What Every Researcher Needs to Know About Commercialization[1]

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In this tutorial we are going to look at what commercialization is and why you should care about it. For those who do care, we will go on to talk about how to accomplish it with the aid of your employer's Knowledge Transfer Office or Knowledge Transfer Officer. (We will use KTO as an abbreviation covering both.) Although the emphasis in this tutorial is on inventions, much of what we say will apply to creative works (such as art, literature, designs) as well. Where creative works are created as part of inventing or commercializing a technology, we will explicitly discuss them.

The Tutorial has four parts. We begin with an overview of the basics. Next, we look at what you can do to improve the likelihood your inventions will be commercialized. We then look at how deals are done. We end with a few closing thoughts.

For those of you working in a research organization with a knowledge transfer officer or office (KTO) – sometimes called a technology transfer officer or office – at the end of each major of this tutorial, we include a brief discussion on working with your KTO. Your KTO, working in collaboration with the Central KTO of the Research and Innovation Foundation (RIF), will help you protect and exploit your inventions on behalf of yourself and your employer. Both your research organization's KTO staff can guide you in documenting your invention. As the legal agent for your employer, they usually have authority to negotiate and sign non-disclosure agreements (NDAs) and do deals. They will also monitor the deals to make sure payments are received from licenses and sales of technology and distribute your share of the proceeds to you. Further, if you want to spin-out a company to exploit an invention, they will explain the process for doing so and help you do just that.

If you are in a business, similar considerations will apply, only instead of a KTO you will work with business development, legal, or another person or group in the company.

Note: nothing in this tutorial should be construed as legal advice. If you want legal advice, see your lawyer.

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Basics

What is Commercialization?

Knowledge transfer occurs when research, development, and innovation (RD&I) results developed in one unit of an organization are adopted by another unit of that organization or by another entity. That other entity can be in the public sector or private sector. Commercialization occurs when the party transferring those RD&I results receives money in exchange for giving up some or all of their rights to specific results. In other words, commercialization involves a sale. The buyer pays the seller for some or all of the seller's rights in the results. Money changes hands.

If no-one wants to pay to acquire the results, they cannot be commercialized. They may still can be great science or great engineering. It even can be incredibly important socially, such as a new way of adapting to climate change or a new way of preventing the next pandemic. But *by definition*, if no money changes hands, nothing is commercialized.

Why Should I Care about Commercialization

If you are the inventor of a new idea, you probably have money coming if it is commercialized. As the inventor, unless you sign away your ownership rights, you own what springs forth out of your head. (Of course, if the invention was a team effort, everyone collectively owns the rights. We shall talk about how to determine your share below.) Most folks would agree more money is better than less money. Now you know one reason why you care. You can make money off your ideas. Depending on your institution's policies for allocating royalty revenues, part of the money collected also may go to your lab, department, or center – supporting future research.

You also garner indirect benefits from commercialization. Inventions that are commercialized help enhance the reputation of a researcher, making it easier to attract government and foundation funding for future research as you now have a track record at doing useful research as well as good science or engineering. Companies that license your inventions are often willing to help support future research in related areas, both to gain access to graduate students and to get a window on the cutting edge of one of the fields of R&D relevant for their business.

Finally, and for many the most important reason, it is personally rewarding to see your ideas become products and services that make people's lives better.

How Do I Know if I am Inventing or Creating Something?

Don't worry about it. You probably already are inventing things. Every time you – either alone or with others – say *Eureka*, an invention likely has occurred. Inventions are always spewing forth, like Athena springing from the head of Zeus. The trick is to stop and recognize them for what they are.

Modern science and engineering is manipulative, by which we mean that we prove our hypotheses by doing something that makes the world behave in a way that it would not but for our intervention. It does not matter if we are slamming subatomic particles together in an accelerator, attaching a protein to a virus to get it through a cell wall, using a new algorithm to recognize a pattern in an image, or knowledge engineering information about career paths and mapping that to college offerings to make it easier for

high school juniors to decide what colleges to apply to. Whenever we manipulate the physical world in new ways and get new outcomes, we have made an invention. Both the outcomes (for example a new material) and the tools and techniques used to create and measure the outcomes may be patentable.

Inventions are a sub-class of innovations. An innovation is a *new* method, contrivance, or device introduced into a field of practical use. Inventions occur when an innovation is *novel, unique, and reduced to practice.* (For the invention to be suitable for patent protection, it must also be in an allowable subject matter, it cannot have been publicly disclosed prior to filing for patent protection, and the inventor or assignee must be the first to file for patent protection.)

Sometimes the invention seems trivial in retrospect. But that does not mean it is not important. Probably the most famous invention in United States' history for Americans is "sliced bread." Everyone in the USA knows the adage, "That's the best thing since sliced bread." The reason American's say that is because early toasters, like Edison's light bulbs, had filaments that burned out easily. Since the filaments could not be easily encased in a vacuum, the solution to prevent them from burning out was to change the width of the bread. It was the constraints on the design of the toaster that led to the invention of sliced bread.

Bottom line: if you can think of any way that a scientific or engineering insight might enable manipulating the world in a novel way, you probably have made an invention. The invention likely is the tools and techniques used to accomplish that manipulation. It may also be the materials created or other outcomes of the experimental procedure.

Who is an Inventor? Who is an Author?

Inventors are the people who conceive useful ideas and reduce them to practice. Conception is the act of coming up with the invention. Reducing to practice means describing them in such a way that they can be made.

Only those people who contribute to the original idea can be considered its inventors. The Research Assistant (RA) who only runs to the library and downloads or synopsizes articles is not an inventor. Providing background data, no matter how challenging the job, is not the same as contributing to the invention. If you are a graduate student or post-doc, the faculty advisor who recommends you read a specific book are article to get ideas on how to solve a problem in your research also is not an inventor.

Now suppose that you are a professor. You are chatting with your RA over a beer at the local pub about what they learned from a literature review you had them do and suddenly you have an epiphany. The RA is not a co-inventor because they did not contribute to the specific idea, to what we can call "the secret sauce" that constitutes the invention. But, if you are having that same discussion about the background information and data found and then you start bouncing around ideas and brainstorming with the RA over the various ways to apply the information and data in your research and you suddenly go "Eureka!", you do have a co-inventor. The reason is the brainstorming process involved building upon each other's ideas of how to do something useful with the information and data from background literature review. The process of invention began when the discussion shifted from what was known and might be useful background to how to do a specific something that is new and useful with that knowledge.

Just having something new and potentially useful is not enough for invention however. The ideas must also be capable of being reduced to practice. For example, I participate in something called Kinetic Skuplture Racing. (See http://www.ptkineticrace.org/.) People build human powered vehicles that go 7 miles over land, through a sand beach, through a mud bog, and across a mile of water. The winner is the racer that finishes in the dead middle of the heat without the rider(s) ever getting off to push or pull or swim alongside. They win the Mediocrity Award. (Kinetic Skuplture Racing is for folks who want to just have fun and do not worry about looking silly.) For a few years now I have been thinking about building an airship with a bicycle powered propeller. I have never seen that done. So the idea is novel. An airship could finish the race, so it is useful. Unfortunately, I have not yet figured out how to make one I can control on a windy day. *Not fleshed out enough to reduce it to practice*. *No invention.*

Let's return to the professor and RA example. Suppose you have been talking about a literature review and suddenly say "Eureka!". So far you are the exclusive creator of the idea. But you cannot figure out how to manipulate the physical world in order to do the experiment. Right now you are in the position of someone who says "A perpetual motion machine is a great idea. The problem is no-one knows how to make one." So you ask the RA for her or his ideas on how to conduct the experiment and, dang, the kid has an idea for a device or a chemical or some other something that makes it possible to actually do it. Co-inventor!

A takeaway is that conceiving and reducing to practice is a process that can occur in a moment or over a period of time. The inventors are involved in the entire process, but when we say the entire process, it is the process of conceiving something feasible (i.e. reducible to practice) we are talking about.

Now that we have inventorship, let's briefly look at authorship. Authorship also involves conception, but here there is no need that the ideas be useful. All that is required is that you embody your ideas in a material form, so they can be communicated. It can be on a piece of paper, in a digital file, or carvings on a boulder in the field.

What this means is that your co-authors on publications about the inventions are not necessary co-inventors. Collecting background data, running the experiment, writing up findings, editing the paper, or any one of the myriad of other tasks involved in getting an article ready for publication has nothing to do with inventing. To invent you have be there when a useful idea is conceived and reduced to practice.

To conclude: People have many ideas, but only people whose ideas are both useful and can actually be made are inventors. In this sense, inventorship is a subclass of authorship.

Who Owns My Inventions?

Inventions are owned by the inventors unless they sign that right away. University, government, and corporate researchers typically sign away their rights to their inventions when they sign an employment contract. The reason this is fair is that part of the reason you are being paid is to create new ideas, knowledge, and knowhow (that is, to do intellectual "work for hire").

The notion of a work for hire may mean you own your invention regardless of your employment contract. In general, researchers only sign away inventions within the scope of employment (that is related to the work you are doing) or which have been made with the aid of their employer's resources, facilities, equipment, etc. Unless you have explicitly signed away the right to an invention or range of inventions, you own what you invent.

Fortunately for you, as an incentive for inventing, most employers share the proceeds from inventions with the people who made them. To clarify what incentives exist, ask your KTO for a copy of the research organization's Intellectual Property Policy or where to find it on-line.

Who Can Negotiate and Sign Non-Disclosure Agreements, Materials Transfer Agreements, Licenses and Other Documents Affecting My Invention

The safest Rule of Thumb is: You cannot sign or negotiate anything! Because in almost all cases you will not be the owner of the inventions you have made, you cannot negotiate or sign anything with third parties that might affect your employer's rights in the intellectual property. That is a job for the authorized agent of your employer. Usually that agent is the Knowledge Transfer Office or the vice-rector, provost, vice-president, or other person who has line authority over the KTO as part of their job. When in doubt, contact the KTO.

How do I Determine Contribution to the Invention among Co-Inventors?

There is no hard and fast rule for determining what proportion of credit a co-inventor deserves. For this reason, it is wise at the time of invention for the co-inventors to determine the proportion of contribution each made to the invention. When it doubt, divide it equally if that seems fair. If it does not seem fair to you or another-coinventor, ask the person disputing the split to justify why it should be not be equal shares in writing, then you and the other co-inventors to comment on that justification, and circulate the responses to see if a consensus emerges. If it does not, it is best to stay with equal shares. After all if you and the other co-inventors cannot agree, it is unlikely someone who was not there know what set of unequal shares would be fair.

This much we do know from experience: It is far easier to fix shares in an invention when its value is unknown than when there is substantial money up for grabs. So, if you can determine relative credit, document the percentage of contribution to the invention of each co-inventor in the Inventor's Notebook and Disclosure. (These are discussed below.) All the fellow inventors should sign and date the Inventor's Notebook or a separate document (which is witnessed by two non-inventors) to establish they signed off on the split of inventorship.

