciding on what venture path is the most practical to pursue in order to commercialize their IP. Here the curves stay relatively close to each other because there are similarities in the expenditures required to commercialize IP.

Zone two is the stage following the decision of what venture to pursue. At this point, the curves begin to look drastically different because the inventor's decisions are starting to conform to the nature of the venture they choose.

Finally, zone three is the zone where the venture begins seeing positive revenues. Depending on the venture path, the approximate timeline of reaching the breakeven point is variable. Figure 19 depicts where the zones are located on the following TVM graph.

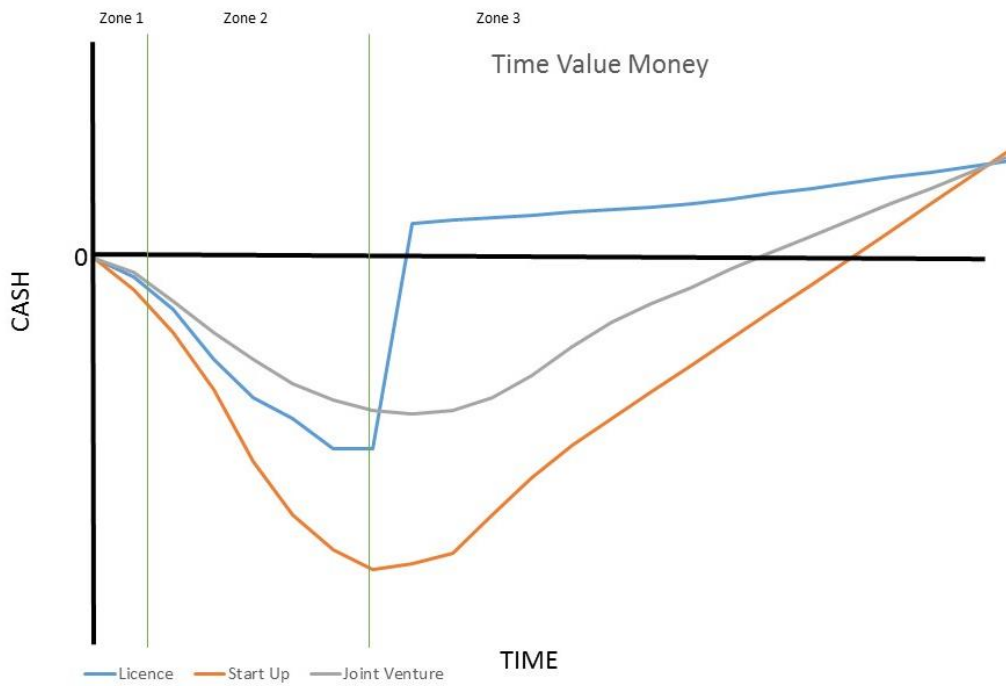


Figure 19: TVM Curves with Zones

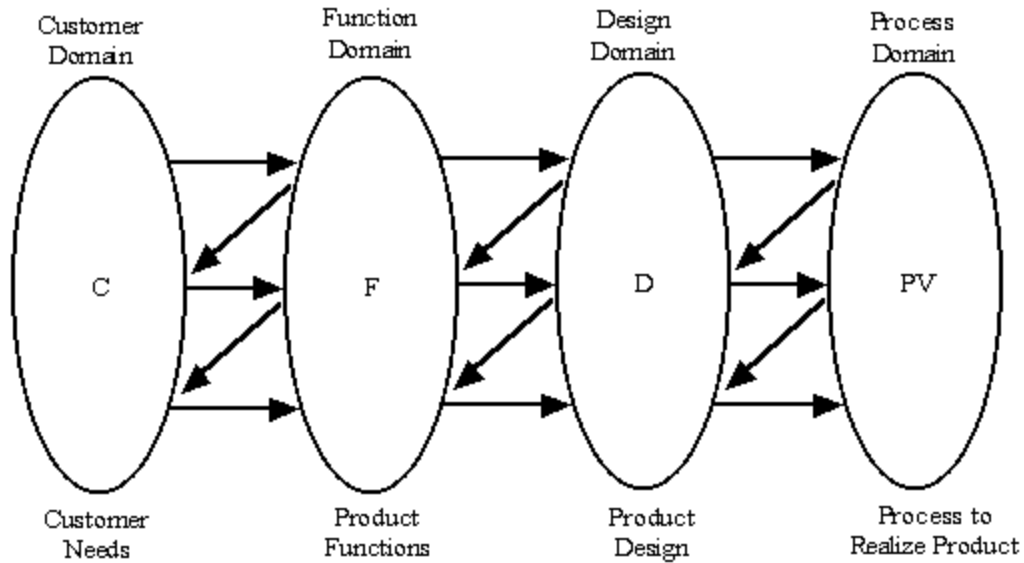
While TVM curves are not a perfect representation of commercializing IP, they do aid in illustrating the expenses that can be expected and incurred while pursuing different commercialization methods, relative to point zero. Both the inventors and the Tech Transfer Office need to understand the type of monetary investment associated with decision paths while determining commercial feasibility.

