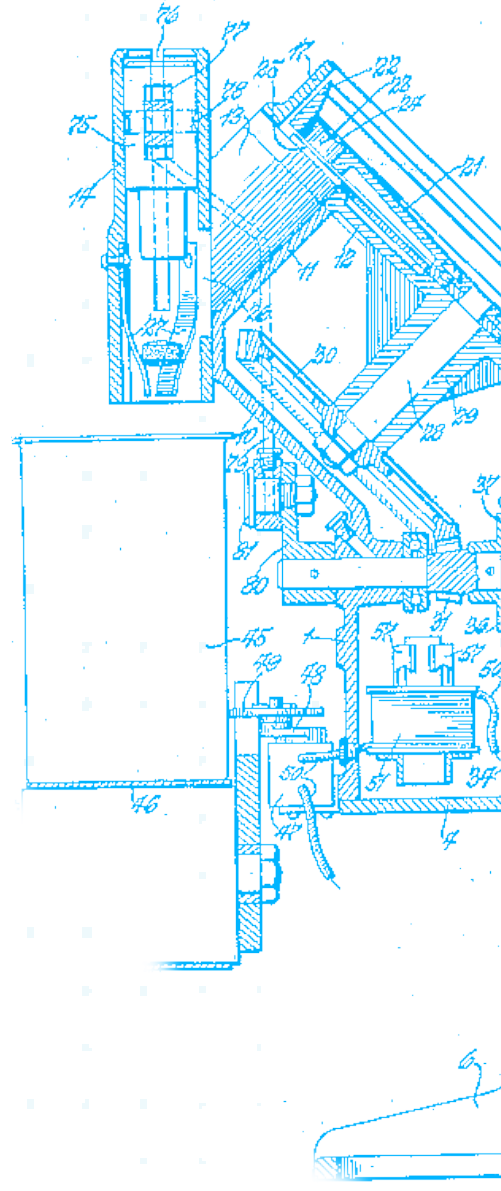
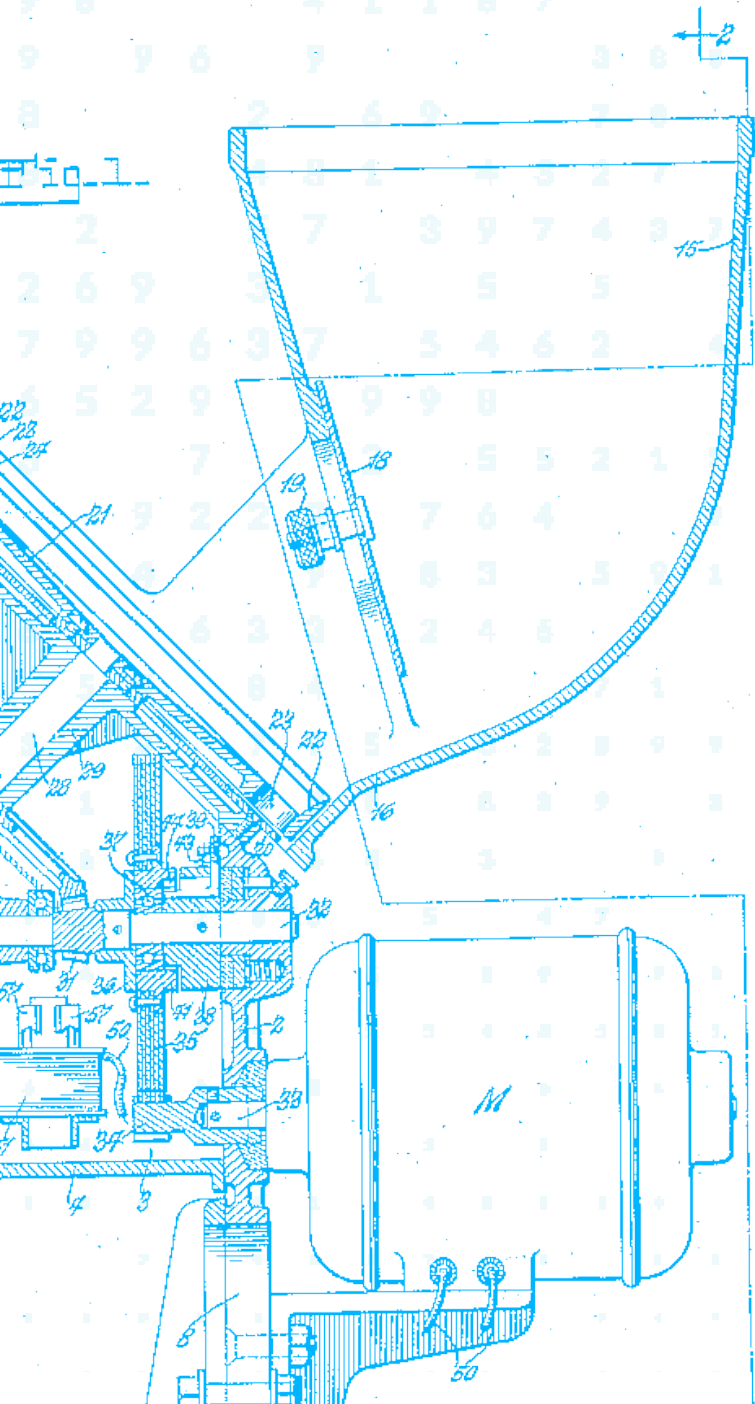


Using Inventions in the Public Domain

A Guide for Inventors and Entrepreneurs

Fig. 1



Using Inventions in the Public Domain

A Guide for Inventors and Entrepreneurs

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Introduction to the guide

This guide is designed to help researchers, inventors, entrepreneurs and micro, small and medium-sized enterprises gain access to, and use, information in the public domain, knowledge and technology for invention, innovation and product development in their own country. To be in the public domain means that information, knowledge or technology is not proprietary and may be freely accessed by anyone. The focus of this guide is on information and technology disclosed in patent documents. By patent documents, we refer to published patents and patent applications plus other publicly accessible official information about pending and issued patents, such as that available through patent offices or courts. The process by which inventions and innovations become products and/or services is called new product development (NPD). NPD is a disciplined and defined process comprising a set of tasks, steps and decision gates that an organization or individual uses to convert embryonic ideas into salable products and services.

Terminology hint

The phrases **public domain information** and **information in the public domain** are used interchangeably in this guide. So too are the phrases **public domain knowledge** and **knowledge in the public domain**.

1. Framework for the guide

This guide's overall content is based on the use of information about inventions available in the public domain with emphasis on inventions disclosed in patent documents. The public domain is the domain of everything that is not owned by (proprietary to) a non-governmental party. Data, know-how, techniques, information, knowledge and land are all examples of things which may be in the public domain. **Information and knowledge concerning inventions disclosed in patent documents may be publicly accessible. However, just because the information or knowledge in a patent document may be publicly accessible does not mean you can use it freely.** Patents give rights to their owners in exchange for disclosing the information in the patent document. These rights relate to making, using and selling the invention disclosed.

The guide refers to goods and/or services either currently or potentially sold in a commercial market as a "product." So, the emphasis of this guide is on public domain information and knowledge about technology and inventions useful for NPD.

Information and knowledge in published patents and patent applications plus other public domain knowledge can be utilized to help conceive, refine and/or formalize a concept for a product, protect the idea for a product and map its path to commercial viability.



Using public domain knowledge in patents to conceptualize product and/or service features and functionality

Conceptualization of a product and/or service can be realized by using public domain knowledge disclosed in patents and patent applications to examine features and functionalities that go into a product.

An inventor or innovator who is starting with an idea for a product can make use of public domain information and knowledge to:

- Gain insights for their product or service concept from inventive knowledge as disclosed in patent documents that are similar to their product and/or service concept.
- Exploit technology and inventive knowledge that may not be protected by an enforceable patent(s) in their or other countries.
 - Anticipate when or where an invention disclosed in an enforceable patent will be available to use as indicated by the date of filing of the patent application and the period of protection in that jurisdiction’s patent laws and regulations.
 - Identify other patents disclosed in the References section of a patent that are not in the same field of use but could offer insight into parallel applications for their technology.
 - Use patent statistics and patent families to help assess the uses of a technology that may directly affect their product.
 - Help determine the potential viability of a product and/or service being conceptualized in terms of end-users, target markets, etc. disclosed in the Background of the Invention section of a patent or patent application or other patent documents.



Using public domain knowledge in patent and non-patent literature in the NPD process

NPD processes can be supported by useful business information disclosed by patent and non-patent literature describing similar technologies.

An inventor or innovator with a formalized new product and/or service concept can seek patent information and knowledge in the public domain to:

- Help estimate the commercial viability and value of their concept by reviewing the patent portfolio of similar established products/services.
- Determine if the product and/or service is novel to a region by searching for patents, patent applications or research reports for similar products/services.
- Avoid infringement of enforceable patents and subsequent restrictive legal actions.
- Conduct technology intelligence using the disclosed innovative activities of competitors with complementary products/services.
- Find experienced personnel who may be candidates for employment by examining the inventors and/or assignees in patents and patent applications for related technology.
- Study the prosecution history of patents of interest with similar technology for useful information to apply to prosecuting their own patents.
- Seek licensing, partnership, mergers or acquisitions by determining the owners of relevant patented or patent pending technology.
- Conduct competitive intelligence by examining patent activity associated with substitutable products and/or services.
- Discover emerging trends leading to new market opportunities in technology fields through exploring the patent activity of others.
- Create innovation and market opportunities by patenting around existing patents.

This guide is organized in three distinct modules that review and explore the applicability of information from inventions in the public domain. The modules are as follows:

- MODULE I** Review of the public domain as a function of geography and time, with a focus on: (1) the public domain in developing and least developed countries and (2) the relationship between patents and the public domain.
- MODULE II** Exploration of public domain knowledge in patents, the relationship between patents and other intellectual property rights, and using the insights gained to find opportunities to leverage existing inventions and public domain knowledge for facilitating business success.
- MODULE III** Using and integrating public domain knowledge in product development processes from an idea's conception to its analysis, design, testing, market launch and post-launch analysis for continuous improvement.

2. Considerations for using the guide

Who should use the guide: The guide is meant for researchers, inventors, entrepreneurs, technology transfer personnel and corporate, non-profit and government research program managers and product developers. It will be particularly useful to users of WIPO Technology and Innovation Support Centers (TISCs) around the world.

TISC staff members may be involved in assisting clients seeking guidance for developing their inventive ideas in developing and least developed countries (LDCs). WIPO established TISCs in these countries to provide inventors/innovators (clients) with relevant technology information from patent and non-patent resources along with services to develop and manage their inventive endeavors.

All readers are assumed to have some understanding of intellectual property (IP) and its applicability in business contexts and to possess a basic working knowledge of management tools.

When the guide should be used: This guide can be used when an inventor/innovator seeks advice/knowledge to bring a novel product or service to market.

How the guide should be used: The guide should be used to explore how public domain information and knowledge can facilitate and improve invention and innovation of new products and/or services. Additionally, the guide should be used as a resource to assist clients to navigate new and untested inventions through the product development process by using and/or integrating knowledge gained from patent documents and other literature in the public domain. This guide is a companion publication to the WIPO publication *Identifying Inventions in the Public Domain: A Guide for Inventors and Entrepreneurs* (2020). You are advised to study this companion document as the two guides contain complementary content.

3. Purpose of the guide

For businesses operating in developing countries and/or LDCs, much of the information disclosed in patent documents is part of the public domain and hence free to use. This guide describes how the information disclosed in patent documents can be used and/or integrated into new products and enhance the processes for their development. With this guide, useful skills, procedures and institutional frameworks can be adopted by those who can benefit from knowledge in the public domain.

Terminology hint

In this guide, the phrase **public domain knowledge** in patents is equivalent to the phrase **public domain invention** as used in the WIPO publication *Identifying Inventions in the Public Domain: A Guide for Inventors and Entrepreneurs* (2020).

This guide is intended to help you efficiently integrate public domain information and knowledge into the process of product design and development. Using the public domain knowledge together with constructs illustrated in the guide can help you and your clients to make more informed management decisions. Doing so will leverage the investments of time and money in developing product and service improvements to add value to inventors' and entrepreneurs' products and services, while minimizing the risk of infringing the IP rights of others. More information about identifying public domain knowledge and related concepts and processes can be found in the companion WIPO publication *Identifying Inventions in the Public Domain: A Guide for Inventors and Entrepreneurs* (2020).

The current guide briefly defines the term “public domain” and its relationship to patent documents. It also identifies information resources that are freely available and how they can be utilized in the commercialization of ideas, inventions and new services and/or product offerings. The guide is intended to serve as a reliable starting point for navigating the universe of publicly accessible patent document information.

Overall, this guide is intended to equip you with knowledge of many of the patent-related resources that are available to help in making suitable decisions about an invention and its future market potential.

4. Scope of the guide

This guide focuses on using information contained in patent documents and elsewhere in the public domain. It adopts a generic process-focused methodology that employs logic, flowcharts and annotated diagrams to aid you in your use of the public domain knowledge contained in patents and non-patent literature. Modules I, II and III primarily have content based on this process-focused methodology. These sections are written for inventors, entrepreneurs, innovators, etc. who would benefit from using public domain knowledge across the various stages of product development to protect their ideas and/or apply such knowledge to facilitate successful commercialization. Contexts and/or Teaching Examples originally authored by innovators in developing countries and LDCs (Module III) explore how public domain information is used and integrated in product development decision-making.

You may have an idea for an innovative product and would like to formalize it, but are unsure of what needs to be done. Public domain resources should help you consider the kinds of technology which may be useful to advance an invention in the market. This guide will assist you in identifying some existing technology resources as well as identifying innovative technologies which may be available as public domain knowledge that could be integrated into your product concept or development plan. Key ideas that can be helpful in Module III are presented as “Helpful hints.” Topics discussed are briefly summarized below:

- **Public domain and patents** with respect to geography and time are described in Module I. Further discussions include the relationship between patents and public domain, and the characteristics of the public domain in developing countries and LDCs.
- **Public domain knowledge about inventions disclosed in patent documents** is reviewed in Module II. Patent no. US 9,715,257 B2 is used as an example of how to identify useful information in patent publications. This module also focuses on the scope of the related patent protection and other IP rights and the public domain knowledge they may or may not contain.
- **Using public domain knowledge in the product development process** is discussed in detail in Module III. This module explores most of the key concepts of the guide and presents

Teaching Examples to help clarify key concepts and how they are applied. These Teaching Examples are scenarios, real and fictional, where market challenges facing individuals and companies are resolved through decision-making processes. These include examples based on:

- an inventor from Zimbabwe whose unique cooking invention helped save time and money for thousands of Africans (Teaching Examples 5 and 6);
- a small software-developing firm that met with challenges when entering international markets (Teaching Example 7);
- an inventor who turned an innovative technology into a commercially viable product by meeting the needs of local farmers in Morocco (Teaching Example 8);
- a small machinery manufacturer that was doing business in international markets and was faced with challenges to its IP (Teaching Example 13).

5. Limitations of the guide

This guide is neither a formal nor a comprehensive introduction to product development. Instead, it is a guide for inventors on how public domain information and knowledge can be used to improve decision-making in product development processes. The guide may be useful to entrepreneurs, including micro, small and medium-sized enterprises, engaging in product development in pursuit of revenue growth and/or better profits. It may also be useful to public institutions that engage in knowledge and technology transfer.¹

This guide does not serve as a legal guide to IP laws. Despite commonalities, each jurisdiction's IP laws are unique, and a general introductory guide such as this cannot cover them all. Nor is it intended to be used as a guide for developing a patent strategy, even though the topic is discussed briefly. Rather, the guide is an introduction to the kinds of resources that are available to the general public.

The guide acknowledges the fact that in many countries patent offices do not have archives of patent documents that are readily accessible through digital platforms. Every region will not have equal access to resources mentioned in the guide. Databases that can be accessed via the Internet may not be helpful in regions where the Internet is not accessible or reliable.

While access to electronic resources may be limited geographically, the guide can help you distinguish and/or select the public domain knowledge resources that may be available to clients. The guide is not a comprehensive description of all that encompasses the public domain. It is designed to be a supplement to enhance knowledge of the potential and limitations of public domain information knowledge that are helpful for identifying and evaluating technology capabilities within a firm or a project and for conducting product development. The knowledge gained by TISCs, technology transfer and other service providers through this guide should be shared with inventors, innovators and managers seeking their support and guidance.

Module I

Defining the public domain and its relationship with patents

This module begins by establishing what constitutes the public domain. It further describes the limitations of the definition. For example, the public domain in one country may not be identical to the public domain in another. The public domain's relationship with patents is also explored in this module. The key characteristics of public domain and what may be considered as "free to use"² are included. As noted earlier, the focus of the guide is on using patent information in the public domain for businesses in developing countries and least developed countries (LDCs).

Learning points

Once you have completed this module, you should understand:

- How the public domain is defined in terms of a specific geographic region and time, with an eye to clarifying what falls into the public domain.
- The relationship between patents and public domain.
- How inventions that have not been protected by patents locally may be in the public domain in that country.

1. Understanding public domain information and knowledge as it relates to new product development

1.1 Public domain as a function of geography and time³

According to Conley *et al.*, there were 147 million patent applications filed globally between 1883 and 2011, with more than 82 million patents granted.⁴ Further, approximately 95 percent of patent applications filed and pursued since 1883 have already entered the public domain. The authors of the study presented a model that likened the public domain to a “universe of freely accessible information.”

They used the following formula to define the public domain with respect to intellectual property (IP) rights:

$$\text{Public domain (g,t)} = U - P - C - M - ID - O + S$$

Where:

g = Geography

t = Time

U = Universe of known and freely accessible information

P = Patent rights

C = Copyrights

M = Mark rights

ID = Design rights

O = Other rights (e.g., geographic indications, plant breeders' rights, mask works, utility models, databases, explicit traditional knowledge)

S = Previously secret information which can be known because it is no longer proprietary and protected but is not yet freely accessible (such as information in a referenced publication that is not proprietary but not yet freely accessible as the journal has not yet published it).

Figure 1, taken from the *Study on Patents and the Public Domain (II)* (see Annex), illustrates where the patent system intersects with the public domain. As can be seen, the “private core” constitutes patent rights that are active and hence enforceable. This domain is defined by the authors of the study as the “core of the domain of private patent rights.” The annular area surrounding the private core is identified as “potentially disputed territory” within which patent rights may be registered or granted but due to legal ambiguities may or may not be enforceable. Utility models most likely exist under “potentially disputed territory.” The rest of the region beyond the potentially disputed territory is inhabited by patents that have transitioned into the public domain. These are expired, abandoned, canceled and/or legally canceled patents. Intellectual assets beyond the private core and potentially disputed territory are part of the public domain in a particular region at a particular time and are available for use within that specific geographic region.

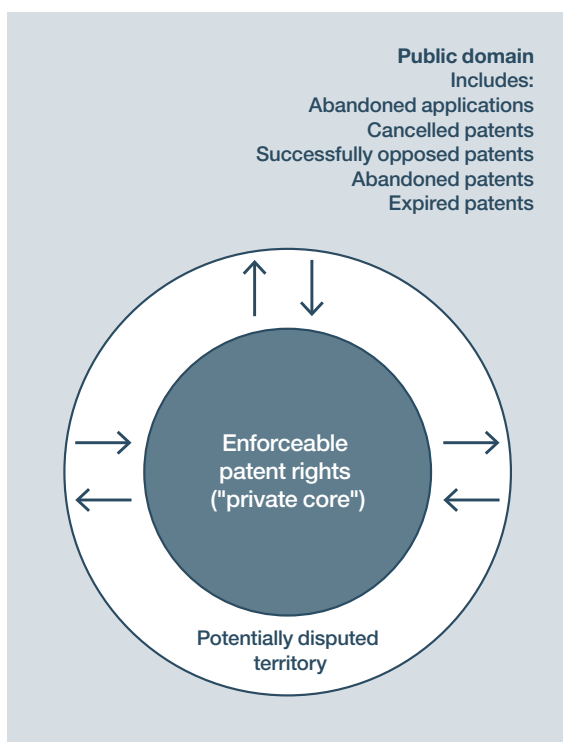
This geographically and temporally specific definition of the public domain in terms of all known private IP rights helps in clarifying what constitutes the public domain in any nation or region (g) at any given point in time (t). The growing stream of patent applications continuously feeds the universe of publicly accessible information, which

Terminology hints

- **Geographic indication** is a legal right granted to a product that originates from a specific geographic region and carries a distinct characteristic(s) that is “essentially attributable” to that region.
- **Plant breeders' rights** are also known as “plant variety rights” and are IP rights conforming to the International Union for the Protection of New Varieties of Plants Convention. They are granted to breeders of new plant varieties and allow the owners of such IP to exclude others from producing and reproducing a “protected variety.”
- **Mask work rights/layout designs (topographies) of integrated circuits rights** are IP rights granted to original work in the field of integrated circuits.
- **Utility models** are also known as “petty patents” in comparison to traditional patent rights. They grant inventors shorter terms of protection and have less stringent requirements for patent applications.
- **Explicit traditional knowledge** is culturally distinct know-how that is developed, preserved and passed on from generation to generation within an indigenous community.

will eventually enter the public domain of the country where the patent is applied. The public domain defined in this manner can be applied across sovereign states to get a full understanding of the scope of the public domain and hence all of the various forms of data, information and knowledge that may or may not be free to use when growing a business.

Figure 1: Intellectual property and public domain⁵



2. Relationship between patents and the public domain

The WIPO publication *Study on Patents and the Public Domain* examined the relationship between patents and the public domain.⁶ According to the study, even though there is no formal definition of “public domain” in terms of international patent law, it can be understood to be an all-comprising compilation of information which is readily accessible. Public domain data, information and knowledge are not owned by anyone. This embodiment of the public domain comprises information publicly disclosed through networks, databases, publications and literary works whose use or duplication is not restricted by any IP regime and thus is available to freely use by those who have access via the Internet, libraries, subscription-based databases or other means.

This guide is focused on using inventions in the public domain. These inventions typically were disclosed

in patent documents. They can be used freely in new product development (NPD) if the invention is not covered by another enforceable patent and the patent being examined has expired due to the end of its patent life, was abandoned due to failure to pay maintenance fees regularly, revoked by decision of the national patent authority, invalidated by court order or because no patent was filed in the specific jurisdiction of interest.

3. Public domain in developing and least developed countries

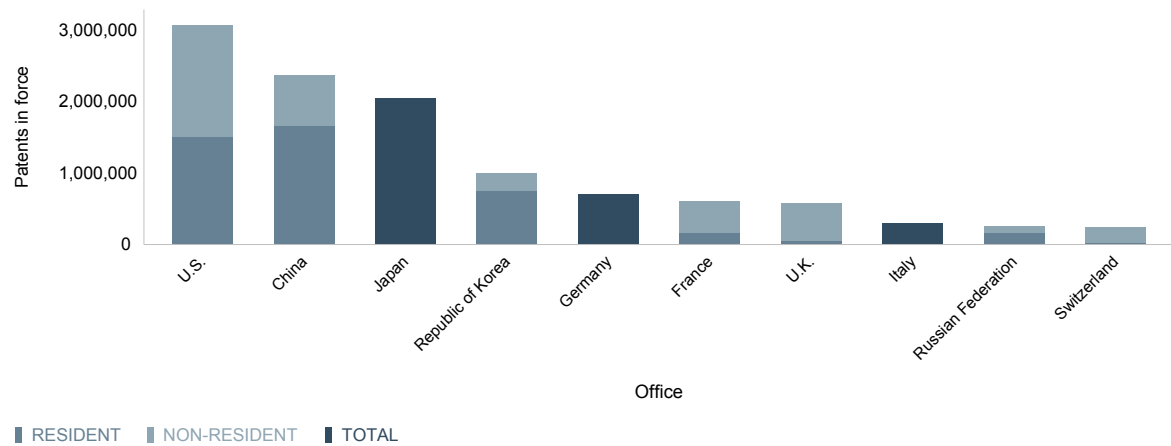
As expressed above, the public domain is a compendium of data, information and knowledge that an individual (such as an inventor, entrepreneur, scientist, academic, manager, marketer, artist or engineer) is free to use depending on where, when and how they want to use it. For inventions disclosed in published patent documents, most of this knowledge is free to use by those individuals who live in developing countries and LDCs to the extent that local patent activity is non-existent or too limited to result in IP rights. In other words, where there are no local IP rights, it is irrelevant what was granted in another country as long as the invention is only practiced in that specific jurisdiction where no rights exist.