Be sure when determining shares to include any technical, staff, students, post-docs or others who contributed to the invention.

How Do I Prove It's *My* (or *Our*) Invention?

First, document it. Write down a description of the invention, sign and date the description, and get a couple of people to witness your documentation and sign and date that fact on the same document. In order to establish who owns what, we also recommend writing down where you made the invention, if you made it on your employer's time, and even if not, whether it was related to the work you were hired to do and whether you used any of your employer's facilities, equipment, or other resources in the process of invention.

We recommend you use an Inventor's Notebook to document your inventions. These notebooks have the pages sewn or glued with each page consecutively numbered so no-one can remover or add pages without trace. Because they are hard to fake, Inventor's Notebooks are admissible in most countries' Courts of Law. The date your invention was signed and witnessed is evidence that proves the date when you came up with the invention. Write clearly and legibly. Drawings often help, so use them. Number them sequentially (e.g. Fig. 1, Fig. 2, etc.) and label them. If you do use your computer to make any of the drawings (or text), print things out and tape or glue them in such a way that it would be very clear that they were moved in order to keep with the intent of creating a documentary record that will hold as evidence if you ever have to go to court to prove your invention is yours.

Be aware that others may independently come up with same invention. For this reason, we recommend documenting the invention as soon as possible and writing down the time as well as the date and filing a patent application as soon as possible to establish your priority date. If the invention is connected with work or use of your employer's resources, immediate file a disclosure with your KTO and ask them to file a patent application. For obvious reasons, it is better if your spouse, children, mother or father, significant other, or friend are not the only witnesses – but if you do it late at night, get them to witness and then have colleagues also witness the invention in the morning. Each witness should write that they have read and understood the invention. As they can be called into a Court of Law to demonstrate that understanding, make sure they do. So if what you wrote is not enough to let them honestly say that, you need to document the invention better.

Because this notebook may one day be used as evidence in a Court Of Law, never write anything in it that is not true and never erase or modify anything that you have drawn or written. Just cross it out with a big X if need be and make it anew. You want to do nothing that would lead anyone to suspect the veracity of the Notebook.

One BIG CAUTION: In almost all countries, patents are issued to the first to file. So just because you are the first inventor does not mean you can get a patent in most countries. For this reason, timely filing of patents is critical if you think your invention has economic value.

Disclosures are another layer of documentation of invention beyond the Inventor's Notebook or witnessed statement. These are used by universities and other research organizations and by companies. Be sure you know the procedure for filing a disclosure with your KTO.

Disclosures record the time, date, and people contributing to/participating in the invention; what it is; what is the "secret sauce behind the invention; why it is significant; whether anyone has done this before; and if have you disclosed it to anyone. It may ask for other data as well, such as who might use it, how it is better than substitutable technology currently on the market or in development, and who might be interested in licensing it, investing in it, our buying it.

Wait! What was that Disclose Thing?

Got your attention. Good. *This next section is very important.*

When you make an invention, it is in your head. (The fact that it is in your head is why we call inventions *intellectual assets.* Intellectual means it comes from your mind. Asset means you might be able to do something economically useful with it.) So far your invention is a secret. If you write it down in your Notebook, it is still a secret because no-one has read it yet.

Intellectual assets become *Intellectual Property* if positive acts are taken to convert the assets into property. By converting an asset into property, we can protect others from using it without authorization. We will discuss Intellectual Property in more detail later. For now, it is important to be aware that just as with land you might own, you can keep people from "trespassing" on your intellectual property, which is to say, you can keep them from using it, making it, selling it, etc.

To get property rights, you need to be proactive. The quickest and easiest way to create a property right in your invention is to take affirmative steps to keep it secret. Trade secrets are ideas that can be valuable (used in trade) and are kept secret. Trade secrets are a kind of intellectual property. If someone who knows your trade secret discloses it, you can sue them in a Court of Law and collect damages for the disclosure if you win.

Now for the tricky part: The moment you open your mouth or show someone the Notebook, you have disclosed it. It is no longer a secret unless they have agreed in advance to keep it as a secret. If they have not agreed in advanced to keep it a secret and you tell them, you lose your trade secret. The way you get someone to agree in advance to keep it a secret and document that they have agreed to keep it secret is to have them sign a Non-Disclosure Agreement (NDA). A NDA is just a contract saying they promise not to tell anyone else what you tell them (i.e., to not further disclose) in exchange for your telling them about your secret.

Because this is so important, forgive me for repeating it. In the absence of a NDA, the people to whom you disclose your invention can blab it to whomever they want whenever they want. That means you have just given your invention away for free. Giving inventions away for free is fine if that is what you really want to do. It is a real bummer, however, if you hope to make money off them.

In the most cases, unless everyone who sees the disclosure is under an NDA, well …., you blew it. Once you publically disclose an idea, you cannot patent it in most jurisdictions. Worse, having disclosed it without an NDA, its status as a trade secret is gone, too. Oops.

One final caution: Be careful when you give symposia or hold classes. A colleague at your own university may not be under an NDA as part of their employment contract. Undergraduates and grad students most likely are not unless they are on institutionally-funded financial aid or hold teaching assistantships, research assistantships, fellowships, and the like and have explicitly consented to an NDA as a term in the contract or grant they accepted. Similarly, you have to watch out during dinner or pillow talk.

Now, obviously this creates a problem for getting inventions witnessed in your Inventor's Notebook. The solution is to either disclose only to people already under an NDA or to have one ready for them to sign. Usually, fellow employees are already under NDAs with respect to each other's inventions. Check with your KTO to make sure that is the case before making a disclosure, if you are not sure. As for everyone else, your KTO can get an NDA in place for you and let you know when it is OK to disclose the invention to them.

If you are your own employer, or own a small business that does not have a standard NDA or a KTO, an NDA from the World Intellectual Property Organization (an agency of the United Nations) can be found at pcd08043_RFP_a5.doc (live.com). Show it to your lawyer to adapt to your needs and to make sure it can be enforced in your jurisdiction. Make sure you put the name of the owner of the technology as the party for the NDA. Do not make one in your own name unless you really are the owner.

But What About Publish or Perish?

A publication is a disclosure. Submitting for publication need not be. If the journal you wish to submit to, and its editors and reviewers, will sign an NDA, then the article you submit is not disclosed until the journal is sent out to the readership. Your KTO will put in place the necessary NDAs. They will also work with you to determine if your technology has commercial value and, if so, get a patent application filed in a timely manner so publication and papers are not held up.

How are Inventions Protected?

Intellectual assets are ideas, know-how, and other economically valuable information and data that has been embodied in some material form and documented. Because they have been materially embodied, they can be shared. They are objects. As we noted above, unless you proactively convert your inventions to *intellectual property* there is no legal prohibition against anyone taking them and using them even if you do not want them to.

Often that is OK. We publish fundamental research results all the time in the hopes that colleagues will find them interesting and use them to further the advance of knowledge. Sometimes, however, we suspect that our advances can be exploited for gain. In those cases, it seems only fair that we should be a beneficiary and receive some of the money that will be made and receive our fair share of any glory that comes from improving the lot of humanity.

Whatever jurisdiction, intellectual property is like any other property. Property is an artefact of law. As the English philosopher Thomas Hobbes said in Chapter XIII of *The Leviathan* in the State of Nature, the life of man was nasty, brutish, and short. No-one could rest secure in their person or property. Intellectual property secures your intellectual assets from unauthorized exploitation by others. As the world is broken up into a variety of sovereign jurisdictions, there are a variety of nuisances in how intellectual property is created and protected as one crosses borders. That said, the trend is clearly towards global harmonization in order to keep pace with the unification of the global economy.

In the eyes of the law, all property is just a bundle of rights. These rights can be sliced and diced however the owner wants. Take a house, for example. You can buy it and own it, in which case you own all the rights to the house. You can lease it for a year, in which case you own some rights to use it for that year, while all the rest of the rights in the house belong to the landlord. You may be able to sublease it, in which case you have the right to sell part of your rights to yet another party. The landlord may let you lease it as you wish or the landlord may restrict subleases to residential use only. Again, all property is just a bundle of rights, granted by law, which you can slice, dice, and divvy out as you see fit within any restrictions allowed by law. (For example, suppose you are the inventor of a thermonuclear bomb. National Security laws prohibit you from licensing it even though you own it.)

Whatever the jurisdiction, we can divide intellectual property up into four main categories or bins. The following table presents these categories with data on their creating and coverage ***in Cyprus and the European Union***. ***Be aware that other countries may have other rules.***

Type	**Protects in the jurisdiction where it was created**	**Created By**	**Duration so long as fees are paid**	**Applicable Law**
Trade Secret	Valuable ideas that are not generally known, not readily ascertainable by normal means, and proactively kept secret	Keeping the idea secret	As long as kept secret	Cypriot Law harmonized with the EU +EU Law +Int'l Treaties
Patent	Inventions that are novel, useful, unobvious, well described, industrially applicable	Filing a patent application and successfully prosecuting (obtaining) it	20 years (which in cases of pharmaceutical or plant-protection products may be extended up to 25 years and in cases of paediatric pharmaceutical products up to 25 years and 6 months,	Cypriot Law harmonized with the EU +EU Law +Int'l Treaties

Type	Protects in the jurisdiction where it was created	Created By	Duration so long as fees are paid	Applicable Law
Industrial Design	The external design or the appearance of the whole or part of a product, which arises from its particular characteristics. It must be new, unique, and not conflict with law or morality.	Filing an industrial design application	25 years	Cypriot Law harmonized with the EU +EU Law +Int'l Treaties
Copyright	Works of authorship or creativity fixed in a tangible medium of expression through which they can be perceived reproduced, or otherwise communicated	Copyright is acquired automatically, without the need to file the work or submit an application and the exploitation right can be exercised automatically.	Generally, life of the creator or author plus 70 years (or the death of the last author/creator if more than one individual is involved).	Cypriot Law harmonized with the EU +EU Law +Int'l Treaties
Trade and Service Marks	A distinctive image/symbol, letter or word (element) or a combination of elements, which is used to distinguish the products or services of an enterprise from the products or services of other enterprises	Registration (which demonstrates the mark is capable of distinguishing the products or services of an enterprise from those of other enterprises and clearly determines the object of the protection provided to its beneficiary with clarity and accuracy.) +Application grants seniority rights already +Use in market +Well-known marks	Ten years from initial registration and renewable thereafter for periods of 10 years indefinitely.	Cypriot Law harmonized with the EU +EU Law +Int'l Treaties

Think of the different kinds of intellectual property as different tools you can use to exploit your invention. For example, an issued patent provides an enforceable right to prohibit non-licensees from making or using the invention in commerce in, selling it in, and in some cases even transporting goods incorporating it through a jurisdiction where patent protection exists. The mere act of publication by the government puts others on notice they should not infringe and also may lead to potential licensees approaching you. However, it is important to be clear that patents are not always the preferred solution.