Chapter 4: Axiomatic Design Analysis of University Tech Transfer

4.1: Introduction to Axiomatic Design

Axiomatic design is a design method that was developed by Nam P. Suh, a mechanical engineering professor at MIT. Axiomatic Design differs from other design methods, because it enables the designer to answer important questions such as: Is this a good design? Why is it better than others? What can be done to improve this design? Etc. In this chapter, Axiomatic Design is used to explore the improvements that could be made to university Tech Transfer and the commercialization of IP (Suh, 1990).

Axiomatic Design is comprised into four domains: Consumer Attributes (CA), Functional Requirements (FR), Design Parameters (DP), and Process Variables (PV). CAs are the customer needs and wants that the design must satisfy and what adds value to the design; FRs are characterizations of the intended functionality of the device; DPs are physical characteristics of the design that must be specified; and PVs are variables that characterize the manufacturing of the product. These attributes can be seen in Figure 20 and display the design process as one that fluidly describes what the designer wants to achieve, as well as how they plan on achieving it (Suh, 1990 & Brown, 2013).



Product Design (source: Nam P. Suh)

Figure 20: Axiomatic Design Process

In this design method, Suh proposed two design axioms in Axiomatic Design: the Independence Axiom and the Information Axiom. An axiom is “...an accurate observation of the world but is not provable. An axiom must be a general truth for which no exceptions or counterexamples can be found” (Suh, 1990 & Suh, 1999).

The Independence Axiom is about adapting to change. Axiomatic Design states that for every FR, there is a DP that will satisfy it. This relationship between FRs and DPs can be expressed in the following design equation:

$$FR = [A] * DP$$

Equation 1: Axiomatic Design Relational Equation

The square matrix $[A]$ is a design matrix, which represents the fact that for each FR there is only one DP that controls it. This independence between the FRs accommodate change, and

allow the design to be able to be modified without having to start everything over from scratch. If there is no independence between FRs, the design is coupled and therefore cannot change one FR without affecting another. The object of this first axiom is to have a fully decoupled design, and if that is not possible, have the least number of couplings possible (Suh, 1990, & Brown 2013).

The second axiom is the Information Axiom and focuses around robustness with respect to change. This axiom uses information and knowledge to assign the parameters of the FR in order to further satisfy the Independence Axiom and assess the probability of achieving it. This is achieved by minimizing the information necessary in order to fully understand the design. For example, when designing something complex in nature, Axiomatic Design tells us that for every FR, it is desirable that a DP could individually satisfy it; otherwise, the design is less than ideal. When Axiom 1 presents multiple design options, Axiom 2 chooses the best option by showing the information content of each design. This occurs because the least amount of information necessary to satisfy the FRs, increases the probability of the success of that design (Brown 2013, Kulak 2010, & Suh 1990).

Axiomatic Design is a horizontally moving design process, which allows the user to move between domains from CAs, to FRs, to DPs, and finally to PVs. Knowing how each of these attributes interact, and how the two axioms affect each attribute, is important. If done correctly, the Axiomatic Design process can assist users from solving problems as simple as a better kitchen sink, to as complex as building a better NASA rocket.

4.2 Axiomatic Design of WPI Tech Transfer System

Using Accarlo®, an Axiomatic Design software, in pursuit of a viable system the top level goal, or FR0, of the current WPI Tech Transfer system is to commercialize IP developed in

a university setting. In the exploration of how this is accomplished, it was determined that in order to commercialize IP and best maximize the potential returns on an initial investment; the functional requirements are subsequently FR1: to protect the IP, FR2: to market the IP, and FR3: to secure potential income streams from IP, as shown in Figure 21.

#	[FR] Functional Requirements	[DP] Design Parameters
0	FR Commercialize IP developed in a University setting	DP System to commercialize IP developed in a University setting
1	FR Protect the IP	DP File for a Utility Patent
1.1	FR Disclose IP to partners (University)	DP Disclosure form
1.2	FR Evaluate patentability	DP System for evaluating patentability
2	FR Market the IP	DP Marketing plan
3	FR Secure potential income streams from IP	DP Feasibility analysis

Figure 21: Design Parameters for Functional Requirements of Current System

4.2.1 FR1: Protect the IP

The first level functional requirement, or FR1, of the decomposition is protecting the IP. FR1 is a multilevel process that requires two additional FRs to be accomplished. At the outset, the IP must be disclosed to the partners (FR1.1), which in the case of WPI Tech Transfer includes, but is not limited to, the IPI Office. Next, the patentability of the IP must be evaluated (FR1.2). In this phase, the IP’s commercial potential is explored. The next step is to then protect the IP by way of a patent or any additional legal protection that need be pursued.

4.2.2 FR2: Market the IP

Marketing the IP is the second level functional requirement, or FR2, of the decomposition. The marketing component focuses on the discovery and understanding of the customer for which the IP is designed. The customer, in this model, can serve as both an investor as well as the end user. This component is important because customers cannot wish to purchase

or invest in a product they do not know about. The distinguishing factor of this FR is that it couples with all of the third level FRs. This is because the marketing strategy that is developed in this level will have direct effect on all of the potential venture opportunities.

4.2.3 FR3: Secure potential income streams from IP

Securing the potential income streams from IP is the third level functional requirement, or FR3, of the decomposition and builds upon FR2. American businessman John D. Rockefeller was once quoted saying, “If you want to succeed you should strike out on new paths, rather than travel the worn paths of accepted success.” This can be particularly challenging when trying to secure income streams for new, untested technology. The inventors and the IPI Office must devise a formula for securing and identifying customers and distributors, which can be accomplished through positive relationships within the industry, and a desire to test waters of markets that have previously been untested.