WIPO reported the total number of active patents worldwide to be 14 million in 2018.⁷ The United States held the majority (3.1 million) of the active patents, closely followed by China, which reported 2.4 million active patents.⁸ In fact, the top 10 patent offices in the list were from countries with developed economies. Figure 2 below presents the leading 10 patent offices and their numbers of active patents in 2018.

It is worthwhile emphasizing that patents enforceable in developed economies may not necessarily be protected by jurisdictions in developing countries and LDCs. For instance, a patent granted by the United States Patent and Trademark Office (USPTO) usually would not be filed for protection in Nigeria, unless there was a significant economic reason to do so. Hence, patents enforceable in developed regions have a higher probability of being a part of the public domain in developing countries and LDCs at any given time.

By understanding the constituents of the public domain and their limitations, you can identify opportunities to legitimately maneuver and leverage inventions and knowledge in the public domain for your client’s business endeavors. When there are restrictions based on patent rights, information in the related documents can still suggest opportunities to partner as well as obtain licenses for use of the desired technology.

Figure 2: Top 10 patent offices with active patents in 2018⁹



Recap

Public domain data, information and knowledge are not owned by anyone.

Patents that have transitioned into the public domain are expired, abandoned, canceled and/or legally canceled patents.

Patents are geographically and temporally limited; therefore, a patent that is enforceable in one country may not be enforceable in another, meaning that the data, information and knowledge it contains may be in the public domain in some countries but not in others.

Module II

Finding opportunities to leverage inventions and public domain knowledge

This module defines the role of public domain knowledge as disclosed, for example, in patents, for identifying opportunities for developing and taking products to market. A patent document is a specific, nuanced explanation of a technology that teaches a person of “ordinary skill in the art” how to practice the invention. When granted, the patent becomes an intellectual property (IP) right to exclude others from practicing the invention in those countries where the patent is granted. In many cases, business economic considerations mean patents are not pursued in certain developing countries and least developed countries (LDCs). Hence, in those cases and in those nations, much of the knowledge disclosed in patent documents is in the public domain and free to use.

Public domain knowledge as embodied in patent documents serves at least two functions:

- To indicate technology, products and services, or features and functionality of products, that can be used as long as they are not patented in the target country or market region.
- To gather business information.

While information in a patent may be in the public domain, how it may be exploited is determined by patent and other IP law. Public domain information can only be exploited as you wish where there are no associated IP rights covering the making, use, selling, etc. of the invention disclosed in the patent. A patent gives specific IP rights to an invention’s owner for a number of years under the laws of the specific jurisdictions where a patent issues in exchange for publicly disclosing information about their invention. We provide examples in this section to demonstrate this principle. In addition to patents, other forms of IP may contain useful and exploitable information. The concept of a unique selling proposition (USP) is introduced to demonstrate how the functional benefits of patents can inform the brand meaning of trade and service marks through original stories and narratives of marketing (copyright).

Learning points

Once you have completed this module, you should understand:

- Patents and their relationship with inventions.
- The scope of protection of patents; that is, the grant to a patent's owner of a limited period of exclusivity in a limited geographic market.
- Useful information that is publicly available in patents.
- Public domain knowledge that may or may not be gained from IP regimes other than patents, such as copyrights, trademarks (service marks), trade secrets and mask works/layout designs (topographies) of integrated circuits.
- How a unique selling proposition links multiple forms of IP to enhance the value of a product or service.

1. Relationship between inventions and patents

The term patent comes from the Latin word *patere*, which literally means to lay open. Patents are a unique type of IP. They are public disclosures of inventions that describe novel, inventive solutions to technical problems or challenges that have been constructively reduced to practice. That means a person skilled in the field of the invention, upon reading the patent, could replicate that invention. Published patents and patent applications are important learning tools for interested parties and are often the preliminary sources of information about new technology. Patents and/or industrial design rights create incentives for inventors, designers and artists to:¹⁰

- Make new inventions and enhance performance of technologies, processes, products, combinations, etc.
- Make early public disclosure of their inventions.
- Seek investments of risk capital to commercialize inventions and leverage the monopoly position provided by IP.
- Make “innovations” or inventions that circumvent the IP protection provided by existing patents held by others.

An invention can be defined as a new way to resolve a technical issue or do something that has not been done before. Inventions often lead to new products, devices, processes or improvements on a product or a process. Developing such a “solution” typically requires investment of skill, time and capital. Humans are constantly researching and inventing, as reported in scientific journals, trade magazines, news articles and other sources. In most cases, such information is available to the general public. But the ability to use public domain knowledge of one geographic region in another may vary, as explained in Module I of this guide.

While knowledge about inventions may be available in multiple forms, a patent document is important because it lays out comprehensive details about inventions in a systematic way and can lead to legal rights over the invention. An inventor with an idea for an invention can seek protection for their invention by filing a patent application. A patent system, through its legal consequences, gives incentives to anyone to commercialize their invention by granting exclusive rights, within the nation, state or region covered by the patent right. The use of a registered patent enters the public domain of its nation of grant only after the expiration of its legally granted patent life, if the patent is invalidated or when a registered patent is abandoned by the patent owner. Patent documents, once they become part of the universe of publicly accessible information, enrich the universe of information on science, technology, innovation and related inventive knowledge.

Though patent documents and the knowledge disclosed within them are accessible in patent databases, once a patent is granted, the owner holds legal rights to exclude all others from making, using or selling the claimed invention in the country or countries where the patent is granted and active.

2. Territorial scope of patent protection

Generally speaking, patent protection is limited to the nation or region where the patent is formally granted. Hence the scope of patent protection is mostly limited to the nations where a patent has been issued and is enforceable. In all other countries or regions where there is no patent granted on the same invention, anyone is free to use and/or practice the invention disclosed in the patent.

Filing a patent application with the United States Patent and Trademark Office, for example, if the patent issues, will grant the patent owner the right to exclude anyone else from making, using or selling the invention in the geographic territory of the United States of America. Moreover, it will also bar others from importing any product created using the process disclosed in the granted patent into the territory of the United States of America. In this sense, patent rights are negative rights, being rights to exclude others, which in practice means the owner has a monopoly with respect to the patented subject matter as long as the patent rights are enforceable. Upon expiration of a patent, which is typically 20 years from the filing date of application, the invention disclosed in a patent document enters the public domain and is free to use by all. At this time, the patent rights are expired or beyond enforceability. In some countries, the term of protection may be extended for inventions that require regulatory approval before entering the market. Such inventions enter the public domain correspondingly later.

A patent application can also be filed in a regional office that has jurisdiction over multiple countries, which are members of the regional patent system.¹¹ For instance, a patent granted by the African Regional Intellectual Property Organization may have effect in 19 member states.¹² Such regional IP organizations may assist an applicant with a simpler application process.

The body of inventive knowledge contained in patent documents continues to grow. WIPO's IP statistics reveal steady growth in patent applications worldwide from 1980 to 2018.¹³ For instance, there were approximately 3.3 million patent applications filed around the world in 2018, which was an increase of 5.2 percent in patent filings compared with 2017.¹⁴ Since 2009, there has been a steady increase in global patent filings. This guide will help you in retrieving and analyzing patent disclosures that are free to use to gain an understanding of the scope of an invention.

Awareness of useful knowledge disclosed in patent documents is primarily in the developed regions of the world. Similarly, awareness of the tools available within WIPO and elsewhere, to help use the inventive knowledge contained in patents, is limited. This guide is designed to assist innovators and inventors in developing countries and LDCs use these resources to advance their commercial interests and hence the economy of their countries.

3. Examples of useful information found in patent publications

The day-to-day running of a business benefits from up-to-date knowledge of competitors and their technologies. The various sections of a patent or patent application can be useful sources of knowledge for these purposes. For example, the front page of a patent contains:

- **Patent number:** This is a unique numerical identifier of a patent, typically listed on the first page of the patent document (publication, application and/or a patent grant).
- **Title of the invention:** A basic, high-level descriptor of the patented invention. Keywords in the title and their relation to other inventions and/or patents can be searched using established methods.
- **Applicant/assignee name and address:** An applicant or an assignee usually appears on the front page of a patent document. This is the entity or person who filed the patent application. The applicant/assignee is almost always the owner of the patent rights post grant. This entity or person would be the primary contact for any licensing or partnership negotiation.
- **Inventor:** As an original creator of an invention, an inventor (or multiple inventors) is usually skilled in the field of technology of the invention. They may provide information on the specific patented invention. Additionally, they may connect the reader to a broader network of experts (scientific communities, academies, professional societies) and published literature by searching their name online through publicly accessible databases or the open web.
- **Dates:** Significant dates and legal priorities for an invention are conveyed on a patent document. Life of an enforceable patent, in most cases, may be calculated based on when the filing date for the application was recorded and the duration of patents in that jurisdiction.
- **Classification symbols and field of search:** Patent classification symbols (national and international) designate the areas of technology related

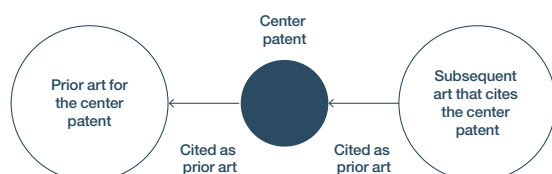
to the patent invention. Note that knowing these fields can help to narrow searches that can lead to alternative solutions and/or competitive technology. Be aware that keyword searches provide a somewhat different slice through the patent literature.

- **References/prior art:** References listed in a patent document often refer to technologies, inventions and scholarly research that pre-dated the application for the patent of interest. These references are part of what is the universe of “prior art.” When an entrepreneur is looking for alternative technology solutions to avoid infringement of a patent, the inventors and companies listed in prior art references can be a fruitful place to search.

Beyond the above examples, citations to the patent of interest can also be a useful source of information. These citations occur in subsequent publications. The grouping of patents that subsequently reference the patent of interest is known as the “subsequent art.” In this sense, the patent of interest becomes part of the prior art to the later patents that cite it.

Figure 3 illustrates the relationship between the prior art, the patent of interest and the subsequent art. Here the patent of interest is named the “center patent.” The prior art collection of patents together with the subsequent art collection of patents form the “citation cloud.” The number of subsequent art citations can be used as an input to measure the relative value of a patent.¹⁵ On search platforms such as Espacenet, the search engine of the European Patent Office, there is a direct ability to identify prior art (cited) and subsequent art (citing) patents. Following a practice in scholarly literature, subsequent citations are one proxy for patent value, as they are usually an indication of a patent’s importance.

Figure 3: Presentation of the citation cloud of a center patent



Teaching Examples 1 and 2 illustrate how data contained in patent documents can be used for management decision-making. Here the elements of a patent document describe the active protection of smartphone screens and other relevant technology.

Information about suppliers, engineering material specifications, costs of procurement, customers, etc. is seldom disclosed in patent documents. Yet this kind of information is necessary to successfully exploit an invention and bring to market a similar active screen protection product. Developing and curating information related to efficient production of the invention is discussed in subsequent modules of this guide.

4. Other IP rights

Patents are not the only IP right that can be used to secure the intangible value of an innovation. Trademarks, trade dress, copyrights and trade secrets are other notable regimes of IP protection that may inhibit unauthorized use, imitation and/or misappropriation/infringement. When these IP rights are acquired by firms, it is a leading indicator for potential commercialization of a patented invention. A brief description of these other types of IP and what usable/applicable information they may contain is given below.

Trademarks are granted for words, names, symbols, appearance or other means used to identify and distinguish businesses, products or services (service marks). Trade dress is a type of trademark that is concerned with the visual appearance of a product or its packaging that signifies the source of the product to its consumers.

Trademark rights are limited to the jurisdiction of national and regional IP offices where the trademarks are used and registered. Trademark protection can last as long as the mark is in use and maintained through timely payments of the required renewal fees. A product or service’s trademark presence in a region could deter competing products and services from using similar marks that could cause confusion among consumers. Trademarks are the legal foundation of a brand’s value as they protect unique identifiers for the brand.

WIPO’s Global Brand Database is one search engine for detailed information on brands (see Annex). Such trademark databases can help entrepreneurs explore the “brand” ownership territory of the markets they may want to enter. This knowledge is helpful when considering whether to partner with an established brand (trademark owner) or build your own brand. For more discussion on trademarks, refer to Module III, section 8.7, “Protecting IP in feasible products.”

Copyrights are measures to protect original works of literature, art, media, computer programs and other

forms of databases. Copyrights for original works exist automatically upon creation. Copyrights require registration in some countries if related rights are to be enforced via the legal system. The duration of a copyright varies across jurisdictions. Many jurisdictions grant protection for the life of the author plus 70 years. Works made for hire may run for 100 years in some jurisdictions.

Trade secrets are useful information and knowledge that are secret (i.e., they are not generally known among, or readily accessible to, circles that normally deal with the kind of information in question); have commercial value because they are a secret; and have been subject to reasonable steps by the rightful holder of the information or knowledge to keep it secret (e.g., through confidentiality agreements). By nature, trade secrets would not be public knowledge as they are not disclosed and should not be easily ascertainable. The life of a trade secret is dependent on the life of its confidentiality.

5. Unique selling proposition and its relevance in IP regimes

A marketing construct that can be used to relate multiple types of IP to a specific product or service is called the unique selling proposition (USP). This construct is explained in Teaching Example 3. It helps relate the technical information in patents and trade secrets to copyrights and trademarks.

With such a tool, the coordination of technology development (patents and trade secrets) on the one hand, and marketing and branding (copyright and trademarks) on the other, can be aligned to create and strengthen enduring brand equity.¹⁶

Collectively the various layers of the USP help build the value proposition of the offering. The more unique the elements of the layers, the more unique the selling proposition that can be established. There are multiple theories of how the collection of IP rights can be used to build a sustainable competitive advantage.¹⁷ Awareness of these theories may facilitate more comprehensive and integrated management decision-making.

Terminology hint

A unique selling proposition (USP) comprises three elements:

1. A proposition made to a consumer stating the benefit of buying the proposed product.
2. A proposition that is unique (competition cannot or does not offer the same proposition).
3. A proposition strong enough to move the masses (bring new customers to the proposed product).

Teaching Example 1: Useful information for business/management as contained in patent publication for U.S. patent no. US 9,715,257 B2

The invention as described in patent US 9,715,257 B2 is an active screen protection for an electronic device. As embodied in the images included in the patent, the invention in part relates to methods for actively protecting an electronic device display screen from damage due to inadvertent dropping. Hence, this invention has applicability where electronic devices with fragile display screens, such as smartphones, can be susceptible to damage.

A quick check for the status of this patent via Espacenet indicates that this patent was only applied for and granted in the United States of America (based on the information accessed as of June 30, 2018). Outside this jurisdiction, including in all developing countries and LDCs, the invention knowledge described in the patent publication is free to use and in the public domain, unless the invention is also covered by another patent in the jurisdiction where it would be exploited.

Since it is free to use outside of the United States of America, you may want to know more about the inventors of this patent. The image (see below) is the patent cover page with key elements of interest identified.

If you want to network with or contact the inventors, their names and resident locations at the time of filing are given on the cover of the patent. We know that this patent is assigned (owned) by Apple Corporation. If you decide to improve upon this invention with your own innovations and plan to sell the improvement in the United States of America, you may have to negotiate with Apple. Outside the United States of America, you are free to do whatever you like with the claimed invention and improvements to this patent.

Those publications that are explicitly cited under References Cited are related to this invention. They may be issued patents or patent applications. If you want more information about the background technology that preceded this invention, there are many information sources in the prior art that are explicitly listed in the patent document (168 separate prior art references in patent US 9,715,257 B2).

	(12) United States Patent Manullang et al.	(10) Patent No.: US 9,715,257 B2 (45) Date of Patent: Jul. 25, 2017	← Patent number and date of issue
Title of invention →	(54) ACTIVE SCREEN PROTECTION FOR ELECTRONIC DEVICE	(56) References Cited	← Portion of domestic patents cited a reference
Inventors and location of inventors →	(71) Applicant: Apple Inc. , Cupertino, CA (US) (72) Inventors: Tyson B. Manullang , Sunnyvale, CA (US); Stephen B. Lynch , Portola Valley, CA (US); Emery A. Sanford , San Francisco, CA (US)	U.S. PATENT DOCUMENTS 2,171,808 A 9/19/30 Von Schirpe 2,989,869 A 6/19/61 Hwang 3,606,296 A 9/19/71 Chassagne 3,772,923 A 11/19/73 Burt 3,919,575 A 11/19/75 Weber et al. 4,278,726 A 7/1981 Wieme 4,288,051 A 9/1981 Göschel 4,314,735 A 2/1982 Fullenkamp et al. 4,370,894 A 2/1983 Stureson (Continued)	
Assignee →	(73) Assignee: Apple Inc. , Cupertino, CA (US) (*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 560 days.	FOREIGN PATENT DOCUMENTS CN 1458804 11/2003 CN 2710238 7/2005 (Continued) <i>Primary Examiner</i> — Brian Wilson (74) <i>Attorney, Agent, or Firm</i> — Kendall W. Abbasi; David K. Cole	← Portion of foreign patents cited as references
	(21) Appl. No.: 14/256,002 (22) Filed: Apr. 18, 2014 (65) Prior Publication Data US 2015/0301565 A1 Oct. 22, 2015	(57) ABSTRACT An electronic device includes one or more screens, multiple screen protectors moveable between a retracted position and extended position where they extend above the screen to create a gap, and one or more sensors. When the sensor detects a drop event, the screen protectors move from the retracted to extended position, functioning as a shock absorber and preventing the screen from connecting with a surface that the electronic device contacts. In some implementations, the screen protectors may be multiple tabs that may be moved between the retracted and extended positions by one or more motors and/or other actuators coupled to one or more pinions. Such tabs may be formed of various flexible and/or rigid materials such as plastic, plastic film, polyethylene terephthalate or other polymers, metal, thin film metal, combinations thereof, and/or other such materials.	
	(51) Int. Cl. G06F 1/18 (2006.01) G06F 1/16 (2006.01) H04M 1/18 (2006.01) H04M 1/02 (2006.01) (52) U.S. Cl. CPC G06F 1/182 (2013.01); G06F 1/1637 (2013.01); H04M 1/185 (2013.01); H04M 1/0266 (2013.01); H04M 2250/12 (2013.01) (58) Field of Classification Search CPC G06F 1/1637 ; G06F 1/182 ; H04M 1/0266 ; H04M 1/185 ; H04M 2250/12 ; H04M 1/02 ; H04M 1/0202 ; H04M 1/18 ; H04M 2250/00 ; H04B 1/3888 USPC 3403.1, 5.1 See application file for complete search history.		
		20 Claims, 8 Drawing Sheets	

Further, using Espacenet and/or other public search engines, you can see who has subsequently cited this patent other than the applicant company, Apple (as shown in the image below). In this case, you can see that IBM in the United States of America, two companies in China and a German inventor have subsequently cited this patent as of August 30, 2018. Further, you can see the names of the inventors who have generated the inventions that reference the center patent (US 9,715,257 B2). These inventors and the respective assignees on the subsequent patents may be candidates for collaboration.

Also, assuming no other blocking patents in a jurisdiction of interest, the inventors of the subsequent patents filed in China and Germany are free to use the information and technologies claimed in patent US 9,715,257 B2 in all countries outside the United States of America. Further, they can and have patented their specific improvement inventions, including in the United States of America. Searching other information sources such as YouTube using the name of the German inventor, Philip Frenzel, yields instructive information and videos about how Philip Frenzel engineered and improved upon the invention of the center patent to create his subsequent art invention (see utility model DE 20 2018 101 276 U1).

Whether you are a manager or innovator, this kind of information is good to know as it expands the product development options available. The easy, direct and quick availability of information in publicly available patent documents reduces the time and money entrepreneurs, inventors, innovators, established business or service providers must spend searching for such options.

The screenshot shows the Espacenet website interface. At the top, there are navigation options for language (Deutsch, English, Français) and a 'Change country' dropdown. Below the search bar, there are tabs for 'About Espacenet', 'Other EPO online services', 'Search', 'My patents list (0)', 'Query history', 'Settings', and 'Help'. The main content area displays 'Citing documents: US9715257 (B2) — 2017-07-25'. A sidebar on the left contains various filters and options like 'Bibliographic data', 'Description', 'Claims', 'Mosaic', 'Original document', 'Cited documents', 'Citing documents', 'INPADOC legal status', and 'INPADOC patent family'. The main list shows 11 documents citing the target patent, sorted by priority date in descending order. The first document is '1. PROTECTING AN ELECTRONIC DEVICE' by NOTHCHEFF, FLETCHER, ELY, and COLIN M. The second is '2. Drop Countermeasures For Electronic Device' by PETERSON, CARL R., WOODRICH, and JUSTIN R. The third is '3. DROP COUNTERMEASURES FOR ELECTRONIC DEVICE' by PETERSON, CARL R., WOODRICH, and JUSTIN R. The fourth is '4. Keyboard used for portable terminal and multi-gear positioning structure thereof' by HAN, FUXUE, ZENG, YONG, and GONG, FANG. The fifth is '5. ACTIVE SURFACE PROTECTION FOR PORTABLE ELECTRONIC DEVICES' by RIVELLINI, TOMMASO P., and KOCH, RICHARD. The sixth is '6. Method and device for preventing stretchable screen from being scraped' by XING, ZHENZHOU, ZUO, and QINSHENG. The seventh is '7. Protective structures to provide impact protection for portable devices' by BUVID, DANIEL, CAMPBELL, and ERIC J.

Citing documents

Apple patent cited by Chinese patent application CN 105607701 A filed by Huizhou TCL Mobile Communications Co. Ltd. (China) inventors F. Han, Y. Zheng, J. Zhou, and R. Jin



Apple patent cited by Chinese patent application CN 106131265 A filed by Wuhan China Star Optoelectronics Technology Co. Ltd. (China) inventors Z. Xing and Q. Zuo



Apple patent cited by U.S. patent US 9,973,231 B1 issued to IBM (U.S.) inventors D. Buvid, E. Campbell, S. Czaplowski, and C. Steffen



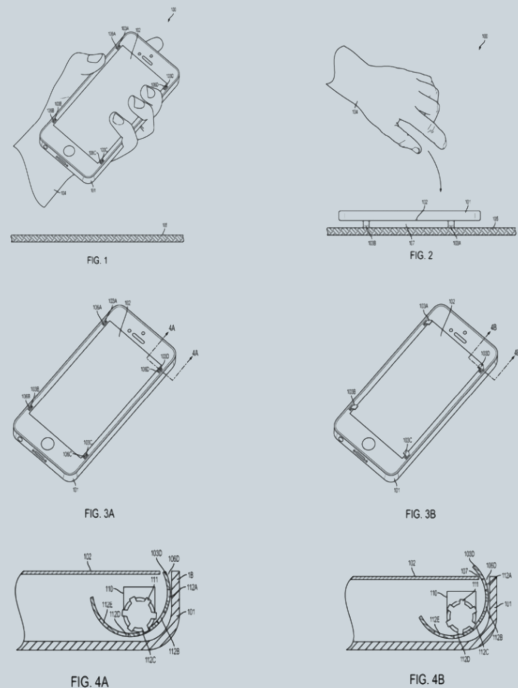
Teaching Example 2: Useful technical information for engineering as contained in patent publication for U.S. patent US 9,715,257 B2

Product development is also informed by the technical detail that is disclosed in the patent on how the claimed invention operates. From the image shown across, the invention in part describes a system of screen protectors made from shock-absorbing engineering materials that actuate and extend when a drop of the phone is sensed. The additional description of the invention, drawings and specifications are included in the complete patent publication accessible for free from several databases, e.g., WIPO's PATENTSCOPE database (see Annex).