To begin with, not everything can be patented. Natural phenomena, including mathematical formulas, cannot be patented. Only man-made "things" can be patented. What is included in the definition of man-made things has been steadily broadened so it now includes software, genetically engineered plants, and in some jurisdictions business methods.

Next, a public disclosure may prevent moving forward with a patent application. While there are some exemptions to this rule in the EU, they are generally seen as hard to obtain.

Third, some inventions, such as manufacturing methods, may be able to be practiced or designed around without your ever knowing it. This is often the case with certain manufacturing methods, such as a way of mixing chemicals to create a common commodity like urea. The trade-off for the exclusive rights patents provide, is that the information in them is published by governments so others may build upon what you have done. That means unscrupulous people may be able to practice your invention without you ever knowing. Sometimes, it makes more sense to keep the invention a trade secret and license it as trade secret. This is the case where an invention is easy to copy and use in secret or design around. Should you have an invention that is easy to design around, or a product that can be reverse-engineered once on the market, another strategy may be more useful. File a provisional patent application to keep it a secret initially. Provision applications are a uniquely American filing that gives the applicant a one-year grace period before a full patent application must be filed. The provisional application is never published or disclosed unless there is litigation, as when there is a dispute over the priority date for an invention. (The priority date is the date used to determine who has the right to get a patent – the date of first invention in the US, the date of first filing elsewhere.) The provisional secures the priority date while giving a one-year period in which to move it towards the market. During that year you can decide whether to continue to file the complete application necessary to obtain a patent.

The final consideration is cost. Patents are not cheap. In the EU, patents can cost between € 25.000 to € 50.000 depending on the county in which you file. If international coverage is desired, the costs can soar. So the downstream Net revenue stream from a product or service protected by a patent minus the costs of obtaining the protection has to be compared with the revenues stream of that product or service without protection to justify the cost.

Also be aware the kinds of IP protection you can obtain are not necessarily mutually exclusive. A user interface might be copyrighted as a work of art and also potentially be the subject of an industrial design patent. If novel software is required to create the interface, it may be the subject for a utility patent. If manuals or other documentation are important for exploiting the technology, it probably makes sense to copyright them to enhance the portfolio of protection for a patented technology. Doing so has an additional benefit. Since the life of a patent usually is only 20 years, by bundling the two together and

writing a license deal to say royalties should be paid until all intellectual property expires, you extend the period in which royalties might be obtained. Similarly, trade or service marks may generate revenue long after the original patent has expired. Think about the enduring value of the label “zipper.”

What is My Invention Worth?

The simple answer is you try to sell it, and if you can, you know what it is worth. Worth, or commercial value, is an economic concept. It refers to what price a technology can command in the market. If there has not been a transaction, then any commercial value placed on the technology is, by definition, a guesstimate.

The value of a technology reflects the Net Discounted Value it generates over time. Net Value in any given year is the profit, that is the revenues minus the costs of garnering those revenues. Discounting takes into account the time value of money and the risks associated with realizing the revenues. Net Discounted Value is a matter of calculating, over the period it generates income, the net discounted cash flow generated.

The calculation of discounted cash flow begins with revenues. We usually use net revenues, which are gross revenues minus sales and discounts. Net revenues are what go into the bank account of the seller. When we measure costs, we usually use the Cost of Goods Sold (COGS). COGS is the materials, labor, direct overhead, and other costs that go into making the product or service. Like Net Revenues, these costs are usually straightforward to measure. Net Revenues minus COGS gives us Gross Profit. (NR – COGS = GP.)

To get to Net Profit, there are other costs we have to take into account. Operating costs are the cost of acquiring the technology, R&D, the cost of selling it, and the allocable portion of General and Administrative costs (G&A, the costs of running the business). We also have to subtract the cost of interest on capital, taxes, etc. before we can know the Net Profit for a technology.

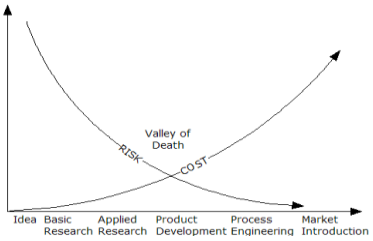
Next, we have to consider discounting. A euro received tomorrow is not worth as much as a euro today (even without rampant inflation), as there is a risk you may never get it. So, we have to take into account the risks our forecasts of revenues and costs could be wrong. The discount rate is simply a probability of receiving the funds which we apply to the Net Profits over time to determine the discounted cash flow value.

If you are getting the impression that calculating a discounted cash flow is somewhat of a black art, you are getting the right impression. Unless we have already sold the intellectual property, its value is always an educated guess at best – and usually a SWAG (scientific wild-assed guess).

Because of the difficulty of calculating reasonably accurate values, we tend to look at comparables and make guesses about the value of a technology by adjusting what we know about sales for related ones. For example, say you have selectively bred a new fish that can be fish farmed for European consumption. We might calculate its value by looking at the sales and COGS history of other fish that have been introduced, such as salmon, tilapia or arctic char, and then making adjustments to those numbers based on what is similar and what is different about this new fish in order to guess at its value.

Note that so far we have been asking about the value of the intellectual property in the market, not how much it is worth to us. What revenues it will generate and what we will make are two different questions. Inventing is only the first step in incorporating a new invention in a product, service, or process and bringing it to market. Thus, the amount of money we make is not going to be the value of the invention but rather some proportion of that value which is equal to the contribution of the invention to the total value of the goods *sold and supported* in the market.

The proportion of total value going to inventors is usually pretty small. The more immature the technology, the smaller is the percentage given to the inventors. The reason has to do with risk. Inventing and R&D can reduce the *technical risk* associated with bringing a technology to market, but there are still very substantial expenditures needed to complete new product or service development and then make and sell products and services. The more product or service development, interface design, production engineering, etc. required, the higher the *technical risk*. The more product or service development, production engineering, sales preparation, etc. that are needed, the more chances there are for something to go wrong. These kind of chances for mistakes are called *firm-specific risk.* These two kinds of risk cause delays in getting to market and drive the costs up in doing so. There is also *market risk*, which has to do with whether the intended customer segments will actually purchase the good or service. The greater the *market risk*, the lower the certainty of the forecasted revenues. Another risk is *IP risk*, which means that an unpublished patent application may sudden show up, become an issued patent, and suddenly the company making and selling a product incorporated the invention covered by that patent is getting sued for infringement. That clearly is an expense, These last two also can reduce revenues or drive up costs.



The rate at which risk is reduced is reflected in the rate of decline in the discount rate. If the discount rate remains high, then the likelihood of attaining the forecasted revenues is smaller and the value of the IP is less. Smaller discounted cash flow values make it harder to justify the ever-increasing cash outlays required to get to the first sales. If the inventors get too large a share of the cash flow, after the costs of acquiring the IP have been paid there is not a lot of money left over for the seller. It may not be profitable to bring the invention to market. This situation is a dilemma. The technology in the invention may be a great idea and potentially a great commercial success, but if, after you run the numbers, you are not sure you make enough money off it to justify the expenses ... well, what good business executive cares to pursue it? You cannot not feed your family or pay dividends to shareholders on “potentially great successes.” The bottom line is the invention has to “pencil” financially. If it does not, the product or service incorporating it cannot cross over the “Valley of Death.”

This is a cruel reality check. The contribution of the invention to total value of a manufacturing process may only be a few percent. For a product, it may be five to 10 percent of the total value, although software may garner higher percentages, as duplicating and distributing code is relatively inexpensive. While technologies can garner nice bonuses, most are not big hits for their inventors – typically generating under $10,000 dollars.

Working with Your Knowledge Transfer Office

Moving a technology to market is a multi-step process that resembles in many ways the game of Snakes and Ladders. If you played this game as a kid, you know sometimes you have to march step by step through each square on the board. Other times you can skip squares and to get the end faster. Yet other times, you slide back and progress is hard to make. Moving technology to market is analogous. The good news is that your KTO, working together with the RIF's Central KTO, will be able to take your invention through the steps if it makes economic sense to do so. The graphic alongside depicts these steps although, to reiterate, not all steps need be conducted for every technology.

The process begins with your disclosure of your invention to the KTO. Your KTO can help you correctly document and protect your invention *if they know about it*. Talk to them when you do make an invention. Call and ask who handles inventions in your field. Invite that person over, or walk over to their office, and show them your Inventor's Notebook.

Be aware that in larger organizations, like universities, the KTO will have to obtain a completed formal Invention Disclosure form before proceeding. These forms are usually found on the KTO website. You will find the KTO very willing to advise and help you should you face any problems completing it. If the disclosure does not ask for it, submit an accompanying document that indicates where you see commercial applications. To come up with applications, think about how your invention might be used. It helps to look at your technology in terms of its functionality. Let's say you invented the better mousetrap. Being a better mousetrap is just one application. Think about what the technology does and how it does it. Your mousetrap is actually just a device with a trigger-loaded spring which, when the trigger is removed, accelerates a metal bar through a semicircle at a certain velocity and then holds an object of up to some mass securely. Perhaps your mousetrap has more commercial viability as a new way of coupling railroad cars. Try to indicate the range of realistic applications.

If there are any companies that you think might be interested in licensing the technology, note that in the disclosure or an attachment to it and also add whether you have had any prior contact at all with anyone in that company concerning this invention or the general field of research which underlies it. If you desire a spin-out, be sure to note that and explain why you think that makes sense. We will discuss when to license and when to spin out in Section 3, below.

Once the Disclosure form is received, most offices examine it through a formal review process. The KTO and RIF KTO will look at potential showstoppers to commercialization which suggest patenting would not be cost-effective. Major showstoppers are:

- the technology can already be found on the market;
- there are patents or patent applications which suggest your idea will fail the novelty criterion;
- the invention is behind the curve economically as other R&D has already solved the problem you are addressing or better ways of solving it exist; or,
- there is no commercial use anyone can foresee.

This analysis can usually be completed within one to four weeks assuming normal workloads. To move it along, it helps if you do some "homework "after making contact with the KTO. Make sure you coordinate with them as you want your efforts to build a strong and synergistic collaboration with the KTO.