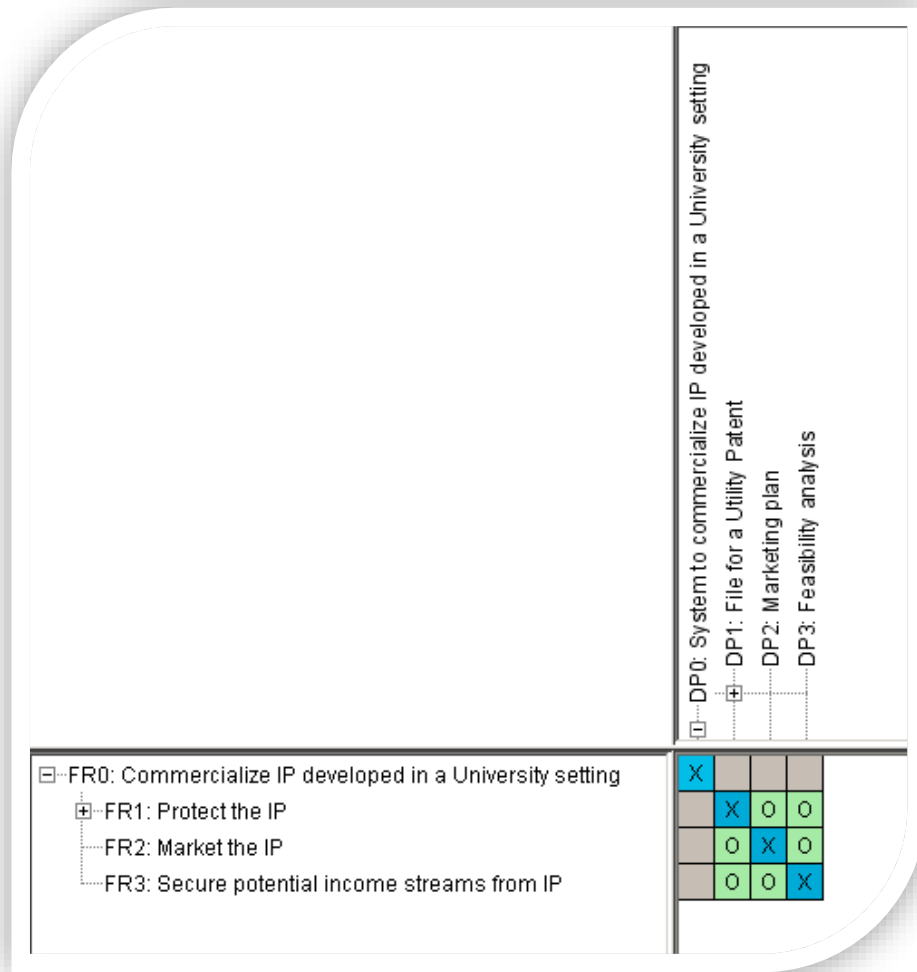


Figure 22: Axiomatic Design Decomposition of the Current System

4.3 Axiomatic Design of Probabilistic Model

Using Acclaro®, a decomposition for the Probabilistic Model proposed by Professor Jerome Schaufeld, which was further outlined in Chapter 3, was created. In this decomposition, the top level functional requirement is FR0: to recognize opportunities for commercially viable products. This goal is accomplished by FR1: recognize commercial opportunity; FR2: perform feasibility analysis; and FR3: establish project plan.

#	[FR] Functional Requirements	[DP] Design Parameters
0	FR Recognize opportunities for commercially viable products	DP Method for recognizing opportunities for commercially viable
1	FR Recognize commercial opportunity	DP Method for determining product viability
2	FR Perform feasibility analysis	DP Determine the optimal business route
3	FR Establish project plan	DP Detail business by developing business strategy

Figure 23: Design Parameters of Functional Requirements of the Probabilistic Model

4.3.1 Recognize Commercial Opportunity

The first level functional requirement, or FR1, of the decomposition is recognizing commercial opportunity. This is where the stakeholders need to have vision and identify whether there is a commercial opportunity for the IP. This opportunity could stem from a blue ocean within the industry or a consumer need for the IP, which is either faster, better, and/or cheaper than the competitors product. If the IP is determined to have commercial viability, then the stakeholders move forward with the commercialization process. However, if the IP is deemed not commercially viable, then the stakeholders must decide whether to hold or abandon the IP.

4.3.2 Perform Feasibility Analysis

The second level functional requirement, or FR2, of this decomposition is performing the feasibility analysis. This is the point where the product must be further evaluated for commercial viability. DP2 thus aims to evaluate and determine the optimal method for monetizing the idea by selecting the best possible business route with which to launch the venture. The feasibility analysis is crucial to understanding the expected returns and likelihood of commercial success.

4.3.3 Establish Project Plan

The FR3 of the decomposition is establishing a project plan. Once the IP has been proven to be both commercially viable and feasible, then the next step is to come up with a plan of attack to commercialize the IP. This plan usually consists of two parts, decision criteria and business strategies. The decision criteria determines how much market share the IP would likely undertake, and how much financial impact the project would undergo. It is important to determine if this product would be elite, meaning it would only target a niche in the market, or a value product, meaning that it would more likely be available to the general consumer.