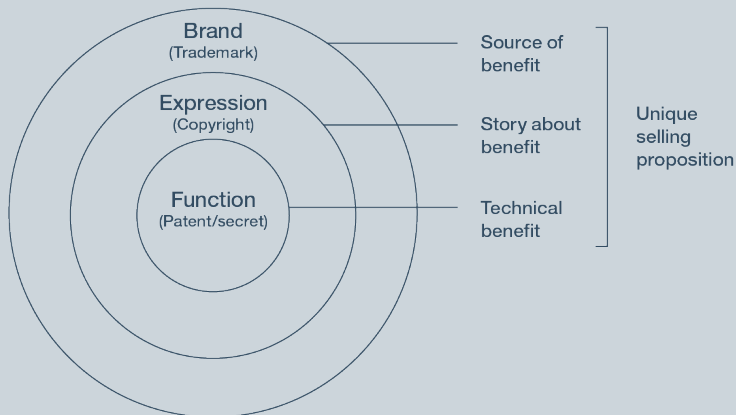
Some possible arrangements of the protectors, actuation sensors, actuation logic and actuation mechanisms are described in the patent. This information is useful for someone interested in duplicating this invention as disclosed. Outside the United States of America, anyone is free to use this inventive knowledge to safeguard device screens and other objects that may benefit from such a protection scheme. Further, they can develop, market and sell products that use this invention in all countries of the world except the United States of America (a transshipment through the United States of America may trigger an infringement).

Note that while the inventive information that is contained in US 9,715,257 B2 as described above may be in the public domain and free to use outside the United States of America, this does not necessarily mean that the inventor of German utility model DE 20 2018 101 276 U1, Philip Frenzel, can sell his improved and protected screen protection devices anywhere outside the United States of America. The device could still infringe other patents. As described in the WIPO publication *Identifying Inventions in the Public Domain: A Guide for Inventors and Entrepreneurs* (2020), pre-existing, third-party patents from relevant jurisdictions should be considered ("lack of a counterpart patent in a country does not mean an invention is free to use in that country").

<p>(12) United States Patent Manullang et al.</p> <p>(54) ACTIVE SCREEN PROTECTION FOR ELECTRONIC DEVICE</p> <p>(71) Applicant: Apple Inc., Cupertino, CA (US)</p> <p>(72) Inventors: Tyson B. Manullang, Sunnyvale, CA (US); Stephen B. Lynch, Portola Valley, CA (US); Emery A. Sanford, San Francisco, CA (US)</p> <p>(73) Assignee: Apple Inc., Cupertino, CA (US)</p> <p>(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 560 days.</p> <p>(21) Appl. No.: 14256,002</p> <p>(22) Filed: Apr. 18, 2014</p> <p>(65) Prior Publication Data US 2015/0301565 A1 Oct. 22, 2015</p> <p>(51) Int. Cl. <i>G06F 1/18</i> (2006.01) <i>G06F 1/16</i> (2006.01) <i>H04M 1/18</i> (2006.01) <i>H04M 1/02</i> (2006.01)</p> <p>(52) U.S. Cl. CPC <i>G06F 1/182</i> (2013.01); <i>G06F 1/1637</i> (2013.01); <i>H04M 1/185</i> (2013.01); <i>H04M 1/0256</i> (2013.01); <i>H04M 2250/12</i> (2013.01)</p> <p>(58) Field of Classification Search CPC ... <i>G06F 1/1637</i>; <i>G06F 1/182</i>; <i>H04M 1/0256</i>; <i>H04M 1/185</i>; <i>H04M 2250/12</i>; <i>H04M 1/02</i>; <i>H04M 1/0202</i>; <i>H04M 1/18</i>; <i>H04M 2250/00</i>; <i>H04B 1/3888</i> USPC 3403.1, 5.1 See application file for complete search history.</p>	<p>(10) Patent No.: US 9,715,257 B2</p> <p>(45) Date of Patent: Jul. 25, 2017</p> <p>(56) References Cited U.S. PATENT DOCUMENTS 2,171,808 A 9/1939 Von Schlippe 2,989,869 A 6/1961 Hangs 3,666,296 A 9/1971 Chassagne 3,772,923 A 11/1973 Burt 3,919,575 A 11/1975 Weber et al. 4,278,726 A 7/1981 Weine 4,288,651 A 9/1981 Gönchel 4,314,735 A 2/1982 Falkenkamp et al. 4,370,904 A 2/1983 Strosser (Continued)</p> <p>FOREIGN PATENT DOCUMENTS CN 1458804 11/2003 CN 2710238 7/2005 (Continued)</p> <p>Primary Examiner — Brian Wilson (74) Attorney, Agent, or Firm — Kendall W. Abbasi; David K. Cole</p> <p>(57) ABSTRACT An electronic device includes one or more screens, multiple screen protectors moveable between a retracted position and extended position where they extend above the screen to create a gap, and one or more sensors. When the sensor detects a drop event, the screen protectors move from the retracted to extended position, functioning as a shock absorber and preventing the screen from connecting with a surface that the electronic device contacts. In some implementations, the screen protectors may be multiple tabs that may be moved between the retracted and extended positions by one or more motors and/or other actuators coupled to one or more pins. Such tabs may be formed of various flexible and/or rigid materials such as plastic, plastic film, polyethylene terephthalate or other polymers, metal, thin film metal, combinations thereof, and/or other such materials.</p> <p>20 Claims, 8 Drawing Sheets</p>
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Teaching Example 3: The IP Atom model and the unique selling proposition



The USP can be described as layers of benefits that help differentiate a product or service from the competition. In some cases, the benefits are purely technical. These technical benefits are communicated in marketing messages to create the product “story.” At the point of purchase, trade and service marks and brand loyalty reduce barriers to purchasing by giving credibility to the product story.

As per the model above, at the core of all products and/or service offerings is a **feature** or **functionality** that satisfies some need recognized by the customer. The desire for the bundle of features and functionalities in the product gives it economic utility for its end-users, meaning they will buy it. Patents and trade secrets are the IP rights that can be used to protect and/or leverage whole inventions or some of their features and functionality benefits.

The story explains the technical benefit at the core of the offering and the reasons for end-users to buy the product. This story is embodied in marketing messages that communicate just what the product does, its technical benefits, its positioning (i.e., presenting it in the most favorable way to capture a target audience) and other messages that should stimulate buying. Because these are physically realized **expressions** (i.e., creative acts) they can be copyrighted. Copyrights are the IP rights that secure and facilitate leverage of marketing messaging assets.

On the outside of the USP is a **brand** and/or source identifier trademark that minimizes the customer’s reluctance to buy. The brand/mark is the cognitive touchpoint of the user experience. It aggregates the impacts of customer experiences, good and/or bad, on the value of the company. It is an intangible asset on the balance sheet. A mark and/or dress is an IP right that secures the brand from being used by others. Together with its utility for making sales easier, this IP right is a contributor to the asset value of a brand.

Recap

Patents are public disclosures of inventions that describe novel solutions to technical problems or challenges. They lay out comprehensive details about an invention in a systematic way and can lead to legal rights over that invention.

Published patents and patent applications can be important sources of information about new technology and up-to-date knowledge of competitors and their technologies; such information can be helpful in making decisions about how to move forward with a proposed new invention.

A patent typically expires 20 years from the filing date of application.

Trademarks, trade dress, copyrights and trade secrets can also all be used to reduce unauthorized use of an invention.

A unique selling proposition combines the features/functionalities, marketing messages and brand identifiers that differentiate a product or service from its competitors.

Module III

Integrating public domain knowledge into product development processes

This module focuses on the implementation or use of public domain knowledge to assist with the development of a product and/or service. It should not be considered as a guide to product development.

Learning points

Once you have completed this module, you should understand how to:

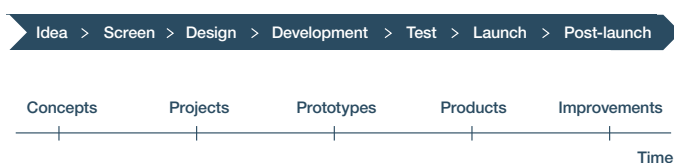
- Gather new inventive/innovative idea(s) and evaluate them within a firm to see if any can bring an attractive return on investment to the firm.
- Assess a team’s culture and capabilities for carrying out the stepwise tasks and gates (milestones) commonly found in new product development processes.
- Review accessible public domain knowledge and other external and internal resources to define a feasible product or service specification for an idea.
- Develop an intellectual property (IP) strategy to better secure tangible and intangible intellectual assets.
- Anticipate market risks and opportunities by using patent and non-patent literature to conduct technology intelligence and competitive intelligence.
- Make use of tools such as business model canvas, balanced scorecard and SWOT analysis to assess the economic value of products at gates in a product development process.
- Use patents as a reliable source of information when using product development design tools such as TRIZ.
- Seek a temporary monopoly position for a product or service “launch” based on the implementation of an IP strategy.
- Continue to keep products and services profitable by introducing improvements based on feedback from customers and end-users and matching their needs and requirements with innovations in the public domain or which can be licensed.

The process by which new commercial ideas and/or inventions find their way to market with minimum risk is often referred to as new product development (NPD). The logic and sequence of decisions in this process are intended to expose challenges and opportunities.

Many different models for the NPD process exist.¹⁸ For the purpose of this portion of the guide, we will discuss the model presented in Figure 4 below.¹⁹ The activities under each step are described in what follows.²⁰

The balance of this section of the guide will discuss how to leverage public domain knowledge in a traditional linear NPD process during the various phases of NPD (idea, screen, design, etc. as shown in Figure 4).

Figure 4: New product development process with maturity of the products being developed



1. Idea phase

1.1 Introduction

You have an idea for your business that you believe is unique and worth pursuing further. You are at the starting point in your journey of invention. Often though an idea that seems brilliant in theory may not be possible in reality. You may like to know how you can make use of public domain knowledge to assist you in assessing the associated risks.

Ideas for innovation can be evaluated with the use of an “invention black box.” This is a preliminary method which allows you to lay out the basic steps needed to transform your idea for a product and/or service into a rough set of technical requirements for the product and/or service. As a first draft approach, it is particularly used where there is only a limited understanding of the innovation to be brought to market. The skeletal idea may benefit from some input from external resources as well as a way to finance further development steps to achieve that desired product/service. Concepts of products and/or services may not be fully formed at this point. Concepts are often used to provoke frank discussion about the idea.

How do you evaluate your idea to see whether it is worth undertaking? There are a number of decision-making tools available in the public domain. One is “product idea scoring and screening” using a balanced scorecard together with pass/fail analysis. This assists governance and guidance of product development. It establishes a set of performance measures along with clear objectives to be

Helpful hint

The linear process for NPD described in this module derives from the waterfall process that became popular in the 1970s and 1980s. Waterfall processes are based on Stage-Gates® and are both intuitive and easy to use. They have since fallen out of favor as more integrated and concurrent approaches have proven to be more cost-efficient and outcome-effective. These approaches bring the voices of customers and stakeholders, and those of representatives of manufacturing, marketing and sales, and customer support, into NPD. Many NPD activities can take place simultaneously as well. However, the linear approach is simpler for beginners, and the knowledge gained from this module remains applicable to more modern product development processes such as concurrent engineering, integrated product development, lean product development and agile development.

achieved by your product and/or service and then allows you to see if those metrics are likely to be obtained. The benefit of using a tool like the balanced scorecard is that it helps in long-term planning regardless of the size of your firm. The balanced scorecard discussed here is simplified and can be adapted based on your experience and requirements.

Also introduced is a public domain method for assessing a team and its capabilities. Regardless of size, product development is a team sport. Sometimes this team is the whole company, as is often the case with a startup. In more established companies it can be a dedicated team or a group of people assigned to product development alongside their other work for the company.²¹

In all product development processes, it is management's responsibility to lay down the vision and goals for a product development team. Management is also responsible for assigning people to the team and motivating them. For effective product development, management should foster an environment and culture that encourages innovation throughout the company. This culture facilitates team cohesion and productivity as the members get to know each other and execute their specific tasks and responsibilities.

By accessing public domain information available in external resources, the team can develop a preliminary understanding of market opportunities and how a product and/or service can take advantage of those opportunities. Related inventions in patent documents that have been commercialized are helpful for brainstorming market opportunities that can be pursued. We will explain how to seek out relevant patent information about technologies and other inventions that can be exploited after undertaking steps to ensure that such information is free to be used.

The discussions and tools introduced so far can help evaluate the feasibility of the concept for the product to be developed. With this higher confidence that there is a feasible product and/or service out there, the idea stage progresses to a fuller definition of the product/service and its features and functionalities. One tool for this task is preparing a business model canvas, breaking down the factors that will make the product/service being developed a business success.

1.2 Idea and its significance

New product and/or service offerings begin their life as an idea. Using idea-generation tools can increase the universe of product and/or service possibilities.

Brainstorming²² and other generative techniques are examples of idea-generation tools used to inspire new solution concepts for what may be an unmet customer need. Patent documents are a reservoir of knowledge about possible solution concepts that can be applied during brainstorming and other ideation methods. Further searching of public domain knowledge may also help in locating expertise for hiring internally, contracting or partnering.

The NPD process as defined in Figure 4 begins with an idea that has the potential to achieve commercial success. Just what success can be achieved varies from entrepreneur to entrepreneur and company to company. Because companies are literally “for profit,” the metrics for commercial success always include revenues and profits. Customer satisfaction, repeat buying and firm growth (whether domestic and/or global) are also commonly used.

Many entrepreneurs and companies are also concerned about sustainability and other public benefits. The precise definition of what makes a new product or service successful is derived from the firm's vision, mission statement, values and business and innovation strategies.²³ These frameworks are used to develop the goals and objectives for an NPD initiative.

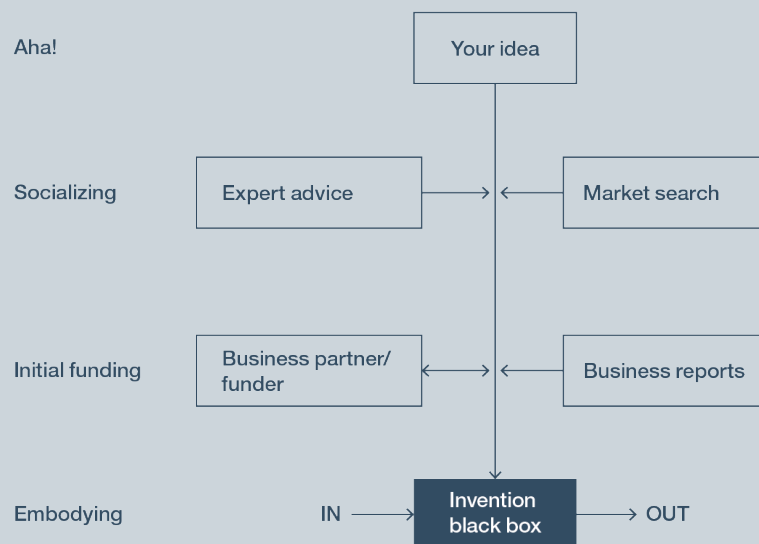
1.3 What is an invention black box?

The concept of an invention black box gives a preliminary view into the various tasks needed to progress through the stages of the NPD process. An invention black box is a simplistic way to think about the technical challenges in developing new products, for which only the invention's or innovation's input and output are known. The intermediary steps between input and output are not yet defined. At the preliminary stage of NPD, an invention black box assists with thinking about how an idea technically becomes an actual product or a service that is commercially available.

The disclosure contained in many patent documents can be a window on what goes on in a black box. The document usually describes some technical challenge or unmet market need. The disclosure in the documents then explains a solution that addresses the unmet need. The unmet need and description of prior art is part of the black box input. The invention described in the balance of the patent document and claims is part of the output.

Teaching Example 4 is a simplistic flowchart for how an idea could be formalized using an invention black box. This tool is used after completing preliminary

Teaching Example 4: Presentation of a business idea from conception to invention black box with intermediary stages of socializing and initial funding



The basic steps in the flowchart that any entrepreneur or inventor would need to go through to take an idea and develop it into a marketable product and/or service are ideas, socializing, initial funding and embodying. (There are other terms that can be used to define these tasks.)

- **Ideas**, however generated, need to be written down, recorded and/or expressed in sufficient detail so that they can be shared. It is not necessary to have all the answers to begin with, and it is wise to seek outside input or even a consultant to help to better determine design requirements and establish potential market feasibility for an idea.
- In the **socializing** phase, the NPD team begins to tap into resources available. These resources include **expert advice** (primary research) and **literature and web searches** (secondary research) to learn about technology, distribution channels, market strategy and so on. The NPD process stages of **idea**, **screen** and **design** primarily involve socializing activities. At each milestone (gate) in the sequence of steps, it is prudent to evaluate whether the evolving product or service still maps to the goals and objectives set for product development. Many of the resources needed for the socializing activities may be available in the public domain, as discussed in section 2.4 of this module, “Evaluation of available resources (internal and external).”

- Additional resources are required to move beyond design to the **development, test and launch** steps of this NPD process. The **initial funding** is either from internal resources or provided by investors. Sometimes early investors are **business partners** for developing, producing, distributing, marketing and selling the new product. Other times investment comes from “Angels,” who are wealthy people who enjoy investing in and helping new companies. Angels have often built successful companies in related fields, so they bring business know-how with their money. At this stage, there needs to be sufficient information about the invention to map out an investors’ package. Details in public domain resources such as **business reports** (annual reports, trade journals, corporate filings, articles, etc.) are resources for doing that. So is examining the patent portfolios of potential collaborators and competitors.
- **Embodying** is where the actual **development and test** steps occur. At the beginning of an NPD process, as the flowchart indicates, these are an **invention black box**. Embodying typically involves iterations based on internal and end-user feedback. A good NPD process incorporates adjusting to changing technology trends and the evolving expectations and tastes of potential customer segments.

market research (socializing) and resourcing (initial funding). This flowchart highlights a bird’s-eye view of the initial NPD tasks that an inventor/innovator may perform. Doing so helps them to convert an innovative idea into an invention black box that is later used to develop specifications, materials and production processes for a product and/or service.

1.4 Product idea scoring and screening using the balanced scorecard

As an idea matures, there are a number of public domain tools that can help evaluate its feasibility. The balanced scorecard is a well-known one.²⁴

The methodology considers various measures and compares them against targets (financial, corporate and customer objectives) presented in a tabular format. The five steps required to design and use a balanced scorecard are as follows:²⁵

1. Translating a firm’s vision, mission and strategy into a set of goals and objectives.
2. Operationalizing the objectives into a set of performance measures.
3. Planning, setting targets and aligning strategic initiatives to enable meeting the objectives.
4. Conveying the scorecard to the team and linking it to individual performance.
5. Measuring progress and capturing feedback about what is working and what is not and integrating the resulting insights into internal learning and improvement processes.

This scoring methodology enables evaluating alternatives based on multiple parameters. The results may be a total score for all parameters per alternative or a weighted score based on the importance of the metric.²⁶ Further discussion on scorecards is presented in the example below.

Figure 5 illustrates an example of a balanced scorecard for a fictional company – an Internet of things (IoT) tech firm. This example is just one variant of the balanced scorecard. Scorecards are customized to suit a firm’s size and needs.²⁷

Referring to Figure 5, the balanced scorecard for the IoT tech firm is broken down into the following components:

- The four parameters that form the vertical axis of a balanced scorecard are called “balanced perspectives.” **Financial, technology, customer** and **internal** dimensions are presented.²⁸
- On the horizontal axis of the balanced scorecard are targets as identified by the firm – **strategic priorities** (overall mission), **objectives** (desired goals), **measures** (tangible and intangible gains), **targets** (financial objectives) and **initiatives** (taken to meet objectives against each measure).

Helpful hint

While developing your idea, do not over-focus on the technology choice per se. Try to include other critical parameters as well, such as development and production costs, freedom to operate (an IP issue), competition, and marketing, sales and customer support costs.

Note: The Product Development and Management Association’s (PDMA) *Body of Knowledge* highlights the importance of considering whether the idea is consistent with the articulated strategy, how much the idea contributes to meeting the firm’s goals and objectives and how well the idea is aligned with the company’s short-, mid- and long-term priorities. Together these can be used to assess the idea against the next best alternative. Opportunity cost measures this difference in a rate of return on the investment required to bring this idea to market versus the next best one. The opportunity cost is the **cost** borne by not receiving the profits and other benefits associated with the alternative choice if this NPD project is selected instead. Opportunity cost is defined as the value of the choice in terms of the best alternative while making a decision.

Figure 5: Example of a balanced scorecard for an Internet of things tech firm

	Strategic priorities	Objectives	Measures	Targets	Initiatives
Financial (weight 3)	Become financially strong	Profitability growth	Cash flow	\$ 200K	Secure clients who pay on time
			Profits	\$ 23K	Reduce costs and use marketing
		Cost reduction	Cost of research and experimentation (R&E)/sales Cost of financing	\$ 80K/\$ 45K 5%	Streamline processes Use collaterals to reduce cost of financing (e.g., use patents and IP)
Technology (weight 2)	Develop competitive IoT technologies	Develop technologies to sell to other manufacturers	Number of technologies licensed to others or components sold to others	2 per year	Invest in research and development (R&D)
			Develop technologies to use only in company's products	Number of technologies used in own branded products	3 per year
		Protect IP	File for international patents	4 per year	Put emphasis on IP and incorporate it in company culture
Customer (weight 2)	Keep customers happy	Build win-win relationship with customers	Returning customers	60%	More efficient product marketing Adjust price Offer incentives
			Spending per returning customers increases	15% increase per month	Work with client in new product development
Internal (weight 2)	Operational excellence	Build innovative products	Number of innovative products per year	2	Train staff for continuous innovation
			Streamline product development and manufacturing to reduce cost, increase quality, reduce time to market	Return on investment (ROI) and R&D Number of defective products Time to market	50% 0.001% 6 months

These combinations of dimensions in the vertical and horizontal axes are then compared individually with the measures to evaluate performance.

The balanced scorecard helps manage expectations across all parties that will invest in the future success of an “idea” for a product and/or service and provides the metrics for assessing progress at each gate (milestone) in an NPD process.

At each stage in an NPD process, there is a review of progress toward the tentative targets. This is a “pass/fail” review. Passes continue an NPD initiative. Fails trigger a more comprehensive review before deciding to continue or terminate the initiative. Remember, this is still too early in the NPD process for a firm to have defined targets. But using business constructs like a balanced scorecard will streamline the thinking process and take a firm closer to those attainable targets.

2. Evaluating team culture and capabilities

Conducting NPD is a team sport, and taking a product and/or service from initial idea to functioning output requires a team that shares the original vision and provides the skill mix and expertise needed to complete the project. Socializing, mentioned previously in Teaching Example 4, can also include using public domain information to search for capable candidates who can perform the tasks needed to achieve the set of objectives. For instance, post-doctoral or graduate students of academic inventors on relevant patents may have useful research experience and capabilities. It is helpful to start thinking early about the skills and personnel needed in the subsequent stages of product development. Novices at innovation may not see a clear pathway to a productive end. But a set of goals and objectives determined at this point along with the metrics in a balanced scorecard provide guidance as to the kinds of tasks required and the team needed to conduct those tasks.

As the preliminary team is assembled, keep in mind that the staff of a firm, its consultants and contractors evolve and are not static. There may be changes and adjustments to team membership over time. The expertise required may evolve as technical and market opportunities are better understood or change, or as the understanding of, and experience with, the field of the innovation expands. Below are some helpful discussions on bringing in a culture of innovation to a firm from the beginning, assessing a firm's competitive advantage through value chain analysis and evaluating the external and internal resources available. These help a team prepare and manage its tasks in NPD.

2.1 Against the flow

Have you ever experienced a moment of great resistance when you are trying to push forward an innovative project, like a fish that goes against the flow?

One reality faced by smaller firms is that most do not have all the capacities required to innovate. Further, an NPD project can be faced with a business culture that may not be welcoming or a complex environment for its conduct. This is what we call **innovating against the flow**.