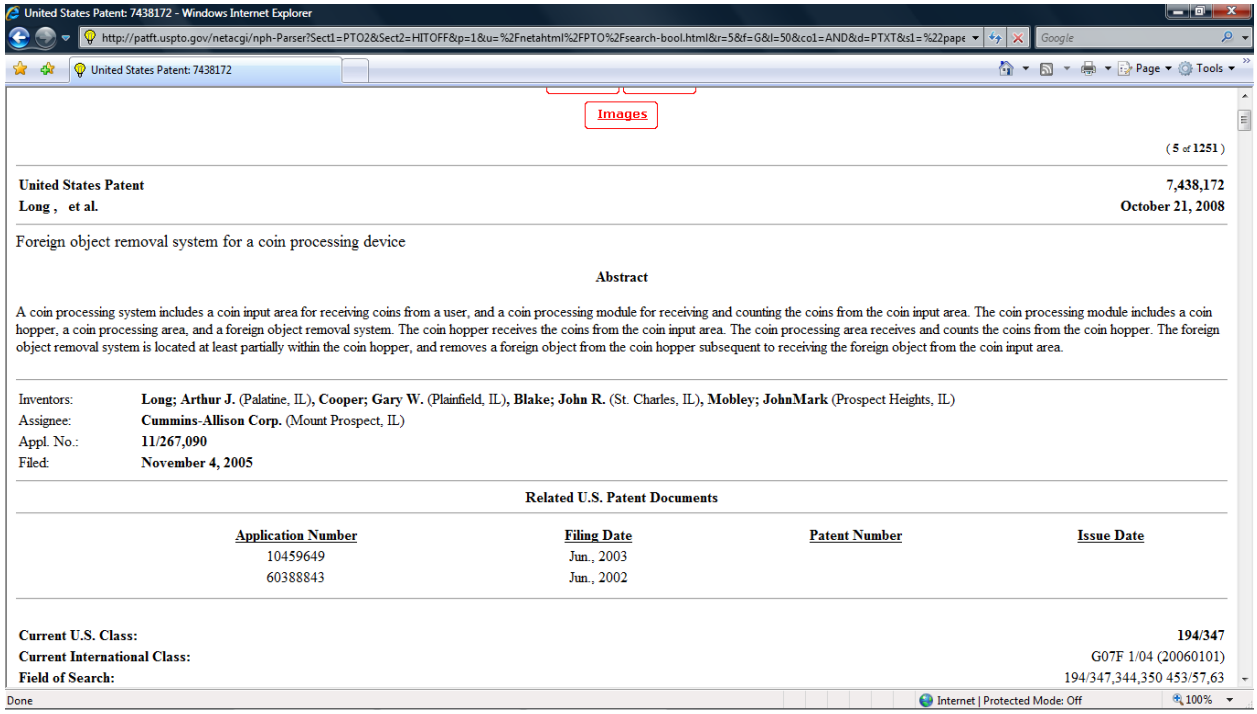
First, make sure you have done a thorough review of the scientific and technical literature. This activity has its own intrinsic benefits, as it helps you keep current in your field. Explicate why you think your technology is better than the other approaches you have seen. Also explain just what you mean by the term "better."

Second, using Google™ and at least one other web search engine, search for products, processes, or technology that has the functionality you think is important for your invention.

Third, go to the European Patent Office and search for relevant patents and patent applications worldwide. The search engines are found at EPO - Espacenet: patent database with over 120 million documents. The server supports free text search with Booleans (such as AND, OR, and NOT) and other means. See Espacenet – pocket guide (epo.org). You can also search the US Patent and Trademark Office (Search for patents | USPTO) if you want to try another search engine from a different jurisdiction where most significant patents are filed.

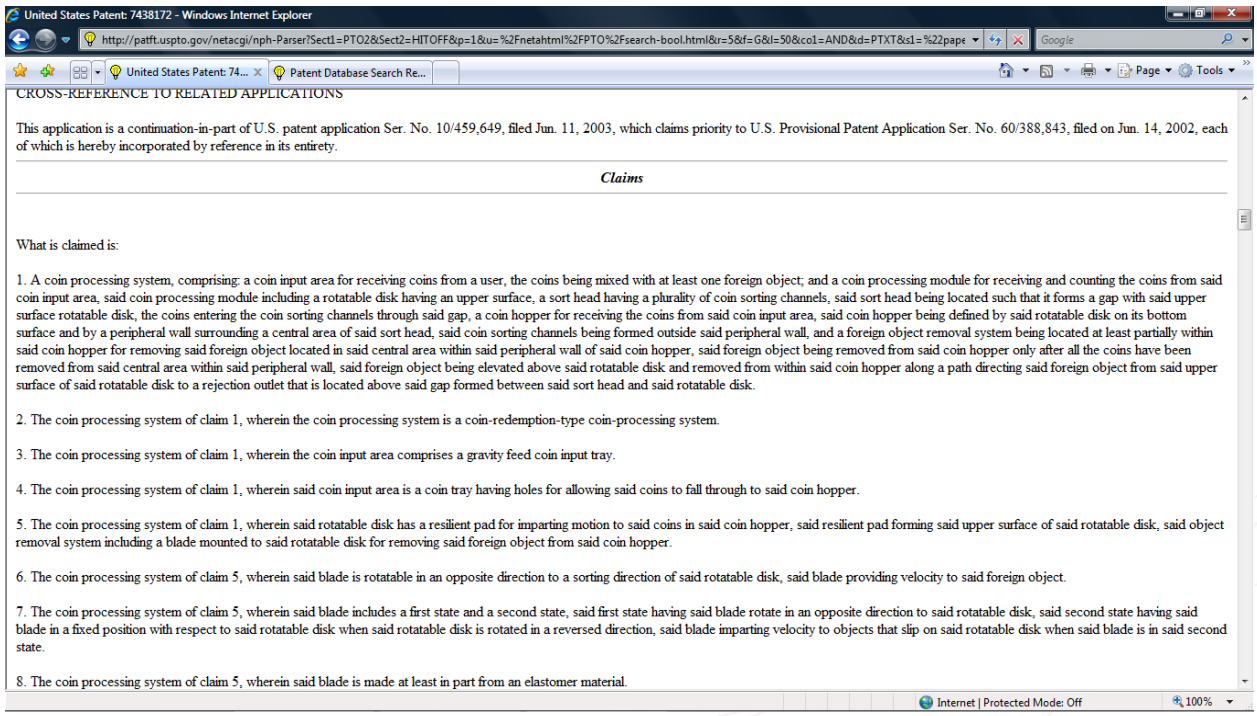
Once you find patents or applications which seem to use similar approaches or seek to accomplish similar objectives, look to see the Patent Class into which the patents fall. Let's say you go to basement of the building where the soda machine is to get a drink. Someone has jammed a slug in the machine. You wonder why they always clog when that happens and *Eureka*, being a mechanical engineering professor, you have an idea on how to fix that. You wonder if this is a novel invention. Below is a screen shot from a US patent that removes foreign objects from coin machines.

Please note, different patent servers may display patents in different formats, but they all will contain the same information in the same order as that is set by international agreements on what must be in a patent.

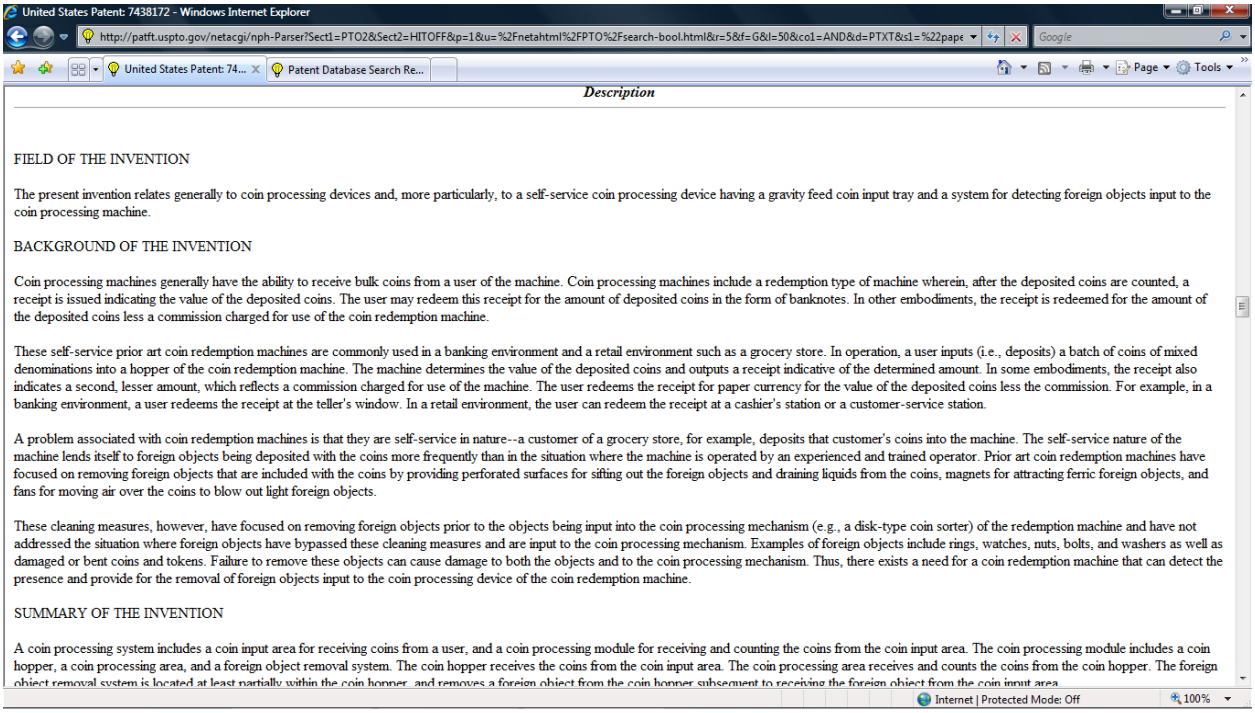


Note on the lower right hand is the number G07F 1/04. That is the International Patent Class. Placing that number in the search engine and setting it to search on patent class returns other patents (or applications) which may prevent Freedom to Operate (that is, a licensees ability to exploit the patent for commercial purposes.

When reading patents, be sure to look at the Claims. Only the Claims have legal force. They state what is (for patents) or is requested to be (for applications) protected. Below is the claims from the patent we previously found.



Reading the Description of the invention helps you better understand what the invention is about and also what problem(s) the inventor thinks it solves.



United States Patent: 7438172 - Windows Internet Explorer

http://patft.uspto.gov/netacgi/nph-Parser?Sect1=PTO2&Sect2=HITOFF&p=1&u=%2Fnetahtml%2FPTO%2Fsearch-bool.html&r=5&f=G&l=50&co1=AND&d=PTXT&s1=%22pape

United States Patent: 74... | Patent Database Search Re...

Description

FIELD OF THE INVENTION

The present invention relates generally to coin processing devices and, more particularly, to a self-service coin processing device having a gravity feed coin input tray and a system for detecting foreign objects input to the coin processing machine.

BACKGROUND OF THE INVENTION

Coin processing machines generally have the ability to receive bulk coins from a user of the machine. Coin processing machines include a redemption type of machine wherein, after the deposited coins are counted, a receipt is issued indicating the value of the deposited coins. The user may redeem this receipt for the amount of deposited coins in the form of banknotes. In other embodiments, the receipt is redeemed for the amount of the deposited coins less a commission charged for use of the coin redemption machine.