Additionally, it is important to consider the financial impact of the product. The financial deficit of the project in the investment phase cannot exceed the expected return of the product, or else the project would likely fail. However, if the financial deficit is considerably below the return of the IP, then it is likely the IP did not capture the desired amount of commercial potential. In order to be successful, it is important to have a proper balance of both desired market share and financial deficit to ensure commercial success of the IP. This balance can be determined by conducting industry research and by determining what kind of product and market the stakeholders believe the IP should satisfy.

Once the correct balance of the decision criteria has been determined, the next step is to establish different business strategies for the commercial venture. These strategies could consist of, but are not limited to, marketing plan, financial plan, organizational plan, business milestones, competition analysis, pricing plan, implementation plan, risk analysis, technology plan, success metrics, and IP plan. A full display of the axiomatic design can be seen below in Figure 24.

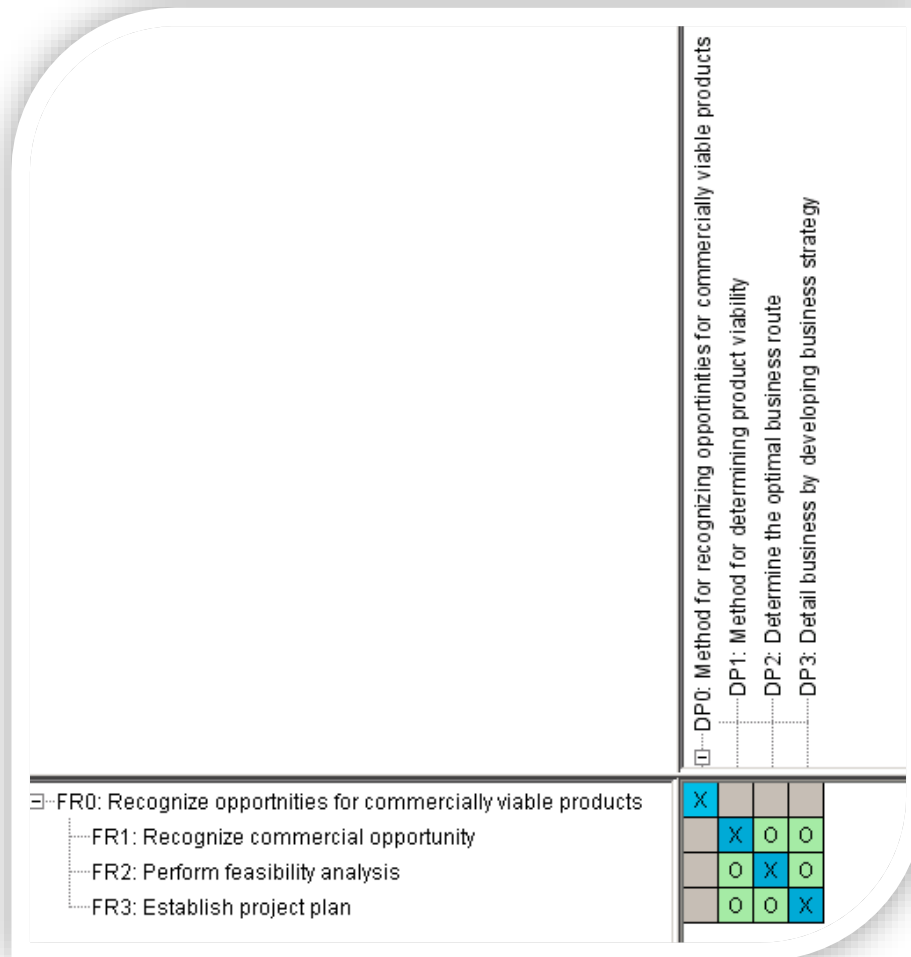


Figure 24: Axiomatic Design Decomposition of the Schaufeld Model

4.4 Comparison of Current System vs. Probabilistic Model

The current system for Tech Transfer and the probabilistic model share many things in common. However, both use different tactics in order to achieve the ultimate goal of successfully commercializing products created from university IP.

4.4.1 The Logic Behind Different Approaches

The existing Tech Transfer model focuses on protecting the IP before evaluating the commercial feasibility of the IP. The probabilistic model focuses primarily on the commercial feasibility and potential of the IP, before considering the protection of the IP.

The primary focus of the current Tech Transfer system is protecting IP and not missing out on an opportunity by being the first to file. Once the idea is considered “good”, a provisional patent is filed and evaluated to find a customer and applications for its use. This rapid approach causes the initial feasibility assessment and opportunity recognition to be done very quickly, affecting how the IP is handled later in the commercialization process. The process follows a push model, where the product is identified before the customers, marketing, and applications are determined after the design itself is completed.

In the Probabilistic model, the primary focus is the evaluation of the commercial possibility of an idea. The IP is evaluated and determined to be feasible before any capital investment is made or any protective measure are taken. This method is lengthy in the beginning of the process, but aims to set a more defined trajectory in the later life of an idea. This planning and thoughtfulness into the market potential and feasibility, coupled with attention to identifying potential customers leads to this process being a pull system. Market opportunities and customer needs are taken into account and a product is refined and presented to meet this need.