Given this challenge, how does a firm organize to innovate? To answer this question, it would be helpful to understand what innovation means and elements that work in creating innovation within a firm.

Innovation is a sociocultural process, not just a technical-economic process. When innovating in a firm, it is necessary to consider the operations, the structure and the culture. These can be complicated to address, since cultural change is often slow. Cultural change, after all, is based on generating confidence and adapting your team's capabilities. Consider the following points in enhancing a sociocultural process:

- **State the intention to be innovative**, as leadership should be explicitly supportive. Short-term financial goals are desirable, but longevity of business success is based on how willing and prepared a firm is to embrace innovation. Make that part of its culture and encourage the personnel to come up with new ideas and participate in innovation.
- **Mobilize with respect and recognition of the people at the firm** around the tasks for creating a future. A combination of people and their knowledge is the key to success.
- **Be an enabling leader** to allow the delivery of contributions and encourage collaborative actions within the firm. The principle of real collaboration requires an open leader willing to receive all kinds of suggestions, without prejudice, without defending any prior knowledge and making sure to recognize the contribution of each person.
- **It is also possible to innovate in the real world** and not only in the world of academia, research laboratories and other specialized institutions. Practical knowledge can be very valuable, and the ideas behind some of the most successful products came from people working in their area of innovation. Innovation does not come just from the world of intellectuals, nor is it meant to be conducted only by specialists. Take into consideration all the people who work for a company in general and all the members of an NPD team in particular. Sometimes those who do the most basic work can provide the best idea for improvement or innovation because they live with the problems that exist every day or have direct interactions with end-users. For instance, customer service representatives who come into direct contact with customer issues daily are most likely to be able to point out recurring problems that should be fixed, in contrast to executives who are responsible for making decisions but see only aggregated data and are not privy to regular direct feedback from the customers.
- **Implement a portfolio approach that includes concrete projects** focused on the day-to-day reality of the firm and that finds a balance of short-, mid- and long-term initiatives with higher and lower risks. It is difficult for managers to resist taking sides for some innovative project or idea that they may want to implement. At all times managers should

be using a structured NPD process that includes specific and concrete metrics for reviewing and evaluating potential projects and evaluating them against alternatives. As projects progress, using a Stage-Gate® system ensures that those which lose their technical or economic justification are terminated. A tiny firm or startup may only have the resources to pursue a single project, but it should keep abreast of its options if that project fails.

- **Identify and explicitly state the potential of the firm** to the NPD team as a motivational element and back that up with financial and other incentives for exemplary performance. It is important to come back to the main values of the firm and the business and personal benefits that will result from a strategy's success.
- **Disseminate and promote the firm's innovation scheme** in a participatory and collaborative way. There are several methods to achieve this. These include team coordination meetings with periodic project monitoring and collaborative or creative workshops (be aware, however, that too many meetings and workshops take away from the time individuals need to actually do the project).
- **Establish a mechanism for managing innovations beyond the daily operation of the firm.** It may be difficult to make innovation a priority, due to resource (time and money) limitations. Hence a dedicated multifunctional team should be leading the NPD process (see the Helpful hint on the right).
- **Use outsourcing to obtain the knowledge required but which is unavailable in-house.** This situation may arise when the diversity and complexity of the knowledge required for NPD makes it difficult to transfer it in written documents, webinars and other such means. Corporate social networks, communities of practice, intranet, collaborative workshops, trade associations, education programs, etc. are some of the ways to obtain knowledge before contracting with vendors. The problem is exacerbated when these resources are located in different geographies from the companies seeking to tap into them.

2.2 Should you abandon the effort or move on to design? Innovate and/or cooperate?

Any process developing innovations into products or services should consider if collaboration will help.²⁹ It is not efficient to only consider a closed product development process in today's interconnected world with its multiple communication channels and existing networks that enable dynamic interaction with a changing global environment.

When conducting open innovation with academic and other research institutions, there are complex elements that may appear, such as differences in the language used by scientists and entrepreneurs, the time needed for decision-making and the priorities of each party. All these elements should be addressed to ensure collaborations are win/win as the NPD process progresses. It is necessary to plan and hopefully anticipate many of the barriers that you may have to face. It is inevitable in collaborations that misunderstandings and tensions occur. Learning while innovating includes allowing yourself to make mistakes but then analyzing them, learning from them,

Helpful hint

There are four options for organizing teams. The first three use a matrix structure to assemble a team with a variety of skills.

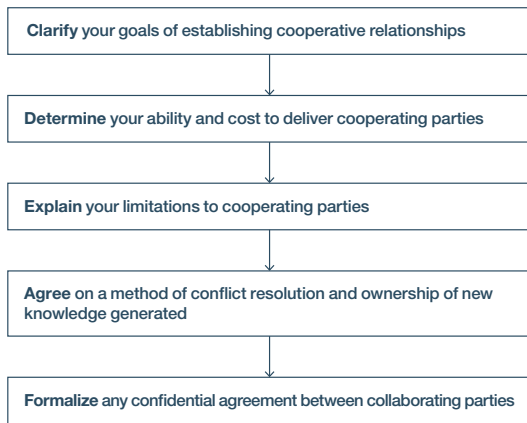
- **Functional teams** exist where the team members remain in their functional unit and do the project as part of their normal workload, reporting to their line manager.
- A **lightweight team** exists where a nominal team leader is appointed to coordinate a project whose team members are delegated to participate on an as required basis. The lightweight team members still report to their functional line manager.
- A **heavyweight team** exists where the team members are told to give the project precedence over their normal functional activities and the project team leader has the power and authority to direct team members to focus on the project. The project team leader is more important than their line manager for the duration of the project.
- The final type is an **autonomous project team**. It is not a matrix structure because team members are re-assigned out of the functional unit to work exclusively for the project team for its duration. The team leader acts like the CEO of a startup.

What works best depends on the nature of the project and the nature of the company.

Note: See the Product Development and Management Association's (PDMA) *Body of Knowledge* (2017), Chapter 4 for a more detailed discussion.

determining how to avoid them and improve in the future, and then capturing the situations and insights so they can become part of the company's continuous quality improvement. Figure 6 highlights some basic elements that help in laying out an exemplary cooperative process of innovation.

Figure 6: Basic elements for advancing a cooperative process of innovation

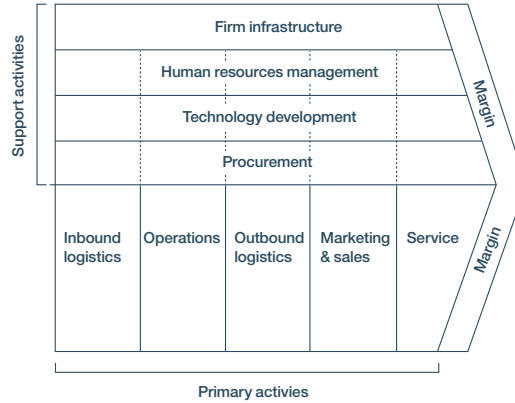


2.3 Value chain analysis in an assessment of a firm's competitive environment

Michael E. Porter in his popular management book *Competitive Advantage: Creating and Sustaining Superior Performance*³⁰ has stressed the importance of looking at a firm not as a whole but as an amalgamation of key activities that add to the firm's competitive and cost advantage. Porter states that a team operating as a firm is engaged in designing, producing, marketing, delivering and supporting its product. The value chain is a tool for systematically evaluating and analyzing all of a firm's activities in order to identify those activities that are strategically crucial for maintaining the firm's competitive advantages, such as quality and cost. Porter's illustration of the components of a value chain is shown in Figure 7.

Value chain activities consist of support activities and primary activities, both of which work together to create a product or service consumed by its end-user. While primary activities are activities involved in creating an actual product, support activities are dedicated to enabling primary activities. This composite of activities creates margin (profit) as shown in Figure 7. Margin, as defined by Porter, is the difference between "total value and the collective cost of performing the value activities." Every firm's ultimate goal will be to gain higher margins through efficiently managing its value activities.

Figure 7: Porter's generic value chain



Source: *Competitive Advantage: Creating and Sustaining Superior Performance* by Michael E. Porter. Copyright 1985 Michael E. Porter. Reprinted with the permission of The Free Press, a Division of Simon & Schuster, Inc. All rights reserved.

Porter's value chain focuses managers on their value-creating activities and how to improve their efficiency and efficacy. The value chain provides a framework for categorizing and evaluating what internal and external resources currently exist and what must be added to complete NPD and bring a product to market success. A clear understanding of which capabilities and resources are currently available together with a clear vision of what is needed next is helpful for navigating the various stages of a product development process.

2.4 Evaluation of available resources (internal and external)

A stepwise methodology to determine technology needs for NPD based on internal and external resources available to the inventors, innovators and entrepreneurs is given in Figure 8. This is informed by a comprehensive assessment of all the varieties of resources (external and internal) available. A product development team can use this survey of external and internal resources to evaluate which are the most pertinent to use, and then move on to the two steps detailed in Figure 8.

The two-step approach outlined in Figure 8 can help to organize and identify possible resources to support the firm or find solutions to NPD challenges. It identifies any deficiencies in available resources or access to them. Where deficiencies exist, removing them becomes part of NPD. Collaboration with existing companies, institutions, research organizations, local innovation support agencies (such as Technology and Innovation Support Centers (TISCs), etc. is a potential solution. The TISC should operate as a central repository for information about, and points of contact in, such resource providers.

Figure 8: Methodology to determine technology needs after a comprehensive assessment of external and internal resources available to an inventor, innovator, entrepreneur or manager

Step 1: Make a strategic diagnosis of the project in development

- Identify and collect the information that exists or the sources in which to find it, which is related to topics defined as strategic for your project.
- Identify critical monitoring factors, aspects or performance measures that are fundamental to progress in the development of your product or service.
- Identify the relevant dimensions of competition.
- Assess the resources of information and technology available.
- Design a research strategy: problem, general and specific objectives, geographic reach, study time, etc.

Step 2: Describe the needs, specifically in the technological area

- Describe your technological knowledge, characteristics and areas involved.
- Monitor the associated technological advances.
- Identify the opportunities that are presented in the market with its development.
- Know the lines in which research is being done for this technological area, distinguishing between lines that already present new lines of development and those that are already becoming obsolete.
- Detect if there are emerging technologies associated with the area involved.
- Investigate what each of the potential competitors is doing, focusing on what their overall technological development trajectory has been and/or will be.
- Identify who the experts are for that particular area or which are the most active firms or institutions working on these issues.

Identifying existing internal resources

Inventors/innovators tend to overlook nearby existing and available sources of knowledge, capabilities, skills and other resources. As suggested above, the first thing to do is catalog and assess what is available internally for NPD in general and this project in particular. Figure 9 outlines the process to follow. Looking at historical and current processes and discussing anticipated resources required with employees should be part of this cataloguing. Next is to catalog what is available through current external partners. Employees, vendors and other people who have a history with the individual or firm are helpful in this process.

With a sufficient understanding of existing resources, management and the NPD team can begin to assess what options are available to develop an idea/invention. Pursuing NPD may include developing a new business.

Lack of financial resources is a common obstacle in product development. Indeed, as NPD progresses the resources required usually rise. New equipment and facilities may need to be purchased, leased or rented. An entrepreneur with limited financial resources may overcome this obstacle by:

- Seeking Angel or venture capital investment.
- Collecting an upfront fee from licensing their product for use in markets they will not pursue.
- Partnering with an establishment that can finance the operations in exchange for equity in the entrepreneur's business or technology or in exchange for exclusive rights to make, use, distribute or sell.
- Licensing to an entity which will conduct the NPD itself and also pay a running royalty on revenues earned from the product.

Recap

New product development is a team sport regardless of the size of your company.

The definitions of success for a product or service are derived from a firm's vision, values and business and innovation strategies; these are all used to develop the goals and objectives for an NPD project.

Every member of an NPD project team needs to buy in to the original vision and contribute the skills and attributes needed to complete the project.

Figure 9: Steps to follow when reviewing internal resources



Document processes: Formalize and document the processes of the business, covering areas of financial, administrative, commercial, production, project management and innovative management.

Identify and classify all existing information and explicit knowledge. This can include all documents, reports and publications and can be shared in a document repository. Further examples of what can be identified and classified under this category are as follows:

- Research reports
- Skills and abilities of your team of engineers, research partners, technical experts, etc.
- Self-owned patents
- Existing bibliography of papers, documents, research reports, books, etc.
- Newsfeeds
- Documented feedback from customers
- Documents or reports that contain technical topics, discussions about new and existing products, surveys of best practices in your company and/or industry, etc.

Strategy of knowledge protection: A set of guidelines should be put in place to control the flow of information, thereby protecting future IP rights against inadvertent disclosure. Such guidelines can be promulgated through codes of ethics, employee agreements, employee handbooks and non-disclosure agreements with outside parties.

Disseminate internal knowledge: This action can be carried out among team members in a controlled manner by using databases, repositories of documents, intranet and/or via communities of practice within the firm.

Promote collaboration: It is beneficial to promote awareness of rules for protecting IP, the means for documenting it, the approved mechanisms for internal dissemination and dissemination with partners under non-disclosure agreements to lay the groundwork for collaboration internally and with partners. Promoting the knowledge-sharing system encourages people to use it to share their knowledge.

Before assessing options for developing an idea or invention, it is important to have a sufficient understanding of existing resources within or available to a company.

Collaborating with others outside of the NPD project team, or bringing in new team members, can be a way of acquiring expertise as a project progresses.

The idea stage of NPD involves assessing whether an idea is worth pursuing and, if it is, moving on to develop a fuller definition of the potential product and its capabilities and functionalities.

A balanced scorecard is a decision-making tool that can be used to evaluate the feasibility of a potential product or service. It establishes a set of performance measures along with clear objectives to be achieved by your product and/or service and then allows you to see if those metrics are likely to be met.

An invention black box helps to determine the technical steps that will be needed to move from an idea to a functional product or service.

3. Developing a product concept

A product concept in business terms is “an idea for a product [or service] which is capable of fulfilling consumer needs.”³¹ The product concept for an idea or invention should be developed with the end-user in mind. A product concept may be rough, such as sketches that later may become drawings in a patent application. It may be a mock-up, that is a simple model made of paper and wood or even a preliminary working model or prototype built with all the components that go into the product. As product concepts mature, a more detailed design is pursued which includes engineering specifications, technical drawings, parts lists, manufacturing instructions, etc.³² Each component that goes into the product or service must be expressed in sufficient detail to make sure that all the components work together and can be reasonably produced or procured. In an agile NPD process, a product concept provides the framework of the product design with details incorporated as product development proceeds.³³

Independent of which product concept approach is favored, a structured process is significant because it facilitates finding solutions for problems that are likely to arise later in product development.³⁴

In addressing possible challenges and solutions, patent information can be very helpful. Patents with similar technology could offer solutions to problems that may arise during product design and analysis, for example. Such patents need not necessarily be in the same field of research or found using the original search terms or patent classes. An example of this would be the “Writing Implement Including an Input Stylus” marketed as the Throttle (U.S. patent no. 5,913,629 granted in June 1999). The Throttle was an ink pen that worked as a stylus for handheld personal digital assistants.

This invention referenced another invention titled “Insert Molded Instrument Marker Pen with Anchored Stylus” that was granted U.S. patent no. 4,203,682 in May 1980. Each of these patented inventions had unique fields of search but the earlier patent was still used as a reference in the patent for the Throttle.³⁵

3.1 Is there a feasible product concept?

How do you determine product concept feasibility? Product concept has been defined earlier as an idea that could be developed to fulfill the needs of customers.³⁶ A feasible product concept takes that idea

a step further and uses market analysis to determine if it is likely to sell in volumes and for prices that meet the targets in the balanced scorecard. To determine the feasibility of product concept, several steps have been laid out earlier in this section:

- Define your objectives based on the initial idea.
- Assess the firm’s and team’s culture and capabilities.
- Initiate the process of formalizing a product concept.
- Explore what market opportunities exist.
- Search for what technologies may already be in existence, for example through patent searches.

These steps help in determining whether an initial idea could materialize into a feasible product concept. Teaching Example 5 discusses an inventor who looked outside the field of his invention for resources that were already in the public domain to help him overcome some of the obstacles to developing his idea into a functioning product.

4. Market opportunities

From idea conception through to launch on the market, there are multiple factors that should be evaluated. The most important two are who are the customers, and what do they need? If the product in question is new to market, then the definition of who the customer segments are becomes significant. Teaching Example 6 describes how the target market for an invention may not be the one that was initially thought of.

Even well-established companies have struggled when failing to address this question. Examples of Google Glass and Segway can be considered as innovative products that failed due to an insufficiently defined target market.

When Segway was introduced in 2002 as a two-wheeled transportation device, it was a first of its kind. Its creators predicted sales of 10,000 units per week, but in reality sold less than 10,000 units in two years after its launch.³⁷ Its creators believed it would change the way people commuted and that commuters would flock to Segway. This assumption turned out to be wrong. Consumers were not ecstatic about purchasing the pricey Segway to travel to places they could get to by car, mass transit, bicycle and walking. What started out as a unique product meant for everyone ended up being used only by niche groups such as city police patrols and sightseeing companies. If Segway had started out as a niche product meant for certain target markets only, its launch expectations might have been managed better.

Teaching Example 5: An inventor's journey from an idea to a commercially viable product

William Gwata was a biochemistry student at the University of Surrey in the U.K. in the mid 1980s. Living away from home, he constantly yearned for food native to his country, Zimbabwe. Often he would attempt to cook for himself but found it to be time-consuming. One dish that was particularly labor intensive and took time to prepare was *sadza*. This is a simple dish made out of corn meal. It is eaten as a staple food in Zimbabwe and many other African countries. *Sadza* has to be stirred constantly during cooking to prevent any lumps from forming. (A well-cooked *sadza* has the consistency and texture of mashed potatoes or polenta.)

William Gwata believed that there had to be a more efficient way to prepare *sadza*. He was aware that he had to make a device that could meet the constant stirring requirements without compromising the consistency of *sadza*. He studied the automated analyzer machines at his university laboratory that functioned through programmed instructions. He understood that these machines operated using hardware and software that were programmed to understand each other. He realized that a machine to make *sadza* could be made with principles similar to the automated analyzers. For this, he needed to conceptualize his product idea into a set of parameters that could be codified and downloaded into a software program. It took years of learning and trials before William Gwata could come up with something substantial.

After developing the prototype in 1996, William Gwata was able to successfully test out his Gwatamatic at the cafeteria of his workplace, National Food Limited, on December 13, 1997. That same year, William Gwata created digital codes to successfully program a machine that could cook *sadza* in a similar manner. Gwatamatic operated as a closed system from start to end, providing an accurate automated meal delivery system. The best part was that it was capable of making *sadza* for 200–700 people in less than an hour (45 minutes), which was less time than it normally took to prepare *sadza* for approximately four people using the traditional method of manual stirring. In a country where an estimated four million labor hours are spent on preparing meals, this invention could prove to be a revolutionary labor saver.

William Gwata is an example of an inventor with a unique invention who managed to make the best use of the resources available to him. He started out with an idea that sought to simplify an arduous everyday household task. As he worked on his invention, he reached out for knowledge that would better equip him for the challenges that he would face as an entrepreneur. He

is an example of an inventor who made good use of the resources available in the public domain.

Note: Adapted from the WIPO case study “Successful Business Model through Partnerships and Smart Use of IP.” Available at www.wipo.int/ipadvantage/en/details.jsp?id=2536. Accessed on September 10, 2019. And: www.techzim.co.zw/2012/06/william-gwata-and-entrepreneurs-journey-part-i. Accessed on September 10, 2019.

Teaching Example 6: Successful implementation of a business plan by a new inventor seeking to address unmet market needs

William Gwata spent more than ten years perfecting his invention – an automated *sadza* maker. During that time, he had not only conceptualized his prototype but also learned how an idea needed to be supported by a feasible business plan to increase the odds of successful market entry. William Gwata also wanted to make sure that he made appropriate decisions as he set out to commercialize his invention. He wanted to draw up a business plan to persuade potential investors to fund his invention and to ensure that he would be prepared to spend those funds in the most productive manner.

A business plan can be for a single product or for a company as a whole. Its marketing and sales section contains the path into one or more viable markets. This requires identifying the initial and, if they exist, follow-on target markets.

William Gwata set out to find the initial market for his cooking apparatus. At first, he assumed that African housewives would purchase his machine for the convenience it offered. But he discovered he was wrong after he attended the Harare Agricultural Show in Zimbabwe two years in a row and exhibited his machine there. The sheer size of the machine and the volume of *sadza* it could cook in one batch made it overkill for home use. He determined that his target market was different from his initial assumption. Gwatamatic would most likely be purchased by large establishments that needed to cook *sadza*. His actual customers would likely be food equipment vendors for those establishments – that is, companies in the supply chain for those large establishments. Ultimately, large commercial establishments became Gwatamatic's main end-users.

A business plan with a clear definition of who is the target market is helpful for the success of any invention that is new to the market. Had William Gwata done his market research upfront and identified his end-users (large establishments) from the start, he would not have lost time in pursuing a disinterested target market (African housewives).

Helpful hint

A good rule of thumb is to do **secondary** market research before **primary** research. Secondary market research examines literature such as market reports, trade and business publications, company annual reports, reports of financial analysts, government and other data, web hits and so forth. Primary research consists of talking to potential customers and experts directly. Methods include interviews, focus groups, on-site visits to potential customers and surveys.

4.1 Market data and research

As an inventor/innovator it is helpful to understand and define a target market before you develop an idea into a product and/or service. End-users in different markets expect different offerings, features and functionalities, and price points. These expectations and needs influence what technologies will have market traction.

Examining and considering multiple market data sources increases the likelihood of developing relevant understandings. Start by performing a web search (secondary research) to identify potential customer needs. Begin with a general set of terms that describe the innovation and its most important features or functionalities. For example, William Gwata, discussed in Teaching Examples 5 and 6, might have searched the web using the string “food preparation and labor saving.” He would have found many results of publications talking about the food service industry and its never-ending search for labor savings.

If these potential customer needs map to some extent to the features and functionalities of the preliminary product concept, a market opportunity may exist. To determine if that is the case, examine the likely competitors and competing products and/or services and determine if customers are satisfied or dissatisfied with these offerings. Examine the key characteristics of products/services and their appeal to customers, identify the problem they solve and the customers’ needs they serve, and ask how the product and/or service can be improved or replaced. What is the value proposition and the unique selling proposition (USP) used by the current companies serving a possible target market?³⁸ In other words, what is it that makes your product and/or service stand out from the competition? What makes it better or different?

The answers to such questions help when refining the specifications for the product or service to increase its market potential. Enhancing the product’s appeal to its target customers increases the chances of success. Listening to the “voice of the customer” is important throughout the entire NPD process. In the design phase you may need to clearly define what the product will do to meet priority customer performance, ease of use and price requirements. In the launch phase for a product and/or service, listening to customers is important for developing sales material and deciding what are the best channels to reach customers and the best ways to get the product into their hands. It is also critical for formulating effective messages that communicate the value proposition for the product, as people pay far more attention to messages which address needs they recognize. These needs are called “pain points” by marketing professionals. If the new product can meet end-user pain points and price points better, a competitive advantage can be gained over what is currently being sold.

Teaching Example 7 discusses a (fictional) company that identified its target customers and offered a tailored product to meet their needs; as its market developed, it evolved its offering to exploit new growth opportunities.

Teaching Example 7: Adapting existing products to changing market needs

MobTech (a fictional company created for the purposes of this example) was a firm launched in the early 1990s to take advantage of the emerging Internet technologies in the Greek market. It specialized in Internet service directories, software programs to help its clients in the automation of business processes and digitization of paper records with online access. It developed preliminary technology by performing detailed market research and analysis. The research involved figuring out the requirements of businesses by studying their public domain publications, exhibitions, marketing material, and business information and reports. From this research, it became apparent that most of these businesses in Greece were new to digital technologies and were looking for a solution to ease their daily operations.