These self-service prior art coin redemption machines are commonly used in a banking environment and a retail environment such as a grocery store. In operation, a user inputs (i.e., deposits) a batch of coins of mixed denominations into a hopper of the coin redemption machine. The machine determines the value of the deposited coins and outputs a receipt indicative of the determined amount. In some embodiments, the receipt also indicates a second, lesser amount, which reflects a commission charged for use of the machine. The user redeems the receipt for paper currency for the value of the deposited coins less the commission. For example, in a banking environment, a user redeems the receipt at the teller's window. In a retail environment, the user can redeem the receipt at a cashier's station or a customer-service station.

A problem associated with coin redemption machines is that they are self-service in nature--a customer of a grocery store, for example, deposits that customer's coins into the machine. The self-service nature of the machine lends itself to foreign objects being deposited with the coins more frequently than in the situation where the machine is operated by an experienced and trained operator. Prior art coin redemption machines have focused on removing foreign objects that are included with the coins by providing perforated surfaces for sifting out the foreign objects and draining liquids from the coins, magnets for attracting ferric foreign objects, and fans for moving air over the coins to blow out light foreign objects.

These cleaning measures, however, have focused on removing foreign objects prior to the objects being input into the coin processing mechanism (e.g., a disk-type coin sorter) of the redemption machine and have not addressed the situation where foreign objects have bypassed these cleaning measures and are input to the coin processing mechanism. Examples of foreign objects include rings, watches, nuts, bolts, and washers as well as damaged or bent coins and tokens. Failure to remove these objects can cause damage to both the objects and to the coin processing mechanism. Thus, there exists a need for a coin redemption machine that can detect the presence and provide for the removal of foreign objects input to the coin processing device of the coin redemption machine.

SUMMARY OF THE INVENTION

A coin processing system includes a coin input area for receiving coins from a user, and a coin processing module for receiving and counting the coins from the coin input area. The coin processing module includes a coin hopper, a coin processing area, and a foreign object removal system. The coin hopper receives the coins from the coin input area. The coin processing area receives and counts the coins from the coin hopper. The foreign object removal system is located at least partially within the coin hopper, and removes a foreign object from the coin hopper subsequent to receiving the foreign object from the coin input area

Internet | Protected Mode: Off 100%

Note any patents or patent applications which seem close to your invention. Explain to the KTO how your invention differs from these patents and applications.

Once the KTO has reviewed the invention, it will probably have to make a recommendation to an Intellectual Property Committee, vice-rector, provost, or vice-president concerning whether it is worthwhile protecting the invention and pursuing commercialization. Since in today's world of tight budgets there are usually more inventions than there is money to protect and pursue them, providing data that helps ensure the docket has accurate and sufficient information helps your technology make it through the process successfully. Fortunately, the RIF Central KTO has funds available to subsidize obtaining intellectual property protection

In working with your KTO, always remember they have multiple goals. One goal is to generate revenue to cover the costs of their work, patenting, and other outside legal fees. Another goal is to generate revenues that can funnel money back into the institution to support future research. Also important is supporting employee retention, by helping you see your inventions make this a better world and generate money for you. Often there are other goals. For example, universities have economic development missions, and these may lead to KPI's for the KTO.

There is an old saying, "Knowledge transfer is a team sport." It is easier for the KTO to give preference to your inventions if you are willing to be an active and supportive team player. It is hard to commercialize inventions without inventor support during patent applications and marketing. After all, who knows the invention best?

We recommend scheduling regular follow-ups with your KTO to stay abreast of developments. Usually these will be brief emails or phone calls. Your KTO may also have a workflow tracking system you can log into.

Be prepared to collect and analyze data your institution's KTO and the RIF Central KTO they may require to move your project forward. For example, they may ask you to look at some patents and explain how your invention is different or if you can adapt or enhance your invention to meet some market need.

If an Invention Review Committee makes decisions on patenting, be sure to ask if it would be helpful if you showed up at the meeting to be there in case anyone has questions.

If your employer decides they do not want to protect and commercialize your invention, you need to decide if you agree with that decision. If you do not, you have four options: (1) do nothing, (2) ask them to make it available via open-source licensing, (3) ask them to reconsider, or (4) ask them to release your invention to you so you can commercialize it.

The first option, do nothing, makes sense if there is little or no market value. In that case, the costs of protecting and commercializing the invention cannot be recouped. Rather than lose money, it makes sense to give it away free via publication or open-source licensing.

If you publish prior to filing for IP protection (or in the case of copyright asserting it), you give up all control over the use, making, and redistribution of your invention. Asking the KTO to do open-source licensing allows you to retain some control and also potentially to garner some revenues.

The first open-source licenses were copyright licenses for software. Under an open-source license, the source code is available under terms that permit modification and redistribution without any payment of royalties to the original author. Such licenses may have additional restrictions. For example, the licensor may require the licensee to preserve the name of the authors and the copyright statement within the code or document. The licensor may also require a small fee, such as $20, to download the document(s) or information on the invention. There is no reason open-source licensing need be restricted to software of course, so this is a viable path for bringing any invention to market where the fair market value is low or where significant social benefits can be generated by widely and quickly disseminating the invention. A good example is education and training materials implementing an innovative approach emerging from RD&I. An example might be a new approach for smoking cessation.

You can always ask your KTO to reconsider. Call them up and ask them to explain why they are not pursuing commercialization. Then collect data which refutes their reasons for not pursuing commercializing. The most persuasive data is someone who expresses interest in licensing or investing in your invention after seeing a non-confidential, non-proprietary description.

The final option is to ask your employer to assign your invention to you. Assignment means they turn over all their rights to you. Since the employer already has some sunk costs from running the disclosure process and evaluating your invention, they may ask for a license providing modest percent of any revenues you receive from commercialization in exchange for the assignment. If you do pursue this option, be aware that the assignment must a legally enforceable, binding agreement and you should have it reviewed by qualified counsel so you are sure you understand what you are signing and that it gives you the rights and control you are seeking.

What Can I Do to Make it More Likely My Inventions will be Commercialized?

The key is having what is called a "market orientation." Market orientation simply means you are aware of the various needs people have that your work might help address. Considering how to link your research or R&D to *needs* in the market, lays groundwork for making your work useful to others. The more useful it is, the more they are likely to pay for it.

Here is a simple mind experiment to illustrate this point. If you read a news online or in a newspaper, ask yourself, what is the price of a new all-electric four wheel drive car? If you have no need for a car, you probably do not know. No need, no buying. So, you are unlikely to pay very much for a car that you do not need. But say you live in the mountains of Cyprus, gas is getting more and more expensive, winter is coming on, your car just died, and you have a nice fat royalty check from your last licensed invention in your bank account. Since your car died and you can afford a new one, you are tuning into the car ads. You think, "Hmm, that price does not seem so bad, as I need a car and I'd prefer an electric one". It is no different in business.

How Do I Get a Market Orientation?

Attaining a market orientation is actually pretty easy. The next time you give a paper at a conference, look around the room. Some people will have name tags that end with Corp. or Inc. or emails that have a .com in them. They are from companies. Ask them why they are there, what they found interesting, and how your paper relates to their work. Listen to their answers. Ask them what kinds of technology they would like to see emerge from your work. Now you have a market orientation. You have better understanding of how your work might relate to the concerns and needs of downstream licensees.

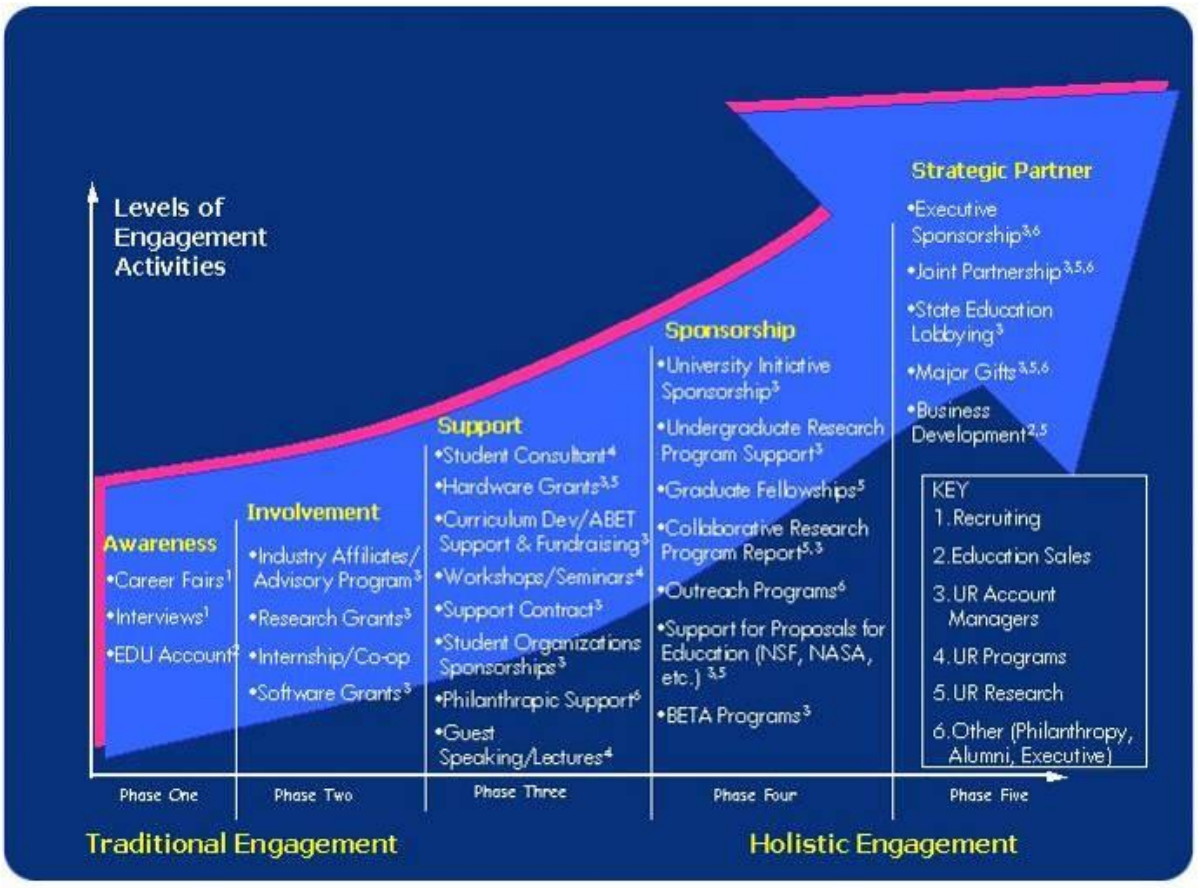
If they are friendly and interested in talking, you can probe further. Be careful though. *Do not provide any proprietary information in any form (written, electronic, verbal) until your KTO says it is OK or you could destroy the ability to commercialize your inventions.* Usually what an invention does is not proprietary. ("I have a better mousetrap.") How it does it is proprietary. ("I use a new metal-matrix nanocomposite with this unique chemical composition to make the spring and manufactured in this innovative way that enhances the tensile and compressive strength.") Raw performance data may or may not be proprietary. *When in doubt, ask your KTO.* If they do not know, they will consult the RIF Central KTO.