Chapter 5: Results & Conclusions

This MQP set out with the goal of trying to assist Professor Brown and Mr. Madura with the commercialization of their ski binding IP, which was established during Mr. Madura's MQP at WPI. However, the project began to shift from assisting Professor Brown and Mr. Madura, to trying to understand how to commercialize IP created in a university setting. This shift is what lead the MQP to the topic of technical transfer and commercialization within a university setting. This chapter highlights the three conclusions and five recommendations proposed about how to better promote commercial success of university Tech Transfer.

5.1: Conclusions

Conclusion	Explanation
Increasing Commercial Focus	Implement guidelines to further stimulate entrepreneurial and business minded thinking.
Understanding Opportunity Cost	Develop a method to understand the costs associated with commercializing university IP.
Improving Communication	Generate an agreement between interested parties detailing the shared responsibilities of commercializing university IP.

Table 3: Conclusions

5.1.1: Increasing Commercial Focus

University students generate hundreds of ideas every year, but of those ideas only few have commercial value. Simply put, an idea can be brilliant, but if there is no market or customer for the idea in question, then the Tech Transfer department is likely to pass on trying to help commercialize the idea. Determining if IP has the potential to be successful in a market is difficult, especially in STEM fields where markets are often yet to be established. An example of

this is Steve Jobs and the iPod. Steve Jobs created a solution to a problem that people were not even aware they had.

In order to adopt a mindset that best promotes having greater commercial focus in Tech Transfer departments, offices would benefit from implementing practices that stimulate entrepreneurial and business minded thinking. A way to do this is by using the thought process presented by the Probabilistic Model (Figure 16) to shape what kind of information inventors and offices consider when looking at IP. The model shows that it is important for the inventors and the IPI Office to first establish the commercial opportunity and feasibility of the IP before a patent is ever filed.

Additionally, Tech Transfer Offices would benefit from stressing the necessity of performing background research on the industry in which they are seeking to penetrate. By applying blue ocean strategy, the idea of the industry continuum, and understanding the industry better as a whole to see whether or not the IP offers a “blue ocean” opportunity can dramatically influence the likelihood of its commercial success (Kim & Mauborgne, 2004 & Sweeney, 2015).

The mission of the WPI IPI Office is to “Accelerate and facilitate commercialization of ideas from WPI research in concert with the overall mission of WPI” (Keiller, 2014). This shows that the IPI Office has a dedication, in its core values, to commercialization. However, practices observed by this team indicate a tendency toward protecting and patenting, versus commercialization and licensing. This is not an uncommon thing for Tech Transfer Offices to do. In an interview with Mark Rice, the former Vice Provost of Innovation and Entrepreneurship at WPI, he indicated that it is typical for Tech Transfer Offices to be better at protecting IP, than the actual commercialization of IP. This idea was further supported by the information received from other universities, as discussed in Chapter 2.

5.1.2: Understanding Opportunity Cost

A second conclusion proposed, was developing a method for better understanding the opportunity costs associated with commercializing university IP. Currently, a common misconception is that all it takes for IP to be commercially successful is if there is a good idea, and it is patented. This assumption is typically not valid, as there is an entire component to making IP commercially successful that is left out. This missing component is the marketing and analysis of the IP, and it is this step that has the ability to ultimately decide the fate of commercialization of an idea.

Commercialization opportunity is something that must be taken into consideration and detailed evaluation. The understanding amongst engineering students must become one that understands patents should not be treated as trophies because this encourages the patenting of commercially unviable technologies. These patents, while novel, will only serve the purpose of adorning a space on their wall. Allowing students to believe this approach to patenting is acceptable only provides them a disservice, and a particularly expensive one at that.

Engineers are among the world's best problem solvers, and this desire to find problems to solve, and invent new capabilities yields every technology used today. The world today poses different challenges than that of the past, and engineers in the past could simply invent, innovate and allow someone else to "deal with" the commercialization aspect. Today's engineer is different. Today's engineer is expected to also have ability to think in terms of business. It is the business side of IP that actually leads to tangible benefits, primarily commercial benefits. For example, there are over 100 patents for mousetraps. Each patent claims to be superior to the other, but only a small percentage of the designs have proven to be commercially successful (Towner, 2014). This is because there was no customer for a "better" mousetrap. The new and

improved mousetrap may have all the bells and whistles, and it may catch mice better and faster, but if people will not buy it, or if the inventors are unable to show its viability, the idea dies. This holds true for nearly every other case of trying to commercialize anything, if the market does not present an evident need, or a case cannot be made for the product, it will fail.

It is fair to assume that not all ideas that are labeled worthy of protecting by the Tech Transfer department will have a return on investment. Fortunately, this MQP does not aim to say every idea should be patented, but merely aims to best prepare and evaluate IP for its commercial potential. It only takes one million dollar idea that succeeds to fund all the other ventures that do not come to fruition. This is the opportunity cost of the university. If the partnership of the IPI Office and inventors cannot convince the world that their IP can perform better, faster, and cheaper, the venture will not make any money.

In the sphere of new technologies, the circumstances surrounding new ventures are tremendously volatile. It is generally a controversial subject in the academic world to use funds from the endowment to support ventures that have uncertain futures. However, for a net positive and successful Tech Transfer department to flourish, it must become clear what the expected rates of success are.