Initially, MobTech started gaining market share from its large multinational competitors mainly due to the firm's focus strategy of catering to clients' needs, competitive pricing of its products and services, efficient business operations and communicating in Greek. It was a Greek firm catering to the specific and sometimes unique needs of Greek businesses, and that made a difference in winning its clients' trust.

One of the key success factors, especially in the early stages of MobTech's expansion, was its flexibility to adapt the products to individual client needs and preferences instead of a one-size-fits-all approach. This came at a higher cost of development but allowed the firm to enter the market and helped it identify technical skills it originally lacked. It invested in training its staff about new technologies and acquired the needed expertise mainly by hiring highly skilled software developers and engineers.

But MobTech was a new small-sized enterprise with limited financial and human resources. So, it had to be very prudent with its strategy and moves. Also, Greece was a small market compared with other European nations in terms of Internet technology. Threat of competition and limited domestic market capitalization were concerns for the firm. For these reasons, MobTech's strategy led it to focus on evolving market needs. It did this by studying market reports, trends, etc. Market research indicated opportunities if the company developed components that could help customers adapt to changing technology trends. The decision to shift its strategy enhanced MobTech's USP in Greece.

As it started growing, MobTech's executives began looking for growth opportunities in the form of new product and service offerings as well as new domestic and international market opportunities. Four years later, MobTech developed a more generic approach to help reduce costs and increase profit margins, while still offering top-quality services to clients. It developed new software using a proprietary programming language and made it compatible with the emerging standards for Internet and business protocols. This was important as the market for Internet technology was getting bigger with the growth of smart mobile devices. This new software was made user-friendly so that new users with limited computer skills could easily adapt to its features. Lastly, MobTech sold its software as a white-label product (i.e., an unbranded product that bears no logo or trademark), which could be branded by the client with its trademark and material to appear as if developed by the client itself.

This novel approach increased the appeal of its products in the marketplace, as it offered lower development and maintenance costs to its clients while reducing the firm's operating costs as well, giving MobTech more flexibility in its pricing. This is an example of how a relatively small and new firm like MobTech successfully adapted its product to changing market trends to deliver products and services, while being mindful of its own resources and capabilities. This example further demonstrates how, regardless of the size of the firm, adapting operations to local market realities is a good survival strategy.

Helpful hint

One good way to find experts for initial discussions is to do a general search, such as **food preparation and labor saving**, and look for relevant associations or professions. These may include unions of food preparation workers, restaurant associations or university cafeteria managers. Then search in an association's website for chairs of relevant committees and presentation topics at recent annual meetings and the people who gave them. Call the person and say you are calling because they hold this position or gave that paper. If you know a position, search the web for a local institution, company or other entity where that job is likely to be found and find out who holds the position. Usually people are flattered you called and will be willing to talk briefly if you start out by explaining you are not selling anything but rather seeking information about a product or service you are thinking of developing. Explain you only need five or ten minutes so it is easier for them to say yes. Think in advance about what you want to know, because you need to get it in that time constraint.

Helpful hint

Begin your search with three sets of literature: patents, research and trade. Bibliometric tools (statistical analysis of hits) can be easily applied to the first two and, with some preprocessing, to the last. For example, when searching patents for seminal technology, a more cited patent is usually more significant than a less cited one. By looking at the cluster of patents that cite seminal ones you can discover a range of ways that technology has been enhanced and applied or alternatives to it.

Collecting market information can be done initially by searching online for market reports available in the public domain, such as the Gartner, Freedonia or Frost and Sullivan reports, firm white papers and trade publications mentioned in the earlier sections of this guide. Although most market research reports are fully accessible only after paying a fee, a great deal of macro-level information can be found in the report summaries. The web is filled with information that may help you develop insight about the target market, target customers and products or services. Particularly helpful are annual market overviews, new product or service articles and supplier catalogs found on trade publication websites. This search strategy (i.e., collecting market-related information from available sources) is particularly useful for understanding current and potential substitutes. Emphasis should be given to collecting information relating to user dissatisfaction with (1) the features and functionality of similar products and/or services and (2) their price. The dissatisfactions indicate gaps in the product or service offerings that can be exploited. This is an important aspect that should not be ignored as it may impact your product development process and choices therein.

If you cannot discover sufficient relevant information on end-user needs or substitutable products, consider buying such information (if available) from a market research firm or perform your own primary research.

Most market research firms can do both secondary and primary market research for you. Hiring a professional consultant or firm is particularly useful when no one in your company has relevant experience conducting market research. The choice to hire a professional depends on cost, among other factors, as a simple online search and some phone calls are free. Purchasing information is not, so it is important to select your provider carefully and to work out in advance just what you need to know to ensure higher-quality results and additional insights at a price you can afford.

5. Reviewing what technologies are already in the market

Once potential competitors are identified, a search of patents and patent applications held by these companies or their inventors provides helpful information on their technologies and inventive knowledge. These patent searches are based on applicants and assignees. Keywords and patent classes are added to searches to focus on the desired information.

Keywords and patent classes can also be used to discover additional substitutable technology – including less mature technologies from universities and other research institutions. Further discussion on patent searches is provided in the companion WIPO publication *Identifying Inventions in the Public Domain: A Guide for Inventors and Entrepreneurs (2020)*.

Combined search results from patent searching and market studies are used to guide NPD. Teaching Example 8 provides an example of an invention that used existing technology to develop its product concept and determine its ideal market.

Teaching Example 8: Existing technology in use to create a new and innovative product

BIODOME DU MAROC.SARL was a startup founded in 2013 by a Moroccan scientist named Fatima Zahra. Its main product was a composter named BIODOME. Fatima Zahra came up with the BIODOME composter after realizing that there was a market for composters as well as for renewable energy in Morocco. She studied how existing composters worked and came up with an alternate composter that could be used more efficiently. The chief technology of BIODOME was a device that released biogas as one of its byproducts. Biogas is a fuel byproduct of composting that can be captured and used in heating, cooking, pumping water, electrification, etc. The other useful byproduct was compost consisting of nutrient-rich organic compounds that could be used for other purposes.

When Fatima Zahra developed her technology, she knew that there were establishments that produced large-scale organic waste from their daily operations. Initially, she assumed urban establishments like hospitals, schools, hotels and industrial manufacturers dealing with decomposable wastes to be her target customers. But these establishments were likely to be located in urban areas where electricity and other resources would be readily available. Further, in order to operate to its full capacity, a BIODOME composter would need to be constructed on a sizable piece of land isolated enough for safety precautions (see image). She was aware that the additional isolated space needed to construct a BIODOME composter might not be feasible with her initial target market located in heavily populated areas with limited access to vacant land.

Fatima Zahra continued with her market research and realized that her ideal customers could be commercial farmers instead of urban establishments. Farmers typically accumulated large amounts of organic waste from their farm produce and animals. Additionally, these farmers would need to power heavy machinery to pump water in their fields as well as to run other equipment. A lot of these commercial farmers did not always have reliable electricity and a steady supply of fuels to run their farm machinery. So, these farmers could benefit from installing BIODOME composters in their farms and making efficient use of the two key byproducts of the BIODOME composter – biogas and compost.

Once Fatima Zahra was able to identify the needs of farmers and present the BIODOME composter as a solution to their farm needs (her USP), it required less effort from her to convince these farmers to install the BIODOME. By identifying the demand for a new technology (combination of a composter and a biogas producer) based on what technology existed in the market, Fatima Zahra was able to turn her innovative technology into a commercially viable one. Her firm subsequently became the first Moroccan company to specialize in the construction of composting facilities and was acclaimed for its sustainability and innovation.



Photo: Beratch Fatima Zahra

A BIODOME under construction in Morocco

Besides the exploration of market opportunities and developing a product concept, there may also be opportunities to find out about relevant technologies available in the market or in the process of making their way into the market. A search of the public domain can be done through web searches and accessing catalog sites like ThomasNet (for supplier discovery, product sourcing and other helpful procurement tools in the United States of America and Canada) and Globalspec (for engineering and industrial products). Social media is a resource as well (e.g., Facebook, Twitter and more industry-centric sites like LinkedIn). Though these information sources may not target markets or technology in developing countries and least developed countries (LDCs), they can still be useful given their breadth of information.

Also useful are national and international trade associations and standards bodies. For instance, the American Association of Railroads provides technology updates and breakthroughs on its website that can be accessed publicly. Such organizations may allow access only to their members, but nonetheless should be considered while doing the secondary research. They may be worth joining to get access to publications and data, identify and contact experts and end-users, and to attend pertinent trade shows at a discount. Similarly, government agencies, non-governmental organizations (NGOs) and intergovernmental organizations like the United Nations track relevant technology and may have roadmaps or other documents available on their websites. WIPO publishes patent landscapes for certain fields of use (see Annex). These landscapes illustrate a methodology for doing your own. In-depth reports on specifications and technology may be available for purchase. These are almost always advertised on the Internet.

Recap

The product concept for an idea or invention should be developed with the end-user in mind.

A structured process for developing a product concept helps find solutions for problems that are likely to arise later in product development.

Taking forward any invention that is new to the market requires a business plan with a clear definition of the target market for the finished product/service.

Defining and understanding the target market is best done before an inventor/innovator develops their idea into a product/service.

Market data and market research can help in understanding and defining a target market.

Both primary and secondary market research can be helpful. Primary market research consists of talking to potential customers and experts directly while secondary market research examines documents such as market reports, trade and business publications, company annual reports and reports of financial analysts, as well as government and other data, web hits, etc.

6. Finding if there are available technologies you can exploit to identify market opportunities

Having market research data in hand informs business decisions as a project moves through the gates in NPD. However, you may still require substantial technical information to conduct make/buy decisions; that is, to determine what you develop in-house and what you buy or license from others. The patent literature is an important place to search. As stated in the introduction, this guide's purpose is to serve as a reliable compass for exploring the universe of publicly accessible information with a focus on inventions disclosed in patent documents. In this section, you will be introduced to preliminary steps for searching patent databases.

Teaching Example 9 shows how searching the existing patent literature can be used to inform the development of a novel product.

6.1 Patent intelligence based on patent database searches, patent statistics and reports

There are different types of patent searches to consider, two of which are shown in Figure 10.

- **Novelty search:** novelty searches are done to see if a technology is new and inventive and thus patentable.
- **Freedom to operate (FTO) search:** freedom to operate can be defined as ensuring that the commercial production, marketing and use of a new product, process or service does not infringe the IP rights of others.³⁹ An FTO search is designed to investigate the patent landscape in depth to determine whether you can “go ahead” or should “abandon/modify” a product and/or service technology. You can also use it to estimate the extent of infringement risk when operating in a specific market, industrial sector, geographic region or technology area. This type of search is typically complicated and expensive as it requires a person

Teaching Example 9: An innovation using existing patent information

The University of Nairobi's Science and Technology Park (STP) hosts innovation hubs that foster solutions for the benefit of society. These innovation hubs provide students and collaborators with a platform to ideate, design and develop products that range from medical devices to other consumer technology products.

One project addressed the lack of routine and advanced medical equipment in health facilities in Kenya. High procurement/replacement costs, supply chain problems and/or designs not tailored to meet local needs were identified as some of the main reasons for the shortage. The project was launched at STP to come up with ways to develop and/or modify existing medical equipment to make it less expensive for the Kenyan market rather than invent new and untested products.

A medical suction pump was one piece of equipment developed under the project (see image). These medical suction pumps are used in operating theaters for suctioning body liquids (such as mucus, phlegm, blood). For this project, the researchers at STP searched for existing patents for medical suction pumps in databases of PATENTSCOPE, Espacenet, Google and the Lens. Patent searches including a comprehensive freedom to operate search were done to ensure that no infringement occurred with the import and use of the medical suction pumps in Kenya.

The patent search showed that no enforceable patents for such a product existed in Kenya at the time.

From an economic point of view, it made more sense to purchase some existing technically advanced components for the medical suction pump and to assemble them into the prototype. The remaining components were manufactured locally. Further study of patent documents on suction pumps was done to ensure proper assembly of the components. The cost of the final assembled pump prototype was significantly less than the cost of the equivalent import. STP, after completing a series of tests on the prototype, filed for patent protection in Kenya on the novel, low-cost aspects of their particular improvement.

Note: See Products and Services page of the University of Nairobi, Intellectual Property Management Office (IPMO). Available at <http://ipmo.uonbi.ac.ke/node/962>. Accessed on September 10, 2019. In general, it is wiser to file for patent protection as early as possible due to first-to-file rules.



Photo: Richard Ayah

A working model of the medical suction pump developed by STP

knowledgeable about patents and patent laws and the regulations and relevant court decisions to make the determination. That person is typically an IP lawyer or patent agent. Nonetheless, an FTO search to identify potentially licensable rights and know-how associated with enforceable patents is beneficial if there are patents intertwined with the product concept with uncertain infringement. The decision to conduct an FTO search should not be limited to whether an invention is protected by patent protection in a single region if the plan is to market it outside one country or region. FTO searches are discussed in more detail in the companion WIPO publication *Identifying Inventions in the Public Domain: A Guide for Inventors and Entrepreneurs* (2020).

Free patent databases such as WIPO's PATENTSCOPE database and those offered by national and regional patent offices provide access to millions of patent documents and a range of different search tools. Fee-paying commercial patent databases additionally include features such as value-added data and more sophisticated search and analysis tools. Figure 11 demonstrates an option for a stepwise patent search.

For patents of interest, there are also patent prosecution histories that may contain useful information, such as examiners' reports, transfer of rights agreements, legal/prosecution events, expiration, abandonment, etc., which can help when making informed decisions on the technologies to use or avoid in NPD. Further, decisions based on manufacturing and licensing of enforceable patents, if applicable, may be supported by research of patent prosecution histories (court decisions and records from patent challenges and disputes may also be helpful).

Patent statistics and patent families can also prove useful for assessing the use of a technology which may then be associated to a product and/or service's market success. The WIPO publication *Identifying Inventions in the Public Domain: A Guide for Inventors and Entrepreneurs* (2020) has a section titled "Patent classification symbols associated with the invention" which discusses in detail how patent classification symbols can be used. (This topic was mentioned briefly in section 5 of this module, "Reviewing what technologies are already in the market.") These classification symbols are more effective when used in combination with other search terms like keywords or phrases to do a hybrid search. Patent classification searching is important and is more productive when relevant symbols are searched. You are advised not to limit a search to the most used patent classification symbols in your field of use or technology but to examine relevant patents to see what other symbols are listed in them. These classification symbols should also be searched to be thorough.

Note that non-patent information helps assess the overall value of a patent. This data may give further insights based on public knowledge beyond patent documents. For this reason, patent searches are better when combined with non-patent literature (NPL), such as trade reports, market trends, scientific publications, trade announcements, white papers, technology roadmaps, legal and regulatory developments.

Helpful hints for patent searching

- If you have no experience in reading claims, you may find it challenging to understand them. If in doubt, skip them and opt for the specification until you have mastered the described invention. Then return to the claims.
- A patent search can be a lengthy and time-consuming exercise. The more you search, the more you will find. You should make a reasonable search effort depending on the length and relevance of your initial findings. There may be a trade-off between the cost of a patent search and its opportunity cost. Professional patent searches may produce better results and ultimately be cost-effective based on the complexity of such searches and your familiarity with the technical field and jargon in the applicable fields of use.
- Do not limit your search to only issued patents, as you may miss published pending patents (i.e., applications still under examination and prosecution).
- Patent classification searches can be a powerful tool. You are advised to use the International Patent Classification (IPC) scheme so as to facilitate international searches or potential extensions in the future. Patent offices do provide crosswalks from IPC symbols to their national symbols.
- You may get helpful results if you search for backward patent citations (i.e., the patents referenced by the patent(s) under study) and forward patent citations (i.e., the patents which reference the patent(s) under study). You can search for backward citations by viewing the patent record in the relevant patent office's database, if available/accessible. For forward citations you may need to use Espacenet or paid patent search tools and techniques, if free databases do not yield results.

Note: For more on International Patent Classification (IPC), see the Annex. For an example of a crosswalk see www.uspto.gov/patents-application-process/patent-search/classification-standards-and-development. Accessed on September 10, 2019.

Figure 10: Types of patent searches

	Novelty	Freedom to operate (FTO)
Question it answers	Is the technology new or has it already been patented?	Will your new product infringe on a certain patent (or set of patents) claim(s)?
How to perform it	<ul style="list-style-type: none"> – Check if patents exist that disclose your technology. – You can take into account the patent description and need not limit your search to the patent claims. – You also need to take into account all publication- and/or invention-related disclosures beyond patent documents. 	<ul style="list-style-type: none"> – Check all patents that disclose technologies related to your planned new product. – Be sure to include foreign patents that could be extended to your current and future target markets. – Include technologies that could be considered as equivalent to your technology. – Be aware of patents which your proposed new product may infringe on.

6.2 Relevant patent identification

Now let us consider the situation where patent searching has identified several patents that may be relevant to you. Typically, professional searchers create an initial list of results by examining titles and abstracts. However, depending on the questions driving a search, a classification-based search and/or a combination of a classification search with patent owner, assignee, inventor, country, date, etc. may be used to make the first cut. Below are some of the next steps to use to get to relevant patents:

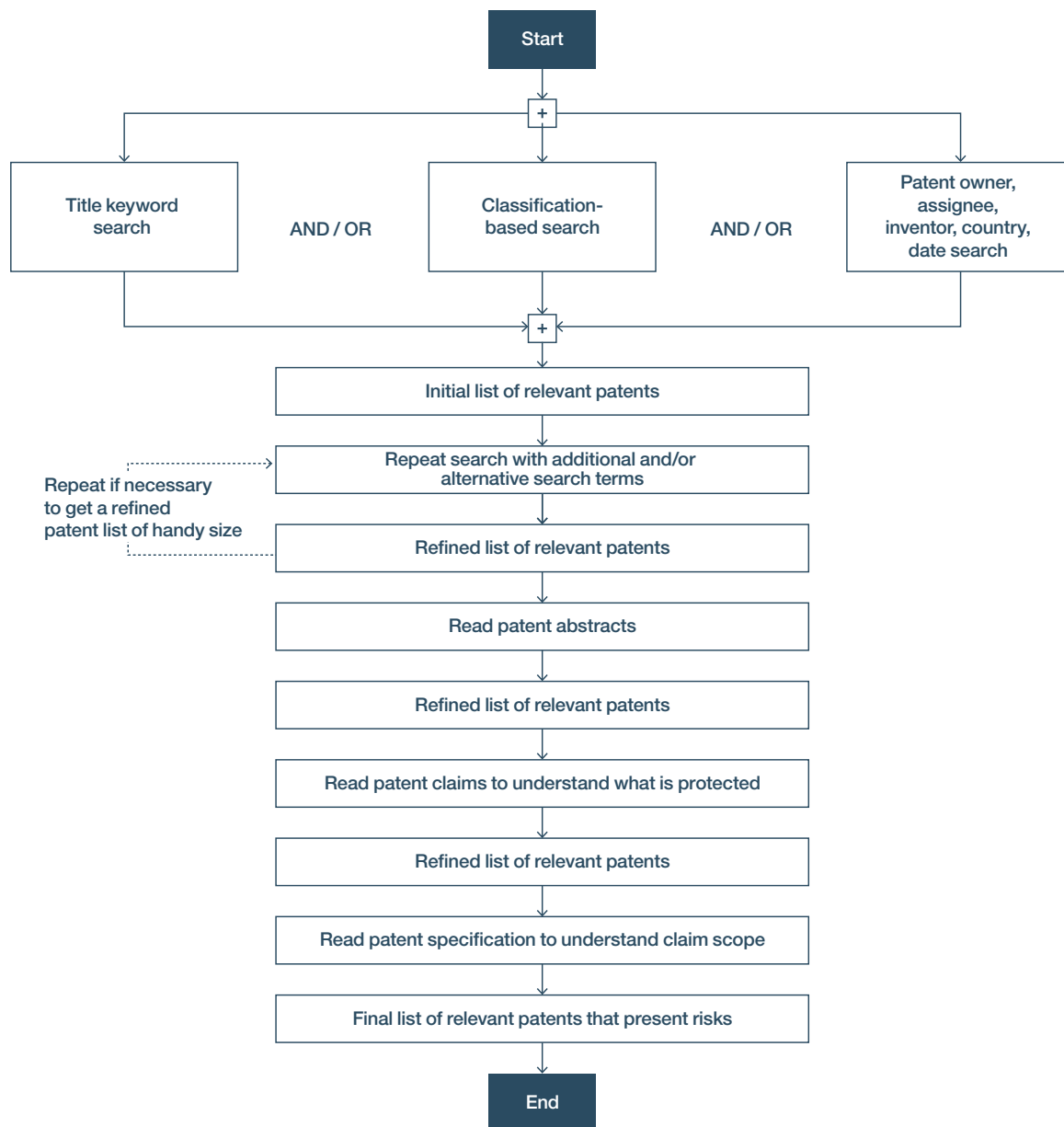
1. Filter the initial search results by adding additional or alternative search terms until the number of patents is manageable.
2. Trim the first list of patents by reading the first claim, rejecting those that are not relevant to your situation.
3. Repeat the filtering process and/or limit the years searched.
4. When there is a manageable number of patents, read them in detail, focusing on the claims and the specification (or description) of the inventions in the patents. The claims of a patent describe what is legally protected. The specification typically discloses more information than what is actually claimed, but it helps to clarify the claims.

This strategy saves time by shortlisting a set of patents since claims are typically written in a specific technical-legal language. They are at times intentionally “vague” to potentially facilitate broader protection. The exact meaning and breadth of protection for claims are determined by the relevant information included in the specification.

When performing FTO searches, be open to finding patents with technologies *that can be exploited in jurisdictions where such technologies are not protected*. These patents are in the public domain in a specific country and their inventions can be exploited freely where they are not protected.

A flowchart of a relevant patent identification process is presented in Figure 11. This illustrates the steps discussed above in a logical manner to help you understand the process of relevant patent identification.

Figure 11: Steps to refine your patent search results to get a list of relevant patents of interest



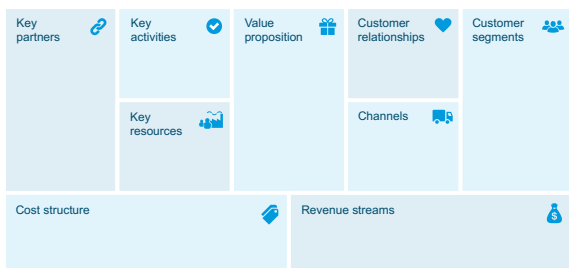
7. Drafting a business model canvas

Having worked through all the stages discussed above, where you once simply had an idea, now you have an increased understanding of how to develop the product and/or service. Value chain analysis has identified key activities within and the capabilities of the firm. Now it is time to look at the product and/or service and see how external factors affect success.

An iterative tool that allows you to have a visual overview of various components necessary to make

the business work is called the business model canvas, developed by Alexander Osterwalder.⁴⁰ In Figure 12, nine elements are laid out in a sample business model canvas that you can adapt for your own use. Creating a business model canvas focuses the user on the important components of a business, business unit or new product. As Steve Blank discusses in his book *The Startup Owner's Manual*, as a business gets established and flourishes, versions of such canvases can be archived as a “flip book” that records the evolution of the business model.⁴¹

Figure 12: Layout of a business model canvas⁴²



A business model canvas focuses on the synergy between the nine components listed below:

- **Key partners** who contribute to making your business a success.
- **Key activities** that are carried out to implement the business model and create value.
- **Key resources** that are needed to create value and are integral to the business model.
- **Value proposition** that is being offered as products which create value for the customers.
- **Customer relationships** that are key in generating demand.
- **Channels** of distribution that are used to take products to customers/end-users.
- **Customer segments** that comprise buyers that can be categorized.
- **Cost structure** that results from understanding the business model.
- **Revenue streams** that distinguish and define pricing models that help in value capture.

A business model canvas is more flexible than a business plan. It allows for different scenarios to be mapped out on a set of canvases to explore how elements can be adapted to match with scenarios. In every scenario, the focus should remain on how the end-user would value the product. Teaching Example 10 illustrates a business model canvas providing an overview of all the components necessary for the success of a novel phone charger.