Ask people in industry for their thoughts on four things. The first thing is the performance they would like to see from this technology. What functionality should this technology need to have to be of interest and how would they measure that functionality? The second parameter is ease-of-use. Who will use this technology you have been discussing and what kind of features and user interface does it need to have to make it easy to use for those people? The third parameter is price. What would they, their company, or the customers of their company expect to pay for a new technology with the functionality and ease of use just described? And finally, what would give it *umpf*? Umpf is that special something that makes someone want to buy something now rather than later. Why did so many people buy Ipods and IPhones? Umpf. Here the umpf was the design quality. How about hybrid cars? The umpf for these was the payoff

period. When the price of petrol was low, hybrids seemed too expensive. When it got high enough, people begin to think they might be a good deal because they could see how they would pay for themselves pretty quickly. Now the price of petrol is so high and the consequences of climate change so serious all-electric cars are looking and more more attractive.

When you get some quiet time, write down who you met, their contact information, and what they had to say. If you have already made and disclosed your invention, send this information in to your KTO as a supplement to the disclosure. If you have not made an invention, you do not have to do anything special with this information. It is just data to mull over. Over time, as you get in the habit of asking people about performance, ease-of-use, price, and umpf they would want from technologies emerging from your research, you will have another source of inspiration for research projects and the inventions. These inventions will likely be worth more than those that have no market pull because they address already articulated problems and needs. The nice thing is you can also approach the companies to provide R&D funding for your research as well.

As you get to know people in industry, be aware that there are a range of options for building longer-term collaborations that can bring RD&I euros into your lab as well as enhance the likelihood your ideas will see commercial success. The following graphic is from a talk by Wayne Johnson, Vice President of Hewlett Packard for University Relations on November 17, 2005. It illustrates from the corporate side how pipelines and collaborations are built.



At each stage in research or research and development there are many stakeholders beyond just corporations you can talk with informally to enhance your market orientation. The following table illustrates stakeholders you might talk with, results you might focus on accomplishing, and steps you can take if you want to enhance the downstream economic value of your work.

PRODUCT LIFE CYCLE	Fundamental/ Exploratory Research	Applied Research and Development	Concurrent Engineering	Manufacturing Sales, Supports	Post-Introduction Improvement
Expected Results	Develop a distinct new technology connected to a market need	Establish technology's practicability, market potential, and plans for development	Embody the technology in production engineered products and/or processes	Get the product or process quickly accepted in the market	Create long-term value by expanding applications of the technology
Demonstrable Steps and/ or Benefits	Technical proof of the ideas, patent, develop vision for thetechnology	Patentif relevant or not done, ready plans for commercialization; prototype, test with key targets	Beta test with key customers, unveil commercial version of the technology	Hit take-off (5% - 20% penetration)	Obtain substantial financial returns and establish the infrastructure for supporting a product family
Relevant Stakeholders	Research partners, technical experts in the field	Technical experts, potential investors and other funding sources, targets, end users, opinion leaders in key entry niches	End-users, lead customers, suppliers of platform or complementary technologies and products, targets, opinion leaders	Targets, end-users, customers, opinion leaders, others in value network	Company management, others in value network, customers, opinion leaders, R&D partners

Expanding upon V. Jolly, *Commercializing New Technologies*, Harvard Business School Press, 1997

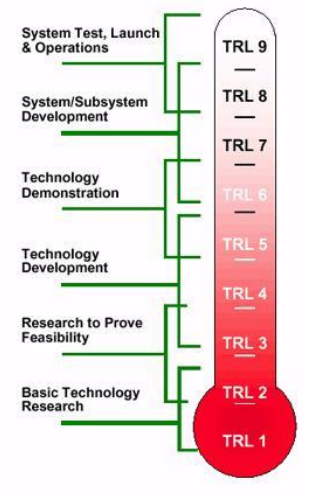
Be aware that as you shift from research to applied research and development, you can involve in your R&D downstream end-users of your technology and potential targets for licenses or investments. (By "targets" we mean the firms, agencies, foundations, or people who will license, invest in, or otherwise pay to acquire the technology or some rights in it.) It takes time to make end-users aware of new technology and to build trust and credibility with targets. Involving them as advisors in applied development and testers in concurrent engineering creates relationships your KTO can build on when seeking downstream deals. Just be sure to get NDAs in place if the ideas have not yet been protected through patent applications, copyright assertion, and all other appropriate IP protection.

Working with Your Knowledge Transfer Office

Now for the really good news: You do not have to be a marketing person, because the KTO, working in collaboration with RIF's Central KTO, already has them. When you are chatting with colleagues from industry at meetings, on-line, and so forth, what you are simultaneously doing is generating leads for inventions when you provide a non-proprietary description. You should also ask colleagues if they know of any firm or any person who might be interested in your invention. By passing these leads to the KTO staff, you are pointing them towards companies or people who might be interested in licensing or investing in your invention.

The marketing staff at the KTOs will take your information and either (1) call the person you spoke with or (2) find the person at that organization that is responsible for in-licensing or investing. Fortunately, it is not hard for a KTO in the Cypriot national system to find the right people. If they do know a company, venture capital firm, foundation, or agency like to have interest, they know how to find them.

Note that the KTOs will have to send information to the target that allows them to confirm their interest in your invention. All targets want to know the functionality and level of maturity of the technology and see data validating the functionality. Targets may also want your and the KTOs views on what the market is for the technology. They may request other specific data. To the extent you can provide this information to the KTOs you can help speed up the process of getting your technology to market. But again, don't worry if this sounds daunting or evenlike gobble-gook. That is what the KTOs are there to do. Their job is to bring your inventions to market.



Let's look at what some of these terms mean. Functionality addresses what an invention does. Features are how it does it. Maturity addresses how close the technology the makes up the invention is to operational use. Alongside is a graphic reproduced from *Wikipedia*'s article on Technology Readiness Levels (TRLs), found at http://en.wikipedia.org/wiki/Technology_Readiness_Level. TRLs measure maturity in terms of scale from invention (TRL 1) through bench top proof of feasibility (TRL 3) through prototyping (TRL 4 and 5) and on to initial field testing (TRL 6), final test and evaluation (TRL 8), and actual operational use (TRL 9). If you read the Wikipedia article, you will find the description of TRLs there seems most appropriate for inventions in engineering and the physical sciences. TRLs for software, hardware, medical devices, and drugs can be found by web searching. For example the US National Institutes of Health provides TRLs for development of pharmaceuticals addressing specific diseases at Technology Readiness Levels (nih.gov). TRLs for medical informatics are presented at TRLs (hbpmedical.github.io). TRLs for software are the focus of a report by the the Carnegie Mellon® Software Engineering Institute at Beyond Technology Readiness Levels for Software: U.S. Army Workshop Report (cmu.edu).

The RIF's Central KTO will also provide the market size information, market drivers, barriers, regulations, and stakeholders in markets tied to the applications for your technology and any other such information desired by targets.

Marketing takes time, so be patient. It can take several weeks to months from initial contact with a target to get feedback as to whether they are seriously interested. If they are interested, they will want additional proprietary information and, if relevant, samples. Your KTO will negotiate an NDA with the target so proprietary material can be exchanged. If samples are requested, they will negotiate a Materials Transfer Agreement (MTA). The MTA sets the terms under which the samples are being provided. It specifies who can use the technology, for what purposes, and how, as well as who can receive any data generated through its use. NDAs and MTAs prevent your "secret sauce" from leaking out. (For more information on the agreements used in Knowledge Transfer please see the World Intellectual Property Organization's primer on them at Technology Transfer Agreements (wipo.int).

Coordinate with your KTO to ensure you get whatever feedback they garner from the targets they approach. Even negative feedback is helpful. You want to know when someone *is not* interested in your invention. Not being interested does not usually mean they are slamming the door in your face. More often it is because they want some specific performance data, the technology is not mature enough, the timing is bad, and so forth. Think about how you can overcome the objections. If you can, prepare the necessary data, provide it to the KTO, and they can re-contact the target and other targets.

If the target is interested and an NDA (and/or MTA) is put in place, you will want to join a KTO staff member in periodically chatting with the technical people at the target. It is important to let them know you are there to answer questions and provide know-how. On the other hand, you do not want to come off as pushy or selling too hard. Ask your KTO or the Central KTO expert you are working with for how often they want to be in touch with a target and what kinds of things they think should be discussed, and what level of non-proprietary or proprietary information to provide.

Doing Deals

Deals are transactions. One party offers some or all of the intellectual property rights to an invention. The other party usually offers money, although other goods can be bartered, such as equipment or equity. What counts is that both the IP rights and the goods bartered are fungible, which means they can be traded again for cash.

In legal terms, what is offered by each party is called consideration. So long as consideration is exchanged, a legally binding contract can be put in place. That means it can be enforced in a court of law. Because it can be enforced, the terms of the contract are very important. All the discussion and negotiation means nothing once a contract is signed. The Court will enforce the terms of the contract. All the discussion becomes irrelevant. Only the contract counts. No contract; no deal. Contract; deal.

What is a Term Sheet?

A term sheet is an offer to do a deal. The first basic principle in preparing them is to be precise about what you are selling, how much you will get paid, and when. The second basic principle is to be fair. After all, fair market value is all there is to divide up between the parties to a deal. By allocating costs to the party who benefits most from their expenditure, the scale remains in balance and the deal is win-win. The third basic principle is to put risk on the party that is best able to control it. Remember, the higher the risk, the greater the discount rate when calculating net discounted cash flow. The lower the risk, the more everyone should make. That increases the fair market value. Win-win. After that, don't get greedy. Everyone has to make money in a deal or the party losing money has no incentive to honour it. Then you can end up in court trying to enforce it. So, the consideration the buyer pays is adjusted down or up to make sure the balance between payments and the allocation of costs and risks is fair.

Term sheets can be simple and only include some core terms leaving the rest to be negotiated later or they can be very comprehensive and cross all the t's and dot all the i's. In our discussion here, we introduce on the core terms. Your KTO or the RIF Central KTO expert assigned to you will walk you

through the terms that will apply to your invention. As a member of the team commercializing the invention, they will ask for your ideas and comments. It is wise to remember others are also being asked and, while you have an important voice, you are not the only voice nor are you the ultimate decision maker. That authority resides in the officer of your research organization that has the authority to do deals.

The term sheet usually begins by specifying just what is the technology and what is the intellectual property that is being offered (i.e., the trade secret(s), patent(s) or patent application(s), copyright(s) and industrial design(s), and trade or service mark(s)).