In an interview conducted with Mr. Peter Russo, a representative from Mass MEP, he discussed success in launching new ventures or licensing IP occurs in a very small percentage of all cases (Russo, 2015). Where a typical employee or department might be expected to achieve success 90% of the time, in a department such as IPI Office or a product development team, the percentage for expected successes is closer to 10%. In an interview with Professor Mark Rice, he shared that in his experience, WPI's IPI Office is "correct" in assessing commercial opportunities about 15% of the time, which relative to other institutions, is far above average.

5.1.3: Improving Communication

The third conclusion proposed is improving the communication between the inventors and the Tech Transfer Office. Communication must be meaningful, and open to the changing circumstances and challenges that could be encountered. Issues such as students graduating in the middle of the patent process, or geographical challenges posed during breaks, can strain communication efforts and the Tech Transfer process as a whole. Communication should be constant and allow the inventors and the office to stay informed as issues may arise and decisions are made. Constant communication also minimizes, and could potentially eradicate, the issue of “dual mystification.”

Once communication is established and protected, it is important that dialogue surrounding the expectations of the IP continue. These expectations can be in terms of what kind of venture to pursue, who to try and network with, and the desired positioning within the industry. Outlining these expectations is important for both partners as it provides responsibility and will allow a better foundation for mutual success.

5.2: Recommendations

President Laurie Leshin, in her inauguration speech, spoke about her goal to make WPI the premiere innovation polytechnic in the country (Leshin, 2014). With all of the brilliant minds that attend this institute, this is certainly attainable. However, in order to achieve this goal, the WPI community, as a whole, is recommended to further develop the Tech Transfer process. Below is an outline of the recommendations in regards to each of the conclusions: increasing commercial focus, understanding opportunity cost, and improving communication.

Recommendation	Explanation
Commercial Research Prior to Expending Resources	Require inventors to perform prior art search and initial market research as a prerequisite before approaching the IPI Office.
Investment in Tech Transfer Department	Additional capital and personnel investment into the Tech Transfer department in order to increase its capacity.
Cultivate Commercial Mindset	Provide inventors with the information to understand the purpose and costs associated with patents.
Communication Agreement	Create an agreement that outlines the expectations and responsibilities of each party during the Tech Transfer process.
Increase Awareness of the Department on Campus	Generating awareness through Tech Transfer website and the use of social media to allow for more people to be aware of the Tech Transfer department and its policies.

Table 4: Recommendations

5.2.1: Commercial Research Prior to Expending Resources

When an inventor first visits the Tech Transfer Office, the office would benefit from requiring the inventor to pitch their idea by providing market research, patent searches, and other valuable information to “sell” their idea to the office before it is taken on by the department. This way, the inventors have to recognize opportunity on their own, and establish if there is a market need for their product before the Tech Transfer Office uses any of its resources. In this model, some ideas have the potential to be abandoned and the office can more definitively assess the remaining IP, in order to determine if the university will invest in the IP. This recommendation is

loosely based off the MIT model, where an inventor is first sent away from the office to use resources found elsewhere around campus.

5.2.2: Investment in WPI Tech Transfer Department

Tech Transfer provides a multi-million dollar opportunity to universities that can best harness the IP generated by its community. A time tested truth of business is that it takes money to make money. Therefore, there must be an institutional commitment and investment in the Tech Transfer department for it to achieve great success. This does not entirely imply budgetary commitment, or the capacity of projects that can be taken on, but also relates to the staff. A correlation between all successful Tech Transfer Offices interviewed, was that they all had multiple employees within their respective departments. A larger department allows the opportunity for greater attention to be paid to individual projects and the realization of their individual commercial potentials. This would also allow for the process to be more personalized. It would be helpful if an idea had a single person to lead it from start to finish, similar to the “Cradle to Grave” approach used by Tech Transfer at Tufts University, and a larger staff would allow each staff member to dedicate more time to fewer projects.

5.2.3 Cultivate a Commercial Mindset

With regards to inventors, the recommendation is simply to provide them with the information to understand the purpose and costs associated with patents. As addressed earlier, there needs to be a cultural change from thinking of patents as trophies, to seeing them as vehicles to income. The expectation needs to be set that having a “good idea” is not enough to guarantee commercial success.

5.2.4: Communication Agreement

In order to improve the communication between the inventors and the Tech Transfer Office, it is recommended the office create an agreement that outlines the expectations and responsibilities of each party during the Tech Transfer process. This contract should not be used as an agreement to outline negative consequences if deadlines or expectations are not met, but rather provide the inventors and Tech Transfer Office with a foundation to their relationship. This agreement could outline things such as when communication should occur, the frequency of communication, when certain deadlines should be met, outline of what each party is responsible for doing in order to bring the IP to commercial success, and additional goals that are set forth by the parties.

5.2.5: Increasing Awareness of the Tech Transfer Department on Campus

Increasing awareness of Tech Transfer on campus is a good way to allow for a greater pool of potential IP to flow into the department. While there is currently some outreach to the student body, via undergraduate information sessions and personal presentations in class by the Tech Transfer department, there is an opportunity to enhance it further. Generating awareness through their website and the use of social media would allow for more people to be aware of the Tech Transfer department and its policies. This increased awareness has the potential to persuade inventors to consider presenting IP to the Tech Transfer department, who otherwise would not have. Social media also provides the opportunity to build a virtual relationship with students, faculty, and university partners, which might otherwise not be possible. This medium would allow for more constant communication of news coming out of the department and bring more positive attention to university Tech Transfer, which might not always be at the forefront of someone's mind.