Recap

Patent literature is an important source of information that can be used to inform decisions about what technology can be developed in-house and what can be bought or licensed from others.

A variety of search techniques can be helpful in identifying patents of interest.

Once you have a more detailed understanding of your idea for a novel product or service, you can

use a business model canvas to help you visualize how you might develop that idea into something that can be marketed.

8. Screening product concepts

8.1 Introduction

The screening stage in an NPD process is the first step in assessing ideas and selecting those that have potential. NPD describes this step as a funnel that starts with many ideas but allows only a select few to pass through based on their quality and potential to be viable in the market.

In the first stage of the NPD process, methods are concerned with building on an idea to develop a product concept. In screening, the concern is to “down select” to one or more ideas that clearly address the needs of a market. Exploiting the public domain information disclosed in patent documents and other sources is a part of this step in NPD.

An inventor may have knowledge of their invention but will still need to learn more about how the product will fare in the marketplace among other competing products. External sources of information support competitive intelligence, which helps anticipate market challenges and risks. This section of the guide explores the role of patents as reliable indicators of technology trends.

The strengths, weaknesses, opportunities and threats (SWOT) analysis and its use is introduced in this section. This analysis tool is helpful when you have conducted your market research and are evaluating capabilities and product concepts along with external factors.

8.2 Validating market pull

So far we have discussed public domain knowledge from patents and other resources as reliable sources of information for relevant technology solutions. These solutions are based on patented inventions that have sought to solve similar technology problems. Patent documents can also be used to analyze or identify shortcomings in a technology that is already commercially available. Such shortcomings may point toward unmet needs in the market. Demand for new products due to unmet needs perceived by buyers is called market pull. Examining shortcomings in an invention as disclosed in patent literature is a source of inspiration

Teaching Example 10: Exemplary implementation of business model canvas

Anthony Mutua was a student at the Technical University of Mombasa (TUM) in Kenya in 2012 when he came up with a unique invention – a shoe phone charger named Hatua (see image). This phone charger built into a shoe had a simple working principle: shoes retrofitted with these thin piezoelectric crystal chips would generate electricity from the motion of walking. The pressure exerted on the chips would then be converted into electrical energy and stored within the chip, which also had storage capacity.

Mobile phones could be charged by simply plugging the phones into extension cords connected to shoes retrofitted with these chargers. Moreover, the Hatua charger embedded within a shoe was dustproof and waterproof. Each charger chip had a lifetime of 6–8 years on average. If the shoe wore out before the chip in the charger did, it could be easily translocated into another shoe.

Anthony Mutua's invention generated curiosity in Kenya because it addressed the urgent need of mobile phone users who were frustrated by the unreliable electrical power supply in the country. Word of his invention spread quickly as more people wanted to see how the Hatua shoe charger would work for them. Among many other details, Anthony Mutua needed to establish suppliers for quality piezoelectric crystal chips, along with shoemakers who were trained to retrofit shoes with the Hatua chargers. He needed a plan to make the Hatua chargers available to the general public. A business model canvas would be an ideal tool for an entrepreneur like Anthony Mutua who was just starting out.

An illustration of using the business model canvas based on Anthony Mutua's example, created for this guide, is presented below.



Business model canvas based on Kenyan shoe charger



Photo: Anthony Mutua

for innovation. Teaching Example 11 introduces an inventor who sought to come up with an improved product based on his study of existing products and their patent disclosures.

8.3 Using competitive intelligence and technology intelligence

The two processes of searching for and analyzing existing knowledge are “**competitive intelligence**” and “**technology intelligence**.” These processes inform decision-making in NPD.

Competitive intelligence focuses on competitors in the marketplace. It is information gathered about commercial strategy, business development, hiring, marketing, sales and the full range of value chain activities. It may also include how competitors perceive technological, social and market trends. A detailed discussion on competitive intelligence can be found in the next section 8.4. of this Module titled “Assessing competitive advantage through competitive intelligence.”

Technology intelligence focuses on relevant technology and its underlying scientific, engineering and technical knowledge and trends. When searching for technology intelligence, it is helpful to use internal and external sources of information. Two commonly used sources are patents and scientific publications because they are systematic presentations of information which can be accessed through various databases or document repositories.

Additional sources of technical intelligence include trade press; blogs and opinion posts on social media sites; reports of research and development (R&D) awards by government agencies, NGOs and foundations; and listings of papers presented at professional and industry meetings. Some of these have been discussed earlier in section 6 of this module, “Finding if there are available technologies you can exploit to identify market opportunities.” Publications from public and private institutions and comprehensive databases hosted by global organizations, like WIPO (e.g., WIPO GREEN) or the Association of University Technology Managers’ Global Technology Portal, are additional examples of technology intelligence.⁴³ A detailed discussion is given in section 8.5 of this module, “Technology intelligence through patents to study evolving technology trends and innovation.”

8.4 Assessing competitive advantage through competitive intelligence

Competitive intelligence is a systematic approach to better understand the market landscape. Firms worldwide make use of competitive intelligence to make critical business decisions. Similarly, small enterprises can also make use of competitive intelligence in maintaining their competitive edge, identifying market opportunities and capitalizing on those opportunities for gains.

In understanding the market where your product will be sold, it is helpful to understand the competitive landscape. The competition in this landscape is not limited to direct competitors selling similar products. It includes any product that can attain similar outcomes for end-users. Substitutes can entail new products entering the market or alternatives already there. For example, a substitute for a new robotic earth mover for mining is an army of lay laborers with shovels and wheelbarrows. What is a threatening substitute is influenced by technological changes, changing customer tastes and responses to them by other companies.⁴⁴ Competitive intelligence contributes to identifying potential market opportunities, sales trends, new product or service designs, supply chains for your product and strategies for market launch and expansion.

Competitive intelligence begins with positioning a product within an industry and markets. This positioning helps determine what companies to study. Teaching Example 12 provides an example of this. Public documents such as corporate publications, market research reports, trade analyst reports, and talks and papers by established industry experts are examples of useful sources for insights. Leading companies and consulting firms often publish white papers detailing their analysis of the industry.⁴⁵ Some of these white papers may not be freely available in the public domain and will need to be purchased. Other times information is gleaned from regulatory filings. In the United States of America and Canada, filings of public companies to agencies regulating stock markets are available, for example. Filings with environmental protection agencies are another example.

Christopher Murphy, in his article “Competitive intelligence: What corporate documents can tell you,”⁴⁶ talks about how mundane activities of a firm, such as hiring announcements or articles and posts about a competitor searching for and purchasing new facilities or business locations, can foreshadow operational objectives of the firm. More relevant here is his emphasis on the importance of patent and trademark filings

Teaching Example 11: Study of patent documents for technology information to address unmet market needs

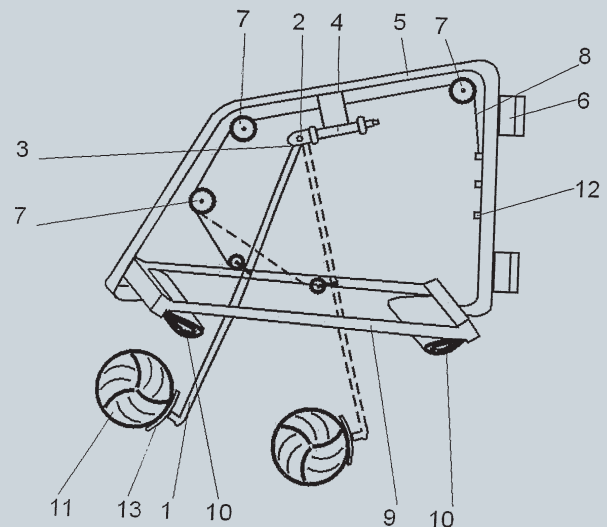
Alekseev A. Leonidovich was a Russian biomechanics specialist with decades of experience in coaching volleyball when he came up with his “simulator for working out percussion movement on the ball.”

Many varieties of simulators were in use to improve physical performances of users, most commonly in sports. However, simulators for working out shock movements were unavailable before Alekseev A. Leonidovich’s invention. He was keen on developing a simulator that would improve a user’s muscle memory by repeating the same movement over an extended period of time.

Alekseev A. Leonidovich conducted a detailed study of U.S. and European patents on existing simulators to identify any shortcomings. His research relied heavily on studying the technical mechanisms of these devices as described in their patent documents. For example, information on simulators for volleyball training based on the principle of placing the ball on an expandable suspension was obtained from U.S. patent no. 4,881,742, U.S. patent no. 595,781, U.S. patent no. US 7,041,016 B1, and similar.

One of the shortcomings of these simulators was that they did not allow their users to correctly assess the technique of impact. This was mainly due to post-shock oscillations or after-hit swings once a ball in the simulator was struck. An inconsistency in terms of the swings occurred, as each swing of the ball depended on the force with which the ball was struck. A trainee working on such a device would not be able to gauge the correct way to strike the ball. Such variability also interfered with the improvement of the athlete’s muscle memory.

Another shortcoming seen after the review of patent documents on simulators was the disparity between the movement of a ball in a simulator and the movement of a user’s arm. For instance, when a user struck a ball affixed to a simulator, their arm would move along an arc. But the ball affixed to the simulator would show linear movement. The differences in trajectories of the ball and the striker resulted in disparate biomechanical conditions. Such simulators also allowed a limited degree of free movement and hence required significant precision from the user. This precision could be expected from an experienced user but not from a beginner just learning the movements.



Alekseev A. Leonidovich wanted to address these shortcomings with his new invention (see image). His simulator (WO/2007/053054) for volleyball trainees had a “fixing element” to which a ball returned once struck by a trainee. The simulator also had a “sporting implement with an indication for the place of strike.” The simulator’s mechanism indicated the correct way to strike the ball, which was reflected in the way the struck ball traveled back to its resting position.

In summary, Alekseev A. Leonidovich’s simulator had the following advantages over the existing simulators in the market:

- It ensured the minimization of shock movements and the qualitative setting of the attacking blow.
- It reduced accuracy requirements in terms of impact movement due to the two degrees of freedom in the ball affixed to the device.
- It provided effective training by reducing the time spent on post-shock ball fluctuations.
- It gave an opportunity to receive information about the quality of the executed strike.
- It excluded injuries and painful sensations at the time of impact.
- It allowed the user to take into account their individual characteristics.

as key sources of competitive intelligence.⁴⁷ These IP filings are indicative of technological and marketing initiatives a firm is making as it is spending money to protect intangible assets.

Based on the FTO⁴⁸ search results, patents on a competitor's products with comparable technology or applications can be used to generate insights. The specifications of patents of interest might indicate performance and ease-of-use features and functionalities deemed important for meeting customer requirements. Also consider patents which address compliance with regulations in the target market.

A more detailed discussion of resources that contribute toward enriching competitive intelligence can be found in this module under section 8.6., "Assessing the ability to build a team and obtain stakeholders' support."

8.5 Technology intelligence through patents to study evolving technology trends and innovation

Technology intelligence is defined as "the capture and delivery of technological information as part of the process whereby an organization develops an awareness of technological threats and opportunities."⁴⁹ Patent documents are important sources for technology intelligence.

Patent data may be used as a proxy for measuring innovation in a field of technology. Rates of patenting are one indicator of the relative importance of scientific, engineering and technical fields for commercial ventures. Comparing rates in countries is one indicator of how lucrative markets are perceived to be. Patent citations to a patent are an indicator of the quality of the technological invention disclosed. For example, the authors of the article "Measuring technological innovation over the long run"⁵⁰ claim that patents that are highly cited are "novel" and "impactful" due to their influence on the subsequent patents that cite them in the references. Hence, if the goal is to discover the core technologies deployed in a field of use, looking for highly cited patents is a tool. Additional information retrievable from bibliographic components of a patent document has already been discussed earlier in the guide in Module II under section 3, "Examples of useful information found in patent publications."

The theory of inventive problem solving (Russian acronym TRIZ) methodology is described in detail in section 9.2 of this module, "Solution of a technical problem through TRIZ." TRIZ can be used as a

technology intelligence tool to help map out technology trends and forecast emerging technology trends. TRIZ experts can give "decisive information to determine the threats and opportunities presented by competing technologies."⁵¹

8.6 Assessing the ability to build a team and obtain stakeholders' support

Identifying external resources

Having a clear understanding of market needs is the first step in identifying possible solutions. A formal, documented sequence for identifying resources is helpful for this purpose. A typical sequence has phases of: strategic diagnosis, search, information analysis, intelligence (analysis of results) and use in decision-making. Figure 13 is a compilation of some external resources that can assist in NPD.

Figure 13: Examples of external resources of an SME

Direct external resources: These resources arise from the business operations of an SME.

- **Suppliers** of an SME and its competitors. Such information, if not publicly known, may be a trade secret of the SME, especially in a competitive market.
- **Customers** of an SME provide key demographic information which could help in determining the SME's target market in the initial stages of the product development process.
- **Subcontracted** third-party service providers may extend beyond domestic providers. This may not be publicly disclosed information as some companies, to enhance their brand identity, retain various subcontracted companies to manufacture their products.
- **Events accessible to the general public** such as technology fairs, exhibitions, seminars, conferences and other gathering events for industry participants.
- **Direct contacts**, such as friends and colleagues, with insights on the movements within an industry.
- **Competitors** of a firm are great resources as observing their product and market strategy and activities may help you develop your own strategies, and you may even learn from their mistakes. Their publications, such as annual reports, trade publications, white papers etc., should be followed closely.

Indirect external resources: These resources are not directly related to an SME's business operations.

- **Patents:** Technologies fully disclosed in patent documents that are not protected by IP laws in your region are free to use.

Teaching Example 12: Competitive intelligence in establishing a niche market for a new product

An entrepreneur working as a marketing consultant for an American firm had an idea for a new product. Originally from the Caribbean country of Trinidad and Tobago, he had been looking for a new approach to concocting a spirit indigenous to the region – rum infused with tea and aromatics aptly called Chai Rum®. But first he needed to make sure that there was no other rum like this in the market. After a careful research of spirits currently on sale and searching in patent and trademark databases, he realized that his concept of the tea-infused rum was novel.

As a startup in the market with limited funds, he also needed to make sure Chai Rum®, when produced commercially, would survive competition from well-established brands backed by larger competitors. After perfecting his blend, he produced a small batch for testing with consumers and distributors. From the outset, he was clear on one thing – he did not want his unique Chai Rum® to be marketed like other rum brands coming out of the Caribbean. He wanted his rum to be a premium drink not to be mixed with cocktails. Desiring to position his rum as a premium product, he identified top-tier whiskeys and cognacs to be his main competition and pursued competitive intelligence accordingly.

To better understand the target market, he attended high-ticket events in the resort towns well known in the West Indies for luxury yachts. He succeeded in gathering initial feedback and was pleased with the overall positive reception. This gave him the confidence to take Chai Rum® to wine and spirits exhibitions in the United States of America where he ultimately wanted to succeed. These exhibitions provided a valuable insight on how smaller brands like his positioned themselves to be successful in the market. He also learned that there was a market for niche brands that catered to a specialty crowd. These brands were not necessarily backed by large corporations. He observed the marketing strategies of both small and large corporations and used the insights gained to develop a strategy that suited his capabilities.

- **NPL** available in the public domain and largely accessible in the Internet. These could be webpages, trade journals, financial/annual reports, books, articles, conference proceedings, published theses, research and market reports etc.
- **Internet databases:** A large volume of information is provided by Internet databases, which may be commercial, governmental, NGO and/or non-commercial. Many government databases are highly structured and easy to use. Others lack uniformity in terms of structure, which makes them harder to use.
- **Academic resources in institutions:** Universities and technology research institutes are key sources of technology information, especially in developing countries as well as LDCs. In challenging economies where private capital is scarce and limited, academic universities and research facilities may work in collaboration with partnering institutions from developed regions in researching and developing technology, as well as getting funding through government, NGO and foundation grants to develop new technologies. The accessibility of such information in the institutions may depend on their individual policies.
- **Organizations:** (which could be associations of local SMEs) In developing countries such as Jamaica, there are organizations like the Jamaica Business Development Corporation (JBDC), which through its partnerships with the Government of Jamaica and Jamaica Intellectual Property Office assists local businesses and entrepreneurs in developing their products and services for the enrichment of local economies. JBDC routinely hosts workshops where participating business owners, designers, inventors, entrepreneurs, etc. can learn ways to develop their brands, ideas, designs, inventions and innovations into commercially viable products and services. Such organizations can prove to be a vital resource as well as a hub of innovation.

While there is a large volume of information, it is possible to filter the information to reduce the volume based on the product's technology requirements. Guides from IP organizations are helpful in identifying reliable resources of public domain knowledge.

8.7 Protecting IP in feasible products

An intellectual asset survey for an entity or individual identifies inventions, documents, drawings, lists and other intellectual work products and creations that may have value and thus should be protected to build competitive advantage and the value of intangible assets on the balance sheet. If there is IP

worth protecting, a clear IP strategy is important. An IP strategy can be defined as an approach and plan to capture the optimum value from IP assets by using intellectual property rights (IPR) in a manner consistent with a firm's long-term goals and objectives. Internally, the IPR strategy ensures that inventors' notebooks, employment contracts, work for hire agreements, non-disclosure agreements and the like, are in place to capture and protect trade secrets, including ideas and work for which you may file for additional IP protection. The internal IP strategy component formalizes the management of IP assets within a firm.

In addition to ensuring that products and/or services are adequately protected, the IPR strategy should include ensuring FTO (i.e., the necessary infringement clearance from third-party patents, copyrights, marks, etc.). This is an external IP strategy component that can be designed and implemented for minimizing your technology and business risk by taking into account different scenarios and threats and providing appropriate means for protection and responses against foreseeable external threats.⁵²

IP rights such as patents, copyrights and trademarks are territorial, and you need to follow the specific rules governing these rights in the countries where you are seeking to sell a potentially profitable product that may benefit from patent/IP protection. WIPO has compiled a list of IP offices across the world with links to their websites.⁵³ WIPO Lex is another notable and vital resource that may assist you with freely accessible legal information on IP-related laws and regulations of member states of WIPO, the United Nations and the World Trade Organization (see Annex).

Patent filings

Once validated, screened and "reduced to practice," IP protection for inventions is possible. Although you may not put an invention through a complete NPD process immediately, as a protective measure to ensure the product's commercial future, pursuit of IP protection at this stage may be advisable.

Patent filing may be a useful strategy for ensuring that competitors cannot replicate new inventions. Attention can be paid to prevent competitors from working around patented inventions. Defensive disclosure may also be a useful element of an IPR strategy, to ensure that FTO is retained.

Depending on the chosen patent application filing jurisdiction (i.e., national or regional patent office), consider disclosing the best mode of implementing your

invention if more alternatives exist. In most cases this will avoid potential future prosecution (legal, etc.) issues, if there are potential plans to expand the patent (application) to other countries.

In order to be granted a patent, the application needs to comply with formal and substantive requirements of the applicable patent law. Key requirements are novelty, inventive step and industrial application. In addition, the technical details of the invention must be disclosed in the application in a manner that is sufficiently clear and complete to enable it to be replicated by a person with an ordinary level of skill in the relevant field. Not required is any physical prototype (not even a non-working prototype), nor are performance measurements or other similar data, although these may be necessary to support a claim.

The absence of the need for a prototype or finished product and/or service is beneficial as it enables seeking patent protection very early in an NPD project. The importance of securing FTO early becomes apparent, as others may be working on the same product and/or service idea anywhere in the world, and in most cases the first one to file for a patent is awarded the rights, even if someone else has invented it first (although prior user rights may exist for parties practicing the invention before a patent application was filed). Even if someone files for protection in a country that is not among the anticipated target markets, this event may be enough to deprive others of IP rights (as publication of a patent application may be considered prior art). The best that can be hoped for then is freedom to use the invention in the countries where that applicant has not sought patent protection.

The choice of filing office and other necessary steps can be described in the IP strategy. Depending on the jurisdiction, it may not be important where the patent application is initially filed, as it may be extended to other countries within a specified period. Businesswise, the filing office may play an important role as it signals competitors, investors and the market in general by providing hints of the intended marketing strategy. Anticipated target markets, future growth, competitors' moves, and regulatory, technology and business trends all affect filing strategy.

Consider too additional or alternative IP protection (e.g., copyright registration, industrial design or trademark filing). Depending on the nature of the product and/or service, trade secrets or copyright may be preferable solutions.

Patent filing by an independent inventor

Independent inventors constitute a small fraction of patent owners worldwide (six percent of total patents issued at the United States Patent and Trademark Office (USPTO) in 2014),⁵⁴ but they are critical for economic development, especially in developing countries and LDCs, where the innovation ecosystem may be less mature. Some countries, such as the United States of America and Singapore, have provisions such as discounted fees for patent application to encourage independent inventors to file for more patents.

For those considering applying for patent protection as an independent inventor, there are resources available online that help in preliminary estimation and preparation, including features such as cost estimations for patent and other IP rights applications which are helpful in estimating the cost of different stages of the application process in different jurisdictions.

Trademark filings

Beyond patents on inventions, trademark protection for the logos or names of a firm or its products adds value during market entry, market expansion or licensing. Marks are signs, designs and expressions that are used to make products and services recognizable in specified markets. They may be transferred or licensed to other parties along with patent rights. A trademark right ceases if the trademark is not used for a period of time. Like all IP laws, trademark laws vary by jurisdiction.

Trademarks should make products distinguishable and should have some intuitively understandable connection between the trademark content or visual appearance and the corresponding product and/or service or firm. Trademarks can be any type or combination of text, design and graphics. Trademarks that are not descriptive of a product or service or not distinctive cannot be registered. WIPO's database of trademarks – the Global Brand Database – can provide insights about what is in use and the nature of registered trademarks (see Annex).

Filing for trademarks is usually part of an IP strategy. The choice of the countries where a trademark is filed is important and should be anticipated by the global marketing plan for the product and the long-term global strategy of the company. Failing to register a trademark in a country early enough leaves opportunity for others to claim its use in that country, thereby depriving a party of its rights of protection should its branded products eventually be sold there. Competitors can even sell against that party using its own branding. This situation may prevent it from entering that market

and/or cause significant loss of revenue to the competitors that own the registered trademark there. A firm may feel forced to buy the trademark or register use of a substitute trademark for that country in order to implement its market entry and expansion strategy.

Trademark filing is normally done per country. It is possible to file for a single trademark covering multiple geographical regions using, for instance, the International Trademark Application and the European Trademark Application. Under the Madrid Protocol, the international treaty for trademarks, a trademark owner may seek to file for trademark registration in the countries that are part of the Madrid Protocol by filing a single application called an “international application.” The member states process the application as per the rules under their jurisdiction before granting any trademark protection. It is good practice to register trademarks as soon as there is a provisional marketing strategy.

Teaching Example 13 highlights the potential consequences of not having an IP strategy from the early stages of NPD.

Helpful hint

File for patents as early as possible, straight after reduction to practice of your invention.

8.8 Strengths, weaknesses, opportunities, threats (SWOT) analysis

A strengths, weaknesses, opportunities, threats (SWOT) analysis⁵⁵ is useful for evaluating the options and making more informed decisions during NPD. SWOT analysis uses a 2x2 matrix as shown in Figure 14, where the selection and evaluation of the most important factors is done by mapping them on the dimensions (i.e., matrix cells). A SWOT analysis is a heuristic tool for identifying relationships between internal factors under a party’s control and external factors that cannot be controlled and have to be accepted as part of the business environment.

A SWOT analysis helps to identify the internal and external factors that are favorable and unfavorable to achieve objectives and should be used for all the main alternative scenarios for a product and/or service options and their market entry. As a heuristic tool, a SWOT analysis is most helpful early in NPD once initial market research, competitive intelligence and technology forecasting results are available. It is a tool for getting your arms around the data collected. It is helpful to revisit the SWOT at each gate in an NPD process.