A term sheet will specify the rights being offered. For example, a licensing term sheet will offer one of the four options below. (*Please note, while people usually refer to the buyer in a licensing deal as the licensee and the seller as the licensor, we use buyer and seller to drive home the fact this is just another transaction).*

- *Assigning the rights* means all the rights of the seller are being offered. The buyer retains nothing.
- *Exclusive licenses* offer the buyer the exclusive right to make, sell, or use the intellectual property (or some combination of these) in a field of use or all fields of use in some defined geographic region over some time period. A field of use is an application. It can be broad, such as the field of use of medicine, or narrower, such as the field of use of diagnostic imaging or the field of use of disease treatment. The region can be the Cyprus, the EU, the USA, North America, the world, the EU and Singapore, the city of Nicosia, or whatever. The period of time can be a day, a year, forever, whatever. Usually, it is the life of the patent. In an exclusive license, the seller offers to transfer *all* of the relevant right(s) in the field(s) of use in the geographic region for a specified period of time. That means those rights cannot be offered to anyone else. It also means the seller does not reserve any part of the rights transferred for itself.
- *Sole licenses* are like exclusive licenses, with the exception that the seller reserves the right to make, use, and or sell the technology itself. Only the buyer and the seller will have these rights for the field of use in the specific geographic region for the specified time.
- *Non-exclusive licenses* transfer the right to make, sell, or use in some field(s) of use in some region over some period of time. The same rights can be transferred to anyone else the seller wants and the seller also retains them.

The term sheet will also specify the consideration expected. It may be an up-front fee and running royalties. (Running royalties are royalties paid out by the buyer as money comes in from sales.) It may also may be some equity or anything else the parties want to trade for. It can be any combination of these as well.

Typically, the royalty rate and up-front fee represent the contribution to the total value of a product or service made by the invention. It takes into account that a technology's value is constrained by the current level of maturity of the technology and the strength and breadth of the intellectual property being transferred. While it is theoretically possible to calculate this value from the ground up with enough market research, people almost always rely on "comparables." What we do is find other deals for similar technology, or technology with similar functionality and complexity, and use the up-front fees and royalty rates from those deals as benchmarks for calculating the value of this deal. Then we adjust

that “industry average” up or down to account for the differences between the technologies and deals we benchmarked with and the specifics of this technology and of this deal. We accept that this price setting is a process involving art as well as science.

Almost always, we add a few clauses that ensure we get paid what we bargained for. So, for example, we want audited financials. If the buyer underpays by some percentage (say 3% or 5%) there may be penalties. We specify when the payments due us must be made.

An aspect of the payment provisions is who pays filing and maintenance fees for patents and other intellectual property. In assignments and exclusive licenses, the buyer usually pays. Otherwise, it is the seller. Who is the lead when suing for infringement and who pays for litigation are usually allocated this way as well. To make the allocation fairer, often part or all of costs of lawsuits can be recouped by the buyer as charges against royalties due.

Warrantee clauses specify what each party will promise to be true and pay a penalty if it not true. The trick here is to avoid warranting anything you are not absolutely positively categorically sure is true. You can warrant to the best of your knowledge you own the rights you are transferring. Unless the technology is at TRL 9, you do not want to warrant anything about how the invention will perform because we really do not know.

Indemnification clauses specify the cases where each party will pay if the other party is harmed in some way, including by being sued. A similar trick applies here. Don’t indemnify anything that is not 100% entirely under your control. So, we cannot indemnify against the sun not rising tomorrow because we cannot control that. In the same vein, we cannot indemnify against product liability because as the inventor, we probably are not the one making the product.

Bottom line: wherever possibly, we rely on that good old Latin adage from English Common Law: *Caveat Emptor. Let the Buyer Beware!*

So far, we have been discussing a term sheet for a licensing deal. As we might expect, term sheets for capital investments look similar in some ways and different in others. The big difference stems from what is being traded. Our buyer now is an investor and our seller the owners or management of a company.

In an investment, what is being traded is some equity or debt in a company for cash. The equity can be given in various ways, such as common stock or preferred stock. The debt might be bonds issued by the company or a loan issued from the investor. Hybrids can also be traded, such as convertible debentures (debt which can be converted to equity).

If debt is traded, the cost of the capital is straight-forward to calculate. You look at what the debt will be used for and find the market price for that kind of debt. A line of credit for operating capital trades at different rate than loans for equipment. Then, the only remaining question is what security the lender will want when providing the money. After all, they too have heard of *Caveat Emptor*. Will they be satisfied with the ability to grab the company’s accounts receivables or equipment if the debt goes bad or do they also want your house, car, and furniture?

If equity is traded, then the company has to be valued to figure out what is a fair trade. The value of a company is not that different from the value of a technology. It is equal to the discounted net cash flow of the company. To get it, we figure out the revenues, subtract the costs, and discount the results to the present. Because it is very hard to predict the future, we only project out until the effect of discounting makes the impact of the farthest out year's net cash flows on the value of the company negligible. If the year that starts occurring is too far out, we stop the calculations anyway and put a place holder in to account for the residual. This residual is called a terminal value.

The other terms will reflect the concerns people have. Clearly, payment schedules will be specified for debt. There likely will be clauses prohibiting or restraining dilution of equity or subordination of debt without permission of the buyer.

What is important to realize is that whatever the structure of the deal, the same principles apply to developing the term sheet. We want to be precise about what we are selling and how we get paid. We want to be fair. We want to minimize risk by allocating it to the party best able to control it. And we do not want to get greedy because win-win deals are just that: win-win.

How do I Know Whether Licensing, Spin-Out, or Something Else Makes the Most Sense for My Invention?

There are primarily three main paths to market for a new invention. At universities, government laboratories, and non-profit research institutions, licensing and spin-outs are most common.

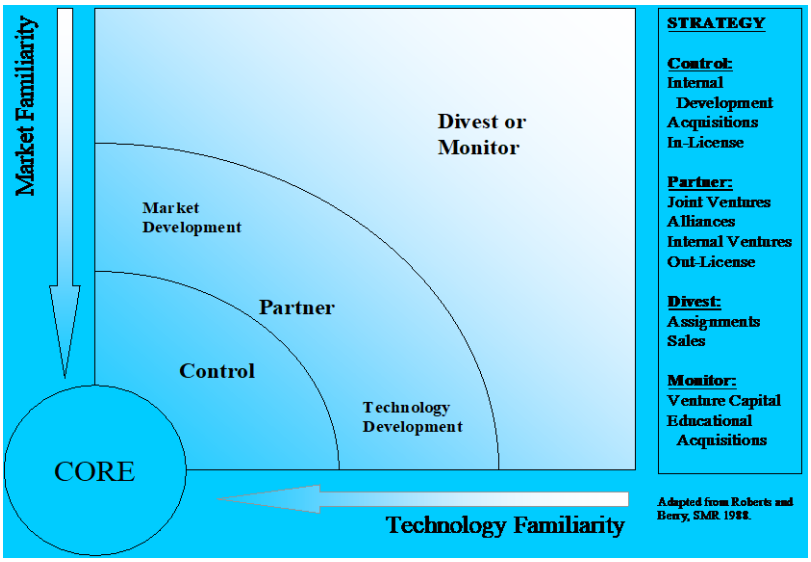
The first path is internal development and use. This path makes sense if you are working for a company and they can make and sell the product you have invented or apply a process you invented to make and sell products.

A variant of internal development is strategic alliance. Here the technology owner signs an agreement with another party under which each contracts to do specific things. For example, one company may provide the product while the other distributes and sells it. In a university setting, sponsored research contracts may incorporate a strategic alliance. Under some sponsored research, the sponsor has the right to patent any inventions of interest in the name of the university in exchange for a first right of refusal to license them. Collaborative projects with a company partner can also be considered strategic alliances.

The second path is setting up a company to exploit the technology. "Spin-outs" make sense where there is a high value platform technology with good intellectual property protection and a very committed entrepreneur. They may also make sense if additional R&D funding is needed to mature the technology and there are sources of funds that only small businesses can tap.

The third path is licensing. This path makes sense if the other ones do not or if you want to hedge your bets and pursue two paths simultaneously.

Joint ventures are a hybrid of spin-out and licensing. In joint ventures, two or more parties come together and establish a free-standing company. Owners of technology license their technology to the joint venture as part or all of their contribution to capital. They receive equity in the joint venture in return. Others may put in money, staff, equipment, or other resources. (Of course, the technology owner may put in additional resources as well.)

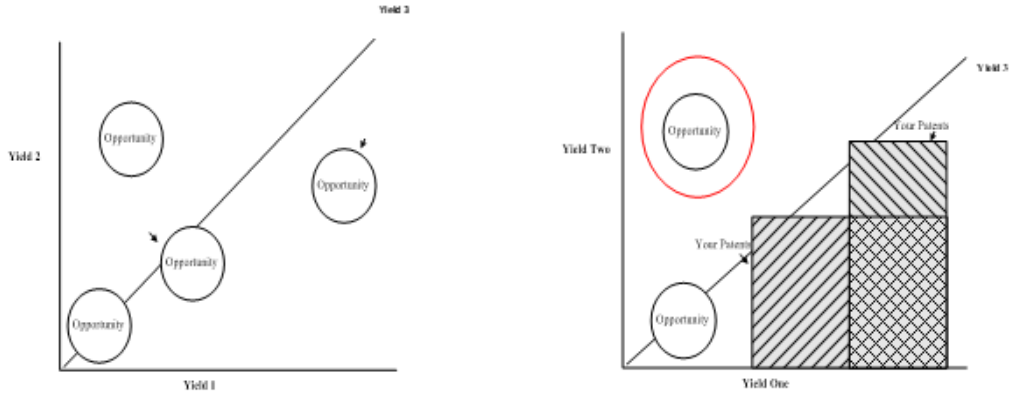


The graphic alongside provides a first indication of when to use each of the paths. Note the graphic can be used by the developer or acquirer of the technology to select a feasible path. Place yourself in the graphic in terms of your familiarity with the technology being commercialized and with the market in which you anticipate commercializing it. Use the strategy sidebar to figure out options given your location.

If control is a viable option, then seeking a venture may make sense. Four criteria can be used to determine whether your invention is suitable for a spin-out and outside investment.