To become the “...premier small technology transfer office that exceeds expectations in licensing technologies...” as the vision of the IPI Office advertises, additional programs would increase the likelihood of commercial success for inventors through practical application. These programs can come in the form of stronger entrepreneurial clubs or organizations on campus, classes that teach entrepreneurial and business skills to complement technical knowledge, and/or a program that encourages students to develop entrepreneurial skills in favor of postponing employment opportunities after graduation. The most important way to attract more entrepreneurial minds to WPI is to create an environment of entrepreneurship. The Innovation studio is an excellent start to this entrepreneurial ecosystem. In addition to the already influential TAN network, the Innovation studio has the potential to encourage alumni, students, and friends of WPI to meet in a common space to share ideas. It is also a place that can bring together veterans of technical transfer with those just starting out.

5.3: The New WPI Plan

In 1970, WPI adopted a revolutionary undergraduate program known as the “WPI Plan” (The WPI Plan, 2013). This plan has been the forefront of the university, and affects the way other colleagues, universities, and industry professionals view WPI. This program aimed to create an approach around education that was student centered and allowed the flexibility and excitement that students craved. The result of this plan was a student body successful at producing solutions. However, the next step of the WPI Plan is now to understand how to harness the opportunities presented by these solutions.

This step can be achieved through an innovative Tech Transfer Office. This office presents WPI with a blue ocean within academia and the university Tech Transfer system. The opportunity is to create a method for “best practices” for commercializing student IP. This

enhances the current system by sharing with students not only the education and experience that comes with patenting and commercializing IP, but also sharing with them profits generated through their ideas. This would place WPI at the forefront of a new frontier for undergraduate students in particular. Everything about WPI is unique to the university. With time, patience, and collaboration, Tech Transfer can be the next area where WPI focuses and decides to once again set itself apart from the paradigm.

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Appendix A: Interview Questions for Todd Keiller

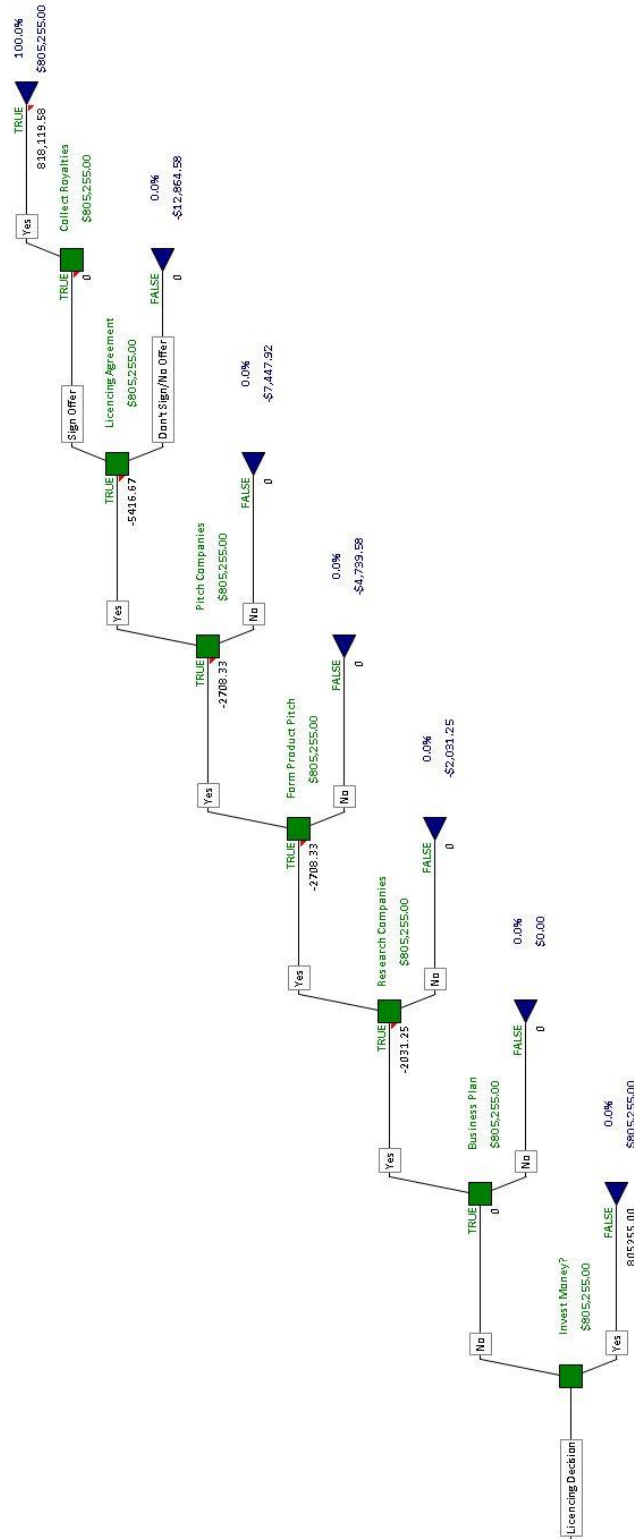
1. Can you describe in detail the process for how a student takes their MQP, gets the IP, and turns it into a business? (Forms, dates, people, places, etc.)
2. What's the difference in being consider "faculty" vs "student"? What makes MQP a "gray area"?
3. Does WPI partner with any technology transfer association? (AUTM, ATTP, MATTO, etc.)
4. What other Tech Transfer Offices do you communicate with? Could we get their contact information in order to interview them?
5. How is WPI tech transfer different from tech transfer at other schools?
6. What current changes are you looking to make to tech transfer at WPI?
7. How up to date/accurate is WPI Tech Transfer section on the website?
8. Can you explain to us your functional role with WPI?
9. What types of issues and opportunities does your office handle?
10. How does a student obtain a patent thru the university?
11. What are obstacles that have been encountered with past student projects relating to IP or patentable projects?
12. Are there any student ideas that have been launched into ventures for example Gompei goat cheese?