Helpful hint

When doing a SWOT analysis, strengths and weaknesses are internal, that is to say under your control, and opportunities and threats are external and outside of your control. Define in advance the strategic or tactical decision that is the reason for doing a SWOT analysis. Then select the two to five most important factors for each cell. By comparing the cells, you can stimulate brainstorming for solutions. For example, if you are trying to work out the 4Ps (product, price, position and place) for NPD, pick any cell at random and ask what it tells you about one of the 4Ps. Then use the remaining three cells to provide a context for working out the other three Ps.

Figure 14: SWOT analysis matrix

	Good factors	Bad factors
Internal factors	Strengths	Weaknesses
External factors	Opportunities	Threats

Teaching Example 13: IP investment to secure competitive advantage

Martech (a fictional company created for the purposes of this example), founded in 2010, was a Greek manufacturer of heavy equipment for ships. Martech started out as a small firm with limited capital and human resources. Its resources were invested in R&D for critical components of technology. Technologies that did not add much value to the firm were supplied by third-party manufacturers, chosen mainly for their costs once performance thresholds were met. Over time, Martech pursued aggressive global expansion, while paying little attention to seeking patent protection for its technologies. It held only a single patent as of 2011 in Greece.

Business ran smoothly until it faced prosecution threats from a Chinese competitor in early 2015. Despite the fact that Martech had developed its own key technologies and bought patent-protected off-the-shelf components from third parties, there were allegations from the Chinese competitor that the firm had been copying its technologies. Martech eventually received a cease and desist letter. Martech had to find an optimal solution toward protecting its interests while keeping its market share and avoiding costly litigation. Martech had never sought patent protection for its technologies in China. The only patent it had was a single utility patent in Greece, which covered a certain technology used in one of its first commercial products. If Martech had accessed IP resources offered by a TISC in Greece or any other country, it might have considered a strategy of broader IP protection early on.

Upon communication with the competitor's lawyer, allegations of infringement were thoroughly investigated. Among the alleged infringed Chinese patents were foreign utility patents filed by the competitor in major ship-building countries. These foreign patents were either filed directly at the corresponding national patent offices or were granted limited protection under the priority period. This was a serious issue as it could make Martech's products impossible to sell in countries where the competitor's patents were granted and enforceable. Fortunately, careful analysis of these patents revealed that they were protecting different inventions, corresponding to different technical implementations from what Martech was using. This was clear from the claims, which had legal enforceability. Claim-by-claim analysis revealed that no infringement occurred as infringement was judged per claim basis and not per patent. The findings confirmed that Martech's

technology did not infringe upon the Chinese patents as claimed by the Chinese competitor.

This ordeal revealed the consequences of Martech's lack of a clear IP strategy. Due to effectively contributing its inventions to the public domain of knowledge across the globe, it deprived itself of the right to patent and protect the underlying technologies.

The first action to remedy this situation was to save any remaining IP rights for unpatented technologies. This was done by filing patent applications for new inventions not previously disclosed in public. The second action was to use professional IP services for analyzing its R&D results, identifying patentable inventions, evaluating their market potential and expected return on investment, and designing an IP strategy in line with the overall company strategy. This strategy was later integrated with regular analysis of its IP and emphasis on continuous innovation. A dedicated legal counsel guided the company executives through the drafting of patent applications, the selection of filing office, its expansion strategy and the IP intelligence for identifying new technologies for products and new markets.

You could learn from Martech's ordeal and plan and implement your IP strategy from the very early stages of setting up your firm or before you start your product or service development.

A SWOT analysis evaluates options by matching strengths against opportunities and weaknesses to evaluate the sustainability of a competitive advantage. It may also explore how various actions can mitigate or remove weaknesses and threats by leveraging strengths and opportunities.

Recap

Screening is the stage of NPD that selects only those ideas with the greatest potential to become successful products or services.

Decision-making in NPD is informed by two processes for searching for and analyzing existing knowledge: competitive intelligence and technology intelligence.

Competitive intelligence aims to provide a better understanding of the potential marketplace for a new product or service.

Technology intelligence aims to provide a better understanding of relevant technology and its underlying scientific, engineering and technical knowledge and trends.

Patents are useful sources of both competitive and technology intelligence.

A clear IP strategy can help ensure that a new product or service is adequately protected from competitors and that FTO is retained.

It is worthwhile seeking early IP protection for ideas that emerge from screening, even if they are not put through a complete NPD process immediately.

It is important to continue filing for patent protection as a new product or service evolves and changes.

A patent may not be the only form of IP protection that can be sought: in some cases trademarks, trade secrets or copyright may be more appropriate alternatives, or should be sought in addition to patent protection.

Analyzing strengths, weaknesses, threats and opportunities can help evaluate various options for taking the NPD process forward and determine how weaknesses and threats may be reduced by playing to strengths and opportunities.

9. Design

9.1 Introduction

The next phase in the NPD process, after the completion of idea and screening, is the design phase. At this stage, the initial idea has been supported by market research and the internal capabilities, perhaps supplemented by external resources, needed to realize an NPD process for the product concept. In design, the final product is codified in product specifications attained by using specific technologies. Drawings associated with the design can be used to prepare design patents (granted by USPTO) or industrial designs (granted by many IP offices), both of which protect the ornamental/aesthetic nature of a product. These IP rights protect the uniqueness of a product's aesthetic design. As part of the design process, the demands of manufacturing, marketing, sales, post-sales customer support and ultimate disposition (including recycling) should be considered.

The method known as the theory of inventive problem solving (Russian acronym TRIZ) is an example of approaches that can be used to solve technical problems during design. Patent information informs TRIZ. This section also discusses how licensing can assist in gaining access to technology to incorporate into product or service designs.

Even more than in earlier steps or phases, listening to the voice of the customer is critical. The focus of the NPD team has to be on what the product actually is, how it can be positioned in a target market, what price to sell it at and how it will be delivered into the hands of customers. A product design for a complicated product may involve offering training, service plans, extended warranties and so forth as add-on features.

For most developing countries and LDCs, the public domain opens a great storehouse of established, available technology that has the possibility of free local use. In principle, the priority should be on using the best available technology that meets end-user needs at an affordable price. If there are several that pass that gate, why not use the technology in the public domain? Its use is free so long as the product will not be sold or used in a country where it is under patent protection.

9.2 Solution of a technical problem through TRIZ

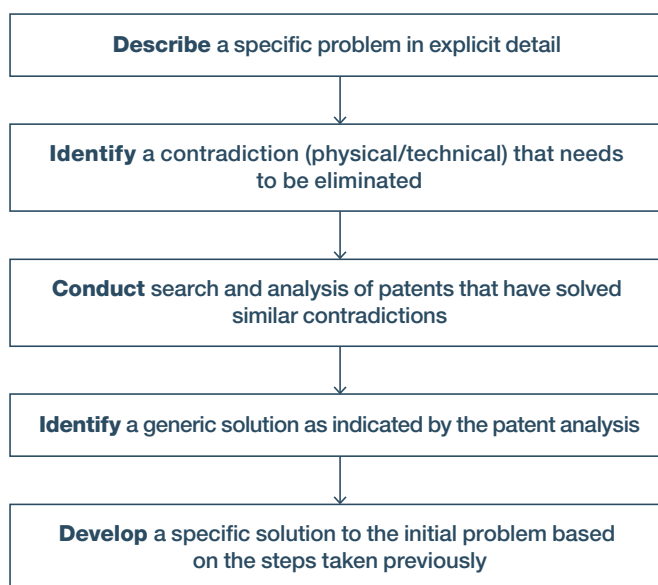
The TRIZ methodology was briefly discussed earlier in this module under section 8.5, "Technology intelligence through patents to study evolving technology trends

and innovation.” Genrich Altshuller, who founded the TRIZ methodology, defined an inventive problem as one that contained at least one contradiction. He further defined contradiction as “a situation where an attempt to improve one feature of the system detracts from another feature.”⁵⁶ For example, putting a bigger battery in a cell phone to extend life can negatively affect size and weight.

There are several TRIZ strategies for searching for solutions to technical problems. The complete TRIZ methodology is quite extensive, with multiple options depending upon the problem to be solved, and can be quite time-consuming to master fully. In this section of the guide you will be introduced only to the initial strategy for solving a technical problem. For more details, you can access various organizations that develop the methodology, such as the European TRIZ Association.

Figure 15 shows the steps to follow to help in the search for solutions to a technological problem that needs to be resolved through the use of patent documents, using the initial steps of the TRIZ methodology.

Figure 15: Steps involved in the TRIZ methodology



Through the analysis of a large number of patents, specialists determined that each invention is not the same in its inventive value. Altshuller was able to identify patterns used more often in the patent documents of innovative technology.

TRIZ⁵⁷ identifies five levels of invention. These range from the simple solution to a problem, to the discovery of new technology:

- **Level 1: A simple or standard solution of a technical system.** This invention requires applying knowledge commonly known within a production/application area. Level 1 represented 32 percent of the patent inventions studied, and presented obvious solutions derived from a few available options.⁵⁸
- **Level 2:** An invention that includes the **resolution of a technical**

Helpful hint

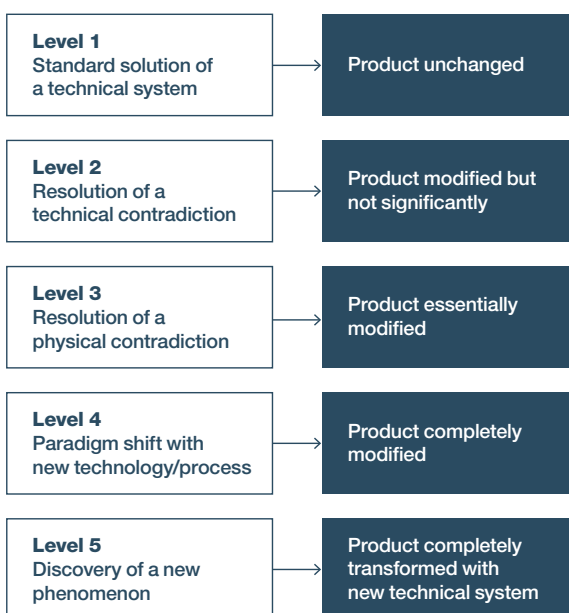
Conducting a successful TRIZ methodology, which results in the discovery of new technology previously not encountered, could mean that you will need to redo your FTO search.

contradiction. It requires knowledge of different fields of technology, in addition to the area of production/application where the invention will be used. Level 2 solutions offer small improvements to an existing system and represented 45 percent of the inventions.

- **Level 3:** An invention that contains a **resolution of a physical contradiction.** It requires knowledge of other production/application areas and fields of technology. Level 3 inventions represented 18 percent of the patents and contributed to a significant improvement in the existing systems, often through the introduction of a certain new element.
- **Level 4: A paradigm shift** that creates a new technology/process that contains a breakthrough solution and requires knowledge of different fields of science. Level 4 solutions, represented by four percent of inventions, result in a breakthrough due to the solutions derived outside a technology’s normal paradigm.
- **Level 5: Discovery,** which involves the creation of a new technology/process that changes what is known by science and establishes a new phenomenon or substance. Level 5 solutions exist outside the parameters of contemporary scientific knowledge and hence are rare, represented by less than one percent of inventions. Such unique solutions occur when a new phenomenon is discovered and applied to the inventive problem.

The result of each stage is illustrated in Figure 16, and Teaching Example 14 shows how TRIZ methodology has been applied over time to improving the electric cooker.

Figure 16: Technological development observed within the levels of invention in TRIZ methodology



9.3 Determining the 5Ps and using them as a guide for design

The 5Ps of marketing

According to marketing experts, to succeed in a market, whether you are selling a product or a service, it is helpful to have the correct marketing mix. The marketing mix is usually called the 4Ps, but it is sometimes expanded to be the 5Ps – product, price, place, promotion (or alternatively position) and people.⁵⁹ These factors derive from an understanding of end-user needs, market size, market drivers and barriers, competition, anticipated stakeholder support and anticipated market share. The marketing mix, like the product concept, is refined throughout NPD.

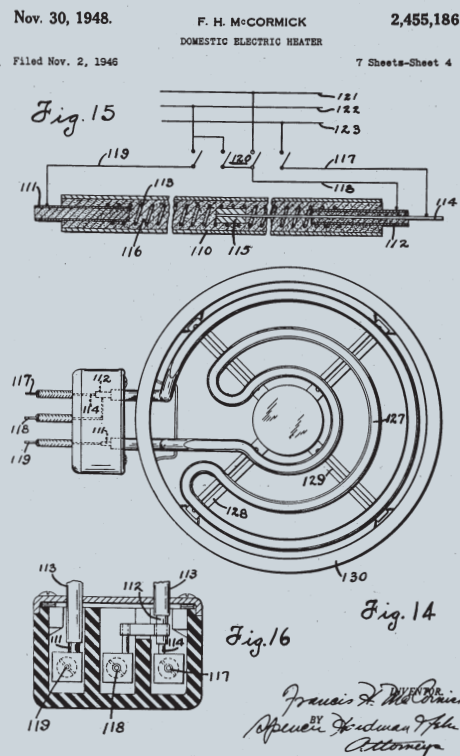
- **Product:** The product is what will be sold. It is not just the core item being developed; it also includes ancillary tangible benefits (such as packaging, brand, quality, warranties, etc.) – in other words, everything needed to meet the user’s need. For example, a cell phone is usually sold with a charger. Market, technology and IP research inform the product definition.
- **Price:** The price is what the product is sold at. The price needs to cover expenses and produce an acceptable profit, while being attractive to buyers and within the limits the targeted customer segments are prepared to pay (to avoid “sticker shock” – an unexpectedly high price that does not reflect the customers’ expectations of the product or service delivered).
- **Place:** Place is how the products are delivered to customers. It can be at a building that is the point of sale, via mail after ordering on an online platform, or a download, as is the case with software generally. Place depends on the complexity of the product, with complex products and services often needing personalized delivery and training, while simpler products can be drop-shipped.
- **Promotion:** Promotion is how customers become aware of the product and its net benefits. It includes the communication channels used to reach them and the content, format and length of the messages that they will read, hear or view. How a product is promoted depends on how it is positioned in the market in relation to competitors and customers (for this reason, many marketing professionals use “position” as an alternative for this particular P).
- **People:** People are those who market, sell and deliver the product. They may work for the company (staff) or be distributors, direct customers (in the case of an original equipment manufacturer (OEM) product) or sales representatives. They are the ones downstream in the supply chain that reaches from the firm to the consumer or other buyer. They must have the requisite capabilities to

Teaching Example 14: TRIZ methodology application in the evolution of the electric cooker

Electric cookers, at one time, were considered to be advanced technology since they were smokeless and cost-effective. Before this, wood, gas and kerosene stoves were used for cooking food. The original electric cooker had an electric resistance element that produced heat. But there was one serious disadvantage. Early models warmed slowly compared with gas stoves. The first reference to this problem in patents was between 1902 and 1927 (for example U.S. patent no. 1,714,175: Electric cooking plate). The following inventions sought to overcome that disadvantage.

- The **first level** of invention was the **rapid electric cooker** (see image A). A high-temperature spiral resistance allowed a heating rate of 10–12 seconds, which was a significant improvement over the previous rate. However, the original electric cooker was not modified; rather, only its electrical parameters and the shape of its spiral were modified. Example patents are from 1947 (U.S. patent no. 2,430,194: Electric hot plate) and 1946 (U.S. patent no. 2,455,186: Domestic electric heater).

Image A

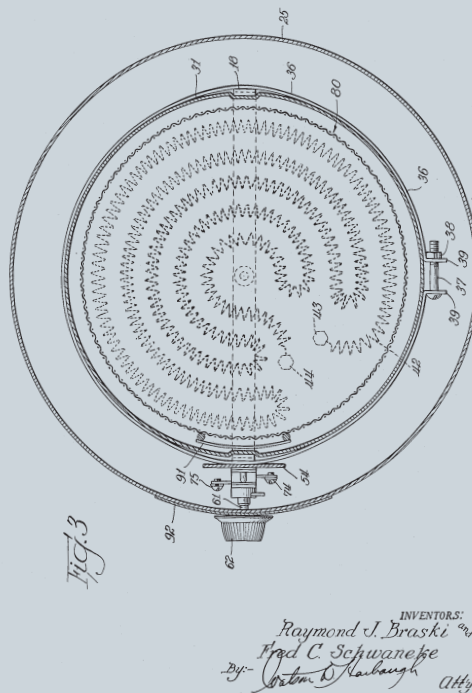


- The **second level** of invention was the **“Hi Light” plate** (see image B). The heater element was clearly

advanced in comparison with the initial design. It used an element in the form of a snake-like strip made of a high-strength alloy. Heating was faster by at least 4–7 seconds, and heat was uniformly transmitted throughout the cooking surface area. Because the new heating element was modified in both its shape and the material, it was novel. This modification provided a solution to the technical contradiction between the parameters of speed of heating and power density, but increased electric consumption by 30 percent. Patents for the invention were U.S. patent no. 2,725,460 (deep fat fryer) and U.S. patent no. 2,601,011 (heating apparatus).

Image B

Nov. 29, 1955 R. J. BRASKI ET AL 2,725,460
DEEP FAT FRYER
Filed Aug. 19, 1953 3 Sheets-Sheet 3



- A **third level** of invention would be the **electric halogen cooker** (see image C), which provided heat using a high-temperature spiral embedded in a halogen lamp made from a tube filled with quartz gas. The lamp shone bright red and produced strong heat. This electric cooker heated up instantly and cooled quickly as well. The technology in this device solved the physical contradiction for the heating element, as a spiral filled with gas generated heat instead of the solid metal spiral in the older apparatus. Hence, the original invention was completely changed by applying a change in the physical level of the heating element. The invention modifications

were observed in patents from the years 1956 (U.S. patent no. 3,086,101: Heaters), 1969 (U.S. patent no. 3,567,906: Planar surface heater with integral fasteners for heating element), 1972 (U.S. patent no. 3,828,163: Electric oven) and 1973 (U.S. patent no. 3,833,793: Electrical cooker unit for a ceramic glass plate type electrical cooker).

Image C

PATENTED SEP 3 1974

3,833,793

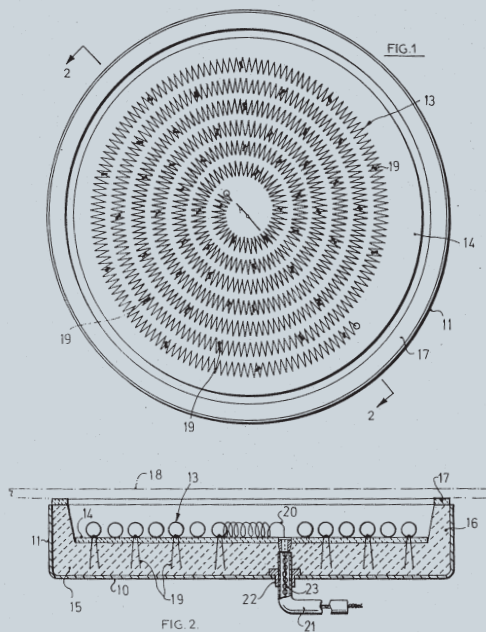
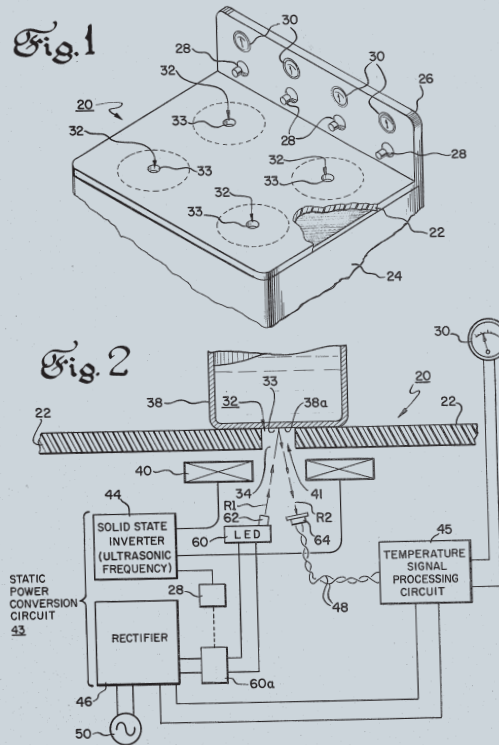


Image D

PATENTED MAR 6 1973

3,719,789

SHEET 1 OF 2



- By the **fourth level** of invention, the heating element was totally modified with the introduction of an induction coil along with a powerful electric generator (see image D). These components rapidly created a variable electromagnetic field. Due to the variation of the electromagnetic field, the atoms of the crystalline network of the alloy, from which the cooking vessel was constructed, created an oscillating movement, primarily heating the bottom of the vessel. The effective induction area only heated the vessel and the coil remained cool. A drawback was the need to use a cooking pan with a magnetized bottom made of ferromagnetic alloys to enable induction. Patents for the invention appeared in 1906 (U.S. patent no. 932,242: Electrical production of heat for cooking and other purposes), 1916 (U.S. patent no. 1,193,404: Induction heater) and 1971 (U.S. patent no. 3,719,789: Induction cooking appliance including temperature sensing of inductively heated cooking vessel by “modulated” light).

This is an example of the evolution that can arise in the development of a product through overcoming existing contradictions and inefficiencies.

An interesting aspect of the heating element patents is that the evolution of technology does not proceed in lockstep with the development and introduction of the products in the market. Some of the inventions patented above lingered unutilized for years before being commercialized. In many cases inventions were forgotten or did not reach the market. This was most likely a consequence of the final product not being developed due to lack of funding, production costs, market resistance or some other reasons. The take-away message is that possible solutions to a technical problem may have already been developed many years ago, so it is important to search for patents over a relatively broad time period.

Helpful hint

Be aware that online buyers may be located in countries where delivering a product means infringing someone else's patent.

execute a marketing strategy and ensure success in the market; therefore, most companies will use a mix of internal staff and outside contractors.

Note that properly managing the “marketing mix variables” or 5Ps supports and leverages the USP to produce a benefit.

Product development managers must think not only as technical innovators but also as marketers. Figure 17 lists questions that help product managers grasp what must be done. They also help stop inventors and innovators becoming so enraptured by the promise of their product that they forget the most important factor – will anyone buy their product?

Figure 17: 10 questions for product managers⁶⁰

1. Do you know who will buy the product?
2. Is your product compelling to these target customers?
3. Have you made your product simple and easy to use?
4. Will your product succeed against current and future competition?
5. Can you explain in one minute how your product is differentiated?
6. Will your product work as promised?
7. Is your product a whole (complete) product?
8. Are your product's strengths aligned with what customers want?
9. Does the product team agree on the product's strengths?
10. Is your product worth the money you plan to charge for it?

9.4 Design for manufacturing and technology risk management

Testing and finalization of the manufacturing process

Sometimes, entrepreneurs focus too much on their product and fail to pay attention to the manufacturing process for it. Determining how to make a product or deliver a service is a critical part of product development. Some of the risks involved in manufacturing include quality, speed, cost, scalability and adaptation.⁶¹

Be aware that, even if there is strong patent protection and FTO analysis finds no barriers to market entry, if the product technology used is proprietary to someone else and patented, its use infringes on their patents.

Usually patent publications filed early in the R&D process disclose only the critical technical information required to replicate an invention using one-at-a-time production. These patents may be supplemented by later patents as the invention is further developed. The information to replicate the invention in a cost-efficient commercial manner without defects and avoiding waste is almost never disclosed in the patent. Similarly, information on how to scale up manufacturing is almost never found in patent publications.

Consider the following options to avoid this problem when using a patented technology not protected in your country to make a product you can sell outside of that jurisdiction:

- Replace the patented technology with another one that has a known production process, or develop your own production process. This is not easy but it is worth a try as cost savings can be significant.
- In a scenario where you cannot buy a license to a patented technology, you cannot substitute it or cannot bypass the patent, you may investigate whether you can move your production to a country where the needed technologies have not been patented and the priority period for patenting there has expired.⁶²
- If the option of relocating to one country is not possible, break down production across several countries to avoid the problems, and exploit countries where the invention parts to be manufactured fall in the public domain. It may be beneficial to invent and to manufacture in separate countries. This may sound strange, but it is an option, as for infringement of a patent to be found, there must be infringement on all elements of at least one claim. In other words, you do not infringe if you merely copy what is described in the specification, assuming this is not claimed in any of the patent's claims. Be aware that is unlikely to occur if the advice of competent patent counsel is sought.