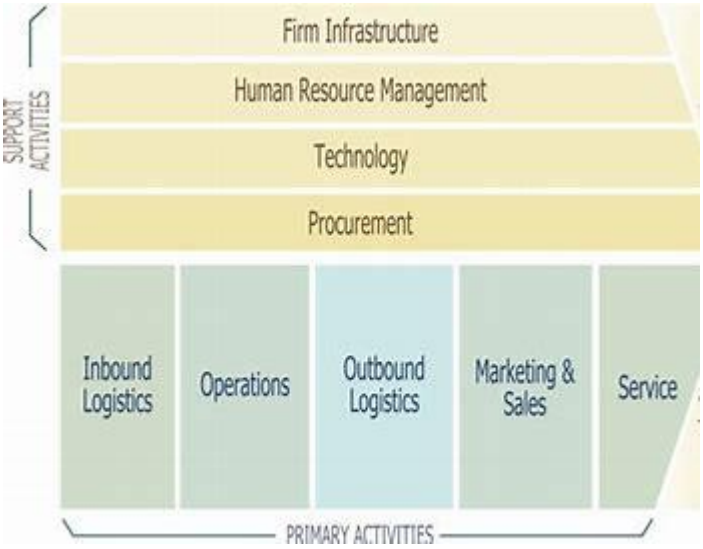
The first criterion is the range of market opportunities for the technology and whether a profitable and sustainable competitive advantage exists for entry into, and rapid expansion in, the first market. The reason for a range of opportunities is it both hedges against failure in any one application and it enables driving rapidly towards economies of scale, scope, or network in production. Economies of scale occur when you can make many of the same things on highly efficient machinery. Economies of scope occur when you can make many different things on the same highly efficient machinery. Network economies occur when you can add many additional units to the same core infrastructure without needing additional investment. In each case, cost per unit goes down as the number of units rises to some threshold. The greater the number of markets you can sell in, the greater the potential revenues. Greater economies mean fewer costs. Higher revenues minus lower costs mean more profits, thereby giving investors a good return-on-investment (ROI). Toss in a quick path to cash flow and you can see how you can rapidly build the value of the company, making it possible to go public or sell the company, giving the investors a way to cash out and realize that ROI.

Second, you need a strong intellectual property portfolio lest others jump in and steal your market from you. In the graphic below on the right, we plot the various opportunities in a market space for a technology. In the graphic on the left, we plot the patent portfolio that protects it. Note how a large area of the market space is locked up by the intersection of the patents. Now, look at the opportunity circled in red. If that was the only zone of the market space your patent protected, you would have freedom to operate but not to exclude others from operating in a significant percentage of the market space.



Third, and often most important, you need a management team that knows what they are doing and are willing, to use the jargon of venture capitalists, "to put some skin in the game." "Skin in the game" means having some of your own money invested in your company. It usually is a good sign that the people in charge are just not going to let that business fail. The rule of thumb is that over time, about half of the small businesses formed are out of business within five years. Only about a third makes money, with another third breaking even, and the last third losing money. Without skin in the game, it is too easy to just give up.

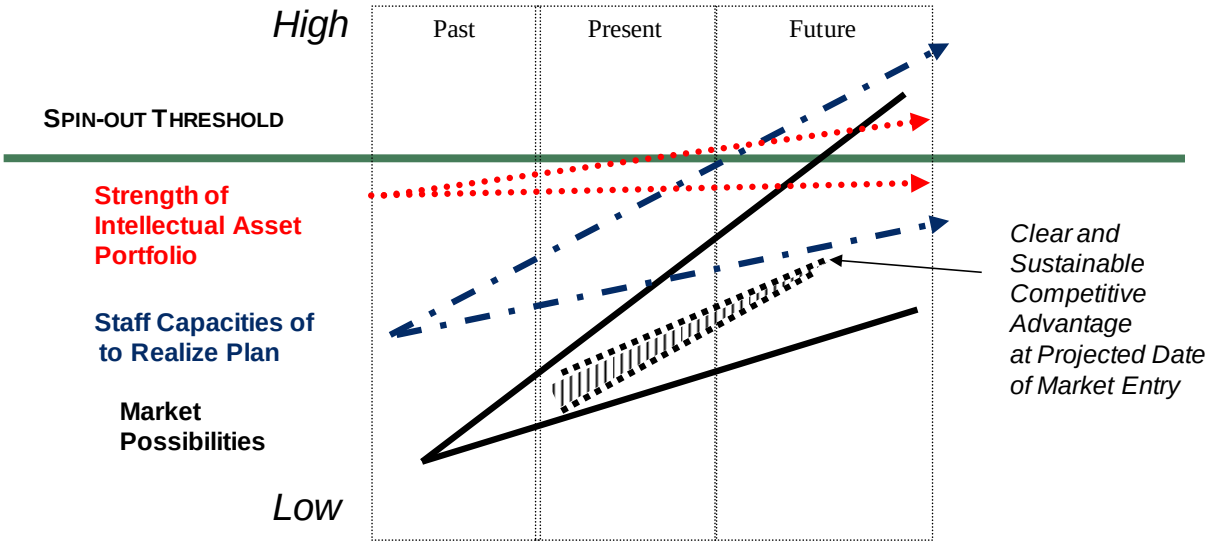
Fourth, there must be people on the team who know how to do new product development, make the product, market and sell the product in the targeted market segments and countries, can handle finances, conduct human resources, manage employees, and develop and adapt the company business, technology, and market strategies, and so forth. Just having someone with technical smarts about the technology is not enough. Collectively, all these people will run what is called the companies value chain. The value chain is depicted in the image below from Wikopedia (Value chain - Wikipedia).



There are lots of good ideas and great inventions. What makes great companies are inspiring leadership and steady management and a complete value chain staffed by capable and competent people.

Finally, there has to be a reason to believe the market opportunities, intellectual property, and management team will grow stronger over time. The company has to grow if the investor is to attain an ability to cash out with a high ROI.

The next graphic summarizes this discussion and provides a tool you can use to see if your invention can provide a basis for a spin-out company. The green line is the threshold which must be met to make a spin-out plausible. We use < shapes to indicate the uncertainty concerning what will happen. The broader the gap between the lines, the greater the uncertainty. By adjusting the lines in your head to fit your situation, you can get an initial idea of whether your invention might provide the basis for a spin-out company. In the graphic below, a spin-out is plausible, although we might like to see less variance in possible staff capabilities and market possibilities and higher revenues from the initial market application.



If you are interested in doing a spin-out, let your KTO know and explain why you think it is feasible. Your KTO can help you examine your reasoning and data to see if a spin-out makes sense.

Be aware that most technologies move to market via licensing.

How do I do a Deal?

You don't. Only the legally authorized agent of your employer can do that. Usually that agent is in the KTO or is the vice rector, rector, provost, vice-president, or the head of a research foundation to whom the KTO reports.

To stay out of trouble, do not make any communication which could be construed to be an offer to contract. Avoid any language that sounds like you intend to make a trade. Avoid anything that could be construed to be a term sheet. Above all, don't sign anything. Don't let anyone assume you have the legal authority to negotiate and sign binding agreements

unless you have explicit written authorization from the appropriate authorities to do so, Leave the NDAs, materials transfer agreements, term sheets, negotiations, contracts, and licenses to your KTO.

Working with your Knowledge Transfer Office

Your KTO will take the lead when negotiating and closing a deal, but that does not mean you are not critical to the process. Deals are done by teams. Someone does the negotiating. Their job is to find the consensus with the party on the other side of the deal and to ensure it will be acceptable to the decision maker. There is usually a lawyer also is involved. Their job is to advise the decision maker and negotiator by pointing out where risks exist and how they can be legally mitigated. If an accountant is involved, they will be monitoring the revenues and costs and advising the decision maker and negotiator on how various terms will affect these. The role of the decision maker is obvious. He or she, and only he or she, has the authority to sign the deal and legally commit the institution.

Because the deal is about your invention, you need to be ready to explain whether or not it can do what the other party is looking for, and with what degree of certainty and reliability. You may also be asked to clarify the difference(s) between your invention and other technology either available today or within some economically relevant time frame. You usually have one other job. When things are put on paper it helps to have as many eyes review it as possible. You probably will be asked to read term sheets and agreements. Look for where you might get ... well ... screwed and point it out to the KTO. Also review it from the standpoint of fairness. Does it seem like a fair deal? If so, it probably is a win-win if your invention does what you say it does within the degree of certainty and reliability that you specified.

Closing Thoughts

- Nothing happens without a sale.
  - David Speser, Chairman Foresight Science & Technology

Commercialization is about sales. Ultimately, somebody has to buy a product or service embodying or made with the aid of your invention. Without sales, there is no money to flow back up the supply chain and into your pocket. This basic fact is why attaining a market orientation as soon as possible is critical for successful commercialization.

- If opportunity doesn't knock, build a door.
  - Milton Berle, Comedian

If you think the world is going to beat a path to your door to acquire your invention, you will be sorely disappointed. You have to make people aware of it and why they should care about it. The traditional way we make people aware is we publish in peer reviewed journals and give presentations at professional society meetings. You can also write articles for trade publications and do a poster session or presentation at an industrial meeting. It also helps if the KTO and you, under their guidance, pick up the phone and start calling people you think should be interested in your invention. If they are not, ask them why not. That may build a door to future conversations. Also ask them who they think might be interested and if they mind if you mention their name when calling those people. Of course, you have to

be careful to not reveal anything proprietary unless a NDA is in place. Nor do you want to offer anything that could be construed as a legally binding offer.

Again, ask your KTO for advice before calling folks.

- A well-defined imagination is the source of great deeds.
  Chinese Fortune Cookie

Imagination is the source of invention. The great deed of commercialization requires discipline. The first step is to document your invention in an inventor's notebook and get that documentation witnessed by two people. Then disclose it to your KTO. The KTO should have forms you can use. Next, support the KTO in seeking intellectual property protection for your invention before disclosing it to others. Until a patent application is filed and/or, if relevant, industrial design, copyright, or trade mark protection obtained, work with your KTO to ensure there are NDAs in place prior to disclosure. Finally, support your KTO in the marketing of your invention and be prepared to cooperate in deal negotiations when a target expresses interest. Remember, good deals are win-win, so do not get greedy and always seek to be fair.

- It's fun to have fun but you have to know how
  Dr. Suess

So, go ahead. Have fun with knowledge transfer. It's your chance to make this crazy world a better place to live. You get all the fame and glory and also get to make money by doing it. When that first check comes in you will want to click your heels and smile. Hopefully, you also will pass what wisdom you have learned about knowledge transfer to your colleagues and fellow researchers and, if you are teaching, to your students. They too can know the joy of seeing their research applied in practical applications.

Phyllis Leah Speser, J.D. Ph.D., is the Senior Consultant for Knowledge Transfer and Commercialization at the Research and Innovation Foundation (RIF) of the Republic of Cyprus. She is a Registered Technology Transfer Professional and a certified New Product Development Professional. Prior to joining RIF, she was co-founder, CEO, and Chair of the Board of Foresight Science & Technology Incorporated, an adjunct Professor of Intellectual Property at the State University of New York at Buffalo, and director of the University of Rhode Island Technology Transfer Office. In her over 45-year career, she has supported commercialization of thousands of technologies from across science and engineering for universities, non-profit institutes, research hospitals and other research organizations as well as government agencies and companies of all sizes.