Appendix B: Interview Questions for Tech Transfer Representatives

Below is a full list of questions used during the interviews with tech transfer representatives from MIT, Northeastern, & Tufts.

1. Can you describe in detail the process for how a student takes their project idea, gets the IP, and turns it into a business? (Forms, dates, people, places, etc.)
2. What is the value to the student to partner with the university and patent through tech transfer (course credit, increased scholarship, split ownership of patent)
3. What emphasis does your university place on tech transfer, is it something regularly advertised or something professors bring up if it fits a students work (basically how do students find out that you exist)?
4. Have there been any obstacles that students have encountered regularly relating to taking their project ideas, getting the IP, and turning it into a business?
5. Are there any student ideas that have been launched into ventures as of late?
6. What practices make for “good” Tech Transfer at the university/academic level?
7. What differentiates your university Tech Transfer process from other universities?
8. What, if any, changes would you make to Tech Transfer at your university?
9. Does your university partner with any technology transfer association (AUTM, etc.)?

Appendix C: Full Decision Matrix



Appendix D: Revised Tech Transfer Flow Chart with Bottlenecks

Once our conclusions and recommendations were decided, we wondered how they would affect the current system flow chart shown in Chapter 2. After comparing the current system flow chart to our conclusions and recommendations, we realized that there were bottlenecks in certain areas of the current Tech Transfer system at WPI. The bottleneck areas, as highlighted in red, can be seen in the figure below.

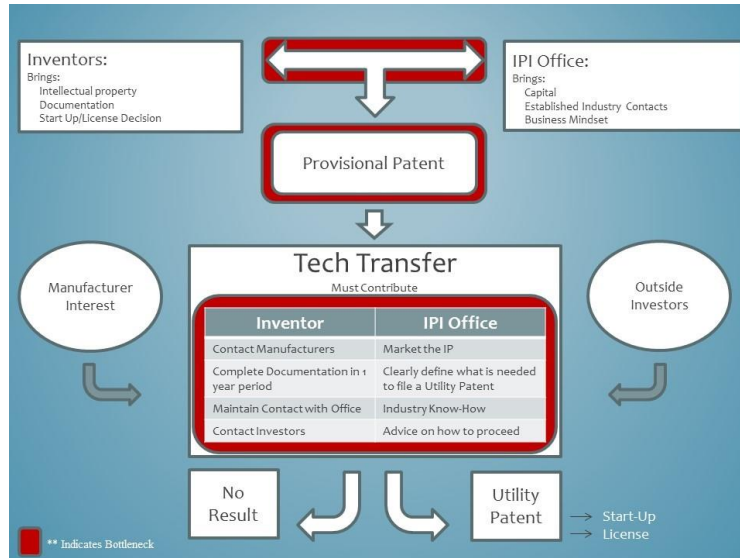


Figure 25: WPI Tech Transfer Process Flow Chart with Bottlenecks

Using the figure that highlights the bottleneck areas as well as our conclusions and recommendations, we designed a new flow chart of what the Tech Transfer process at WPI could look like. This design can be seen in the figure below.

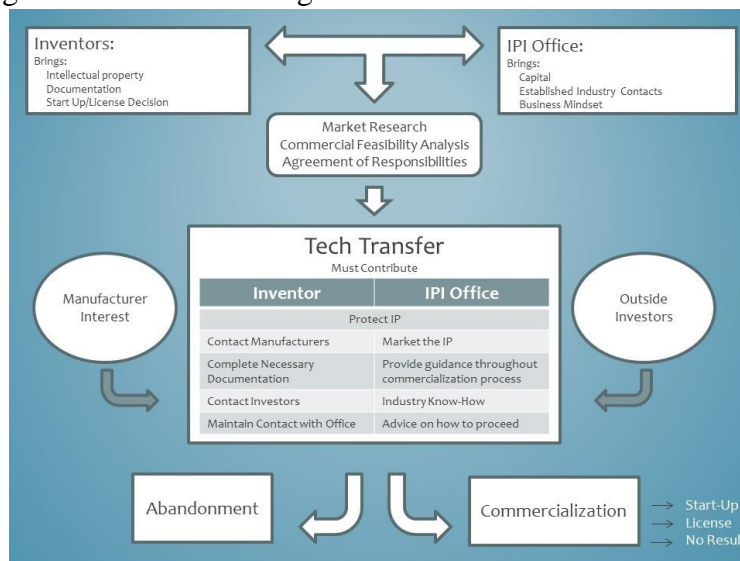


Figure 26: Revised WPI Tech Transfer Process Flowchart