Patent filings for manufacturing process and/or machine/robot/tool

In many cases, entrepreneurs or firms lack relevant experience and capabilities, or cannot figure out how to meet a production cost target. One possible solution for such cases is outsourcing production to a contract manufacturer. As with any vendor, due diligence is required to select a good one and monitoring is necessary to ensure you get the quality and quantities in a timely manner and at the cost promised in the contract.

Entering such an agreement poses risks for IP rights. This is because the product design must be disclosed in the utmost detail (if not for the entire product at

least for the parts the contractor will manufacture). Unfortunately, theft of design does occur and the counterfeit market is filled with copycat products bearing an original brand's trademark, which are then sold at bargain prices. This theft can obviously erode expected market share or even lead to abandoning markets. Theft of IP is a chronic challenge that can be mitigated by choosing competent, reputable and reliable manufacturing partners, having solid patent protection, requiring any person or entity having access to proprietary information to sign non-disclosure agreements (NDAs)⁶³ and vigorously monitoring for breach of contract due to IP theft or negligence in the handling of IP. In jurisdictions with weak or no enforcement of IP rights, additional measures may be needed.

Before discussing or disclosing a product to an outside manufacturer, file for patents covering both the invention and any associated inventions describing the manufacturing process used to produce it. International filing is expensive, but it should at least take place in those jurisdictions which will account for significant revenues or where manufacturing will occur.

Technological risk management

Patent analysis reveals what markets related technologies are typically protected in. The results may be used to indicate how to better protect technologies by filing patent applications in those countries. These could all be in the same country or involve several countries (e.g., when production is split between various factories around the globe, or where service provision includes servers located in different countries, as in cloud computing).

Options for ensuring the patents of others do not affect FTO include:

- Buying them from their owner in the form of OEM components or software, etc. A purchased good should come with a license to use it provided by the selling party and assurances that the seller either owns the IP rights or has a license from the owner that allows that party to sell the rights and transfer a sublicense to use.
- Buying a license from the patent holder and further developing/improving the technology internally. This choice allows use of the patented technology according to mutually agreed terms.
- Finding alternative technologies which are not protected. This choice requires paying no purchase price, royalties or other remuneration of any kind. Instead, it requires taking into account the costs of developing and maintaining the alternative technologies.

Helpful hint

Depending on the type of product and/or service that you want to protect and the particular market circumstances, you may also consider alternative means of protection. As far as patents are concerned you may opt for a **utility patent**, where you protect the functionality of a technology used in a product and/or service (i.e., novel technology, or novel use of an existing technology).

If an innovative feature of a product and/or service is not its functionality but rather its appearance, this ornamental innovation can be protected by a **design patent** (also known as registered industrial design).

There are differences across national patent offices, so for more details consult the relevant national IP office.

Note: For more information about industrial designs, see www.wipo.int/designs.

The best option depends on market context, the technologies available and the circumstances of the entrepreneur or company conducting NPD. Finding alternative technologies (i.e., bypassing the third-party patents) is the only solution which does not depend on the patent holders' willingness to work with the people and entities involved in NPD. It is essentially a make/buy decision.

In the case where filing for patent protection is likely, technology discovery and forecasting searches should be international and include non-patent searches to look for publicly available materials like competitors' product and/or service brochures, presentations at conferences and exhibitions, scientific publications with authors working for a competitor or funded by it, sales announcements, advertisements, press articles, etc., as well as interviews with people who sit on nodal points for communications about technologies of interest. Such people include government program managers, technology transfer/industrial liaison and research personnel at labs working in the field of technology or field of use, editors and authors of trade publications, and committee chairs in relevant professional and trade associations. The reason for extending the search is that publicly available information (patent and non-patent) at the date of a patent application filing (regardless of where this filing is made) is considered prior art against the invention in the patent application.

Regardless of whether patent protection is sought for a product, for products like software, copyright protection exists. Copyright can help you prevent others from verbatim copying of your creative content, in this case the software code. However, copyright does not prevent competitors from working around the code by using different commands, variable names, programming language, etc. to achieve the same function and/or result. This is why it is usually preferable to both file for a patent *and* register a copyright if patentability is an option. The patent application can be filed once the design of the software has matured or been finalized, while the copyright is filed once the software has been written. This protection may also be limited to regions where patent protection for that kind of invention is possible.

The potential patentability of an invention can be explored by looking for similar inventions that have been accepted or rejected by their patent office examiner. Remember that once a patent application is filed, the invention will usually become public knowledge. (An exemption commonly exists for inventions related to national security concerns.) This disclosure usually occurs 18 months after the filing date (the time period varying by region). As a result, if it gets rejected or abandoned, competitors will be free to copy it and will know of the disclosed technology inventions.

It is always important to weigh the pros and cons of patent protection from a business perspective. Rapid product cycles reduce the value of a patent. So do technologies that are easy to design around. Patents disclosing production methods that can be "hidden behind factory walls" are usually best protected by trade secret. Trade secret, as the name implies, occurs when the invention is kept secret. It is permissible to officially confirm possession of the secret at a notary bound by an NDA or completely omit this step and keep it like an ordinary secret.

Teaching Example 15: Technology risk management and seeking technical solutions from patent and non-patent sources of information

Discarded vehicle tires posed a serious environmental threat in Cuba. Other hazards such as forest fires and spread of deadly diseases like dengue and yellow fever are facilitated by improper disposal of vehicle tires. The Cuban government wanted a long-term solution for the proper disposal and/or reuse of discarded tires. Empresa Nacional de Recuperación de Materias Primas de La Habana Cuba, also known as the Union of Raw Material Recovery Companies (UERMP), an affiliate of the Ministry of the Iron and Steel Industry, was commissioned with the task of managing tire waste.

UERMP aligned with the TISC at the Cuban patent office for technological information on the processing methods of discarded tires. The first step in processing discarded tires for reuse was to grind them into smaller pieces. For this the TISC provided UERMP with international database patent search results for grinding machinery. There were 51 patents and/or utility models identified for “mechanic treatment of solid wastes focused on grinding.” Patent applications were examined to further narrow down technologies of interest to those held by established multinational companies that could supply their machinery to Cuba.

As a result of studying this patent information from the public domain, Guangzhou Lianguan Machinery Co. Ltd. was shortlisted for the procurement of grinding technology. Guangzhou Lianguan held utility models CN 202045120 U, CN 201997367 U, and patent CN 102166578 B related to technology for the treatment of solid wastes including discarded tires.

Once UERMP made the decision to acquire the technology from Guangzhou Lianguan, an FTO search was done by the Invention Department of the Cuban patent office. This was to ensure that the technology to be purchased for use in Cuba was not protected by any other patent or utility model in Cuba. This patent search was part of the technology risk management practice of UERMP and in line with how it had carried out its operations in the past.

In addition to the patent search, UERMP also accessed non-patent literature from developed countries to study how they processed their discarded tires. This helped UERMP in taking the next step in processing discarded tires after they had acquired the grinding technology from Guangzhou Lianguan. Their key findings were based on how American and Spanish

companies reused raw materials from discarded tires. For instance, American Rubber Technologies Inc. reused discarded tires to manufacture a wide range of products such as bags and briefcases. A Spanish firm called ELSAMEX reused materials from tires in the production of hydraulic binders and emulsifiers and in road construction.

UERMP was not only able to process Cuba’s discarded tires but it also succeeded in devising a clear strategy to utilize the processed materials. This was achieved in part through its access to and use of patent and non-patent literature from resources available in the public domain.

Trade secret is suitable for products/services which competitors find very hard or virtually impossible to uncover and copy or which may only have a very short life in the market. A famous example of the former is the original recipe of the Coca-Cola® soft drink. Be aware that reverse engineering can often reveal well-kept trade secrets. In addition, a trade secret could be leaked to the public by an active or previous employee. As a safer alternative, consider the combination of patents and trade secrets, as there is almost always know-how required to use a patented technology most efficiently and effectively.

This “technology risk management” step is significant. If done right, it leads to avoiding, or at least mitigating, future legal problems. This step allows for filing for patents to protect technology and allows exploiting the protected technology by selling it yourself or licensing your IP rights to third parties. The latter makes sense where the market response to a technology is positive and the patent holder cannot meet supply on their own.

Teaching Example 15 shows how technology risk management can be used to identify technology that can be acquired from a patent holder, and also how non-patent literature can be a useful source of information about potential solutions to a technical problem.

Tools for evaluating technology risk exist and can help navigate around competitors’ patents. These include scorecards and graphical visualization tools like graphs and geo-mapping.

Recap

The theory of inventive problem solving (or TRIZ) is a technology intelligence tool that can help map out technology trends and forecast possible emerging technology trends; it is also an effective tool for searching for solutions to existing, unresolved technical problems.

TRIZ categorizes five different levels of invention, ranging from simple solutions that solve an identified problem but essentially do not modify an existing product or service, through to solutions that involve the creation of a new technology/process that changes what is known by science and establishes a new phenomenon or substance.

Once an idea for a product or service has emerged from the screening process, it moves into the design phase. Parameters to consider in this phase include:

- the marketing mix for the product or service

- **how to manufacture the product or deliver the service**
- **whether patent protection is required for the manufacturing process for a product**
- **which countries patent protection must be sought in.**

The type of IP protection that you seek will depend on what it is you want to protect.

By protecting your product or service, you also gain the right to license or sell your IP rights to third parties.

10. Development and implementation

In this step or phase the technology is matured to a production-ready prototype. Options for materials, components, subsystems and systems are evaluated. Hardware or other machinery is built using materials, components, subsystems and systems that will be incorporated in the final product. Software code is written. The phase may involve making just one prototype or a spiral development approach in which a prototype is made and tested. The test results are then analyzed for improvements and the next prototype is made. The cycle iterates until the product or service specification is met. Along the way, how the product will be manufactured, sold, supported and disposed of is always considered.

From an IP perspective, the activity in this phase is primarily monitoring for new intellectual assets that may be created and need protection. Primary among these are manufacturing methods and new materials or components, subsystems or systems. A secondary activity is monitoring patent and other databases and talking with experts to ensure no new technology has emerged which might threaten FTO or market viability.

11. Test

This step involves validating that the new product under development meets market needs, satisfies design intent and can obtain certification approval by regulatory or standards bodies. Tests can vary in complexity based on the technology level of the products. Through validating tests, new products are evaluated to assure that production quality is sufficient for market launch.

Validation tests are similar in nature to **alpha and beta testing**, which are terms most commonly used when

testing software products and applications. In **alpha testing**, a product undergoes in-house tests to ensure it meets the design specifications. Testing is conducted before passing through the gate to full-scale commercial production. Part of meeting the design specification is ensuring a user's experience with the product is as planned. Such tests are normally done in-house by employees, engineers, friends and family members.⁶⁴ **Beta testing** is done after initial production begins but just before scaling up production, as its focus is on fixing minor problems that have a big impact on customer satisfaction. This allows for any glitches and issues in the product to be eliminated. Beta testing is typically carried out with existing customers to facilitate a more calibrated validation of product performance. It is a final test before scaling up production and doing the main rollout of the product.⁶⁵

A review of the IP package should be made before launching a product into the market. This review identifies improvements and new inventions made during NPD. Protecting these intellectual assets as IP is a preventive measure that makes it harder for potential competitors to enter your target markets with a similar offering. A good IP strategy includes evaluating whether, where and when to file each performance improvement and becomes a part of the calculus or product management over the "life cycle" of the offering. The life cycle management tasks include elements of launch and post-launch.

12. Launch

This is a culmination of the NPD efforts in the preceding stages. This step involves deploying resources such as time, money and staff to prepare the market for the new product. This step implements the 5Ps. At this stage, those findings are re-examined to see if they still align with the expectations and performances of the product or service in light of the feedback received during testing and the current conditions in the market. Though sales techniques are outside the scope of this guide, as they do not typically utilize patent information, they are obviously important.

Patents of related technology can be used during launch. For example, patent landscape reports (PLRs) are detailed analyzes of patents in a specified sector. Preparing a PLR requires expertise and is time-consuming. But such reports are helpful for identifying potential strategic alliance partners and licensors from whom a license would protect the product in regions where enforceable patent rights restrict the product launch or would prevent launch by competitors. The

WIPO *Guidelines for Preparing Patent Landscape Reports* (see Annex) is helpful for understanding the significance and characteristics of PLRs.

We have discussed FTO searches and how crucial they are in formulating patent strategies in the product development process. At this stage, you should update the FTO search conducted previously to mitigate any risk from new patented technology, undiscovered previously.

13. Post-launch

The discussion in this section is brief but the step is just as important as the other steps. Launching a new product is not the end of the road for an inventor/entrepreneur or company as iterations and enhancements will need to be done to make sure that the product's success continues. The NPD process can be reinitiated based on new ideas generated from the constant study of public domain knowledge. Post-launch is also a learning phase for an entrepreneur or manager as your understanding of market dynamics and internal capabilities evolves. Product development should be an iterative, multifaceted, ongoing process. Embracing and utilizing all forms of information available in the public domain during the post-launch phase will help with making enhancements to the original product over time.

Recap

Once a new product or service moves into the development and implementation phases, it is important to continue to seek IP protection for any new technology or processes that are developed in these phases.

During the final stages of NPD, including the launch phase, it is important to continue to monitor the patent literature for emerging patents that may impact your product or service. An updated FTO search will help to mitigate any risk from new patented technology that was not discovered previously.

A final check of the IP package around a new product or service should be made just before it is launched to the market to ensure that all aspects have the protection they require and to make it harder for competitors to enter your target markets with a similar product.

NPD is an iterative process and further new ideas may be gained from constant study of information in the public domain.

14. Conclusion

The content of this guide was prepared and organized to assist readers such as inventors, entrepreneurs, academics, professionals and TISC staff helping clients in developing countries and LDCs in understanding how inventive knowledge as disclosed in patents and available in the public domain can be used to develop an idea/invention into a profitable product and/or service. With this goal in mind, the guide begins by defining the public domain and what relationship patents have with the public domain. Next, it introduces elements in patent and non-patent literature that contain information that can be used to enhance their technology intelligence and competitive intelligence. It then considers the steps of NPD based on public domain knowledge.

The guide is designed with the purpose of providing preliminary information and understanding to readers who may have an idea for a new offering or those who are providing support services to inventors and innovators. It focuses on how to use public domain information to develop an idea into a product and/or a service. With the aid of various management tools like balanced scorecard and business model canvas, the guide provides readers with suggestions for analyzing public domain information during NPD. With the understanding that public domain information resources may be limited, the guide suggests ways to start thinking about what can be done to learn more about the target market and emerging technology substitutes during the product development process. In each of the major steps of the product development process, the guide discusses how relevant patent information can be used.

The public domain frameworks and information introduced and exercised in the final module include:

- Illustration of the steps in one example of a linear product development process.
- Visualization of how your idea can be socialized, funded and built using advice and information from the public domain.
- A method for scoring and screening ideas via the balanced scorecard.
- Team culture considerations during product development.
- The value chain construct to help understand the functions within the firm that may impact, or be impacted by, NPD.
- Frameworks for finding resources within the firm and the public domain.
- Comparisons of different patent search objectives.
- The business model canvas method of illustrating key tasks in bringing a new product to market.
- Concept screening considerations.

- Trademark and other IP filing considerations.
- The SWOT analysis for refining strategies and tactics.
- The TRIZ technology analysis methodology for finding solutions to technical problems and developing innovative products and services.
- The marketing mix variables of product, price, place, promotion and people.
- Product and project management considerations.

The discussion on using public domain information is illustrated using Teaching Examples from multiple contexts including:

- The conception and development of Gwatamatic for cooking sadza in Zimbabwe.
- The concept and development of the BIODOME composter for processing organic waste in the Moroccan context.
- The conception and development of an affordable medical suction pump for the Kenyan market context.
- The application of the business model canvas to the development of a shoe charger for the Kenyan market.
- Using patent data to conceive and develop an improved athletic performance simulator for Russian volleyball players.
- Using external resources to validate a concept, then plan and launch a new Chai Rum® product from Trinidad and Tobago to the global market for high-end spirits.
- Application of TRIZ methodology to better understand important evolutions in cooking technologies.
- Using patent information to understand and inform the selection of machinery providers for processing and shredding used tires in Cuba.

This guide is a starting point for thinking about the role of public domain information in NPD. It is up to TISC readers and their clients to apply it. There are numerous additional resources that provide more comprehensive and specific guidance for NPD programs and the use of publicly disclosed information in them. The publications and events of the global Product Development and Management Association (PDMA) are one place to start. PDMA-certified NPD professionals are a source of proven and qualified experts, who can provide in-depth help with NPD. Other useful information resources can be found in the Annex.

Annex

WIPO resources and tools

Studies

Conley, J.G., P.M. Bican and N. Wilkof (September 16, 2013). *Study on Patents and the Public Domain (II)*. (CDIP/12/INF/2 REV). WIPO.

Phillips, J., M. Sibanda, H. El Saghir, E. Rengifo García, O.P. Orlyuk and C. Gabriel (February 28, 2012). *Study on Patents and the Public Domain*. (CDIP/8/INF/3 REV. 2). WIPO.

Guides

Identifying Inventions in the Public Domain: A Guide for Inventors and Entrepreneurs (2020). WIPO.

WIPO Guide to Using Patent Information (2015): www.wipo.int/publications/en/details.jsp?id=180&plang=EN

WIPO Guidelines for Preparing Patent Landscape Reports (2015): www.wipo.int/publications/en/details.jsp?id=3938&plang=EN

Tools

Global Brand Database: www3.wipo.int/branddb

Global Design Database: www3.wipo.int/designdb/en/index.jsp

International Patent Classification (IPC): www.wipo.int/classifications/ipc

PATENTSCOPE: www.wipo.int/patentscope

WIPO IP Facts and Figures: www.wipo.int/publications/en/series/index.jsp?id=36

WIPO IP Statistics Data Center: www.wipo.int/ipstats/en/help

WIPO Lex: <https://wipolex.wipo.int/en/main/legislation>

WIPO Madrid System: www.wipo.int/madrid

World Intellectual Property Indicators: www.wipo.int/publications/en/series/index.jsp?id=37

Other useful resources

WIPO Directory of IP Offices and Regional Offices: www.wipo.int/directory/en/urls.jsp

WIPO Patent Landscape Reports: www.wipo.int/patentscope/en/programs/patent_landscapes

WIPO Technology and Innovation Support Centers (TISCs): www.wipo.int/tisc

Endnotes

- 1 For example EMBRAPA is a state-owned research institution in Brazil that also functions as a cooperative enterprise partnering with institutions and research centers in Brazil and other countries.
- 2 Module I titled “Patents and the public domain” in the WIPO publication *Identifying Inventions in the Public Domain: A Guide for Inventors and Entrepreneurs* (2020) highlights conditions under which inventions may be free to use.
- 3 Conley, J.G., P.M. Bican and N. Wilkof (September 16, 2013). *Study on Patents and the Public Domain (II)*. (CDIP/12/INF/2 REV). WIPO.
- 4 As reported in Conley *et al.* (2013).
- 5 Conley *et al.* (2013).
- 6 Phillips, J., M. Sibanda, H. El Saghir, E. Rengifo García, O.P. Orlyuk and C. Gabriel (February 28, 2012). *Study on Patents and the Public Domain*. (CDIP/8/INF/3 REV. 2). WIPO.
- 7 World total based on WIPO estimation of data reported by 125 jurisdictions. *World Intellectual Property Indicators 2019*. WIPO.
- 8 *World Intellectual Property Indicators 2019*. WIPO.
- 9 Based on the data provided in *World Intellectual Property Indicators 2019*. WIPO.
- 10 Aharonian, G. and R. Stim (2004). *Patenting Art and Entertainment: New Strategies for Protecting Creative Ideas*. NOLO.
- 11 WIPO Directory of IP Offices and Regional Offices (see Annex).
- 12 Available at www.aripo.org/member-states. Accessed on September 10, 2019.
- 13 WIPO IP Statistics Data Center (see Annex).
- 14 *World Intellectual Property Indicators 2019*. WIPO.
- 15 Ernst, H. and N. Omland (2011). *The Patent Asset Index – A New Approach to Benchmark Patent Portfolios*. World Patent Information.
- 16 Conley, J.G., P.M. Bican and H. Ernst (2013). “Value articulation: A framework for the strategic management of intellectual property.” *California Management Review*, 55(4).
- 17 See Conley, J.G., P.M. Bican and H. Ernst (2013). “Value articulation: A framework for the strategic management of intellectual property.” *California Management Review*, 55(4), 102–120; Conley, J.G., J.D. Berry, L. Dewitt and M. Dziarski (2010). “Inventing brands: Opportunities at the nexus of semiotics and intellectual property.” *Design Management Review*, 19(2), 58–66; Parchomovsky, G. and P. Siegelman (2002). “Towards an integrated theory of intellectual property.” *Virginia Law Review*, 88(7).
- 18 The major ones are presented in Anderson, A. (2017). “New Product Processes.” In *Product Development and Management Body of Knowledge*. For an in-depth textbook on bringing new ideas and products to market that contains extensive hands-on guidance and tutorials, see Speser, P. (2006). *The Art and Science of Technology Transfer*. John Wiley and Sons.
- 19 Based on the NPD process as described by the faculty at McDonough School of Business (MSB) in the United States of America. The inclusion of the “Post-launch” step has been added and is not a part of the NPD process as laid out by MSB.
- 20 For a much more thorough and complete introduction to product development, see the Product Development and Management Association (PDMA) *Handbook of New Product Development* 3rd Edition. The PDMA ToolBook 3 for New Product Development is useful for actually conducting product development.
- 21 According to Ron Adner in *The Wide Lens* (Portfolio, 2013), product development requires creating win/win scenarios for three groups: the firm and team engaged in developing the new good; its internal and external collaborators for developing, marketing, and selling the new product; and the end-users who will buy it, adopt it, and praise it so others buy it too. A useful framework for thinking about the relationship of these groups during product development is how they fit into Michael Porter’s value chain, discussed on p. 35.
- 22 Gregersen, H. (March/April 2018). “Better brainstorming.” *Harvard Business Review*.
- 23 Annacchino, M. (2011). *The Pursuit of New Product Development: The Business Development Process*. Amsterdam, Boston. Butterworth-Heinemann. (p. 21).
- 24 Anderson, A. (2017). “Strategy.” In *Product Development and Management Body of Knowledge*. Chicago, PDMA.
- 24 Kaplan, R. and D. Norton (1992). “The Balanced Scorecard: measures that drive performance.” *Harvard Business Review* (Jan–Feb).
- 25 Kaplan and Norton (1992).
- 26 For detailed information on this scoring methodology, refer to Kaplan and Norton (1992).
- 27 Examples of contemporary use of the balanced scorecard are available at www.balancedscorecard.org/BSC-Basics/Examples-Success-Stories. Accessed on September 13, 2018.
- 28 The original version of the balanced scorecard created by Kaplan and Norton lists the four perspectives as: financial, customer, internal business process and learning and growth. Substitution of “technology” for “learning and growth” has been done by this guide’s author to explain the objectives more specifically.
- 29 This collaboration is sometimes called open innovation. A good primer for open innovation by inventors, innovators or small companies is Escoffier *et al.* (2016). *Open Innovation Essentials for Small and Medium Enterprises: A Guide to Help Entrepreneurs in Adopting the Open Innovation Paradigm in Their Business*. Business Expert Press. The book takes a no-nonsense,

- bottom-line-driven approach to using open innovation and presents methods for accomplishing it and resources to gather information and obtain technologies.
- 30 Porter, M. (1985). *Competitive Advantage: Creating and Sustaining Superior Performance*. New York: Free Press, and London: Collier Macmillann.
- 31 “Product concept” in C. Pass (ed.) (2006), *Collins Dictionary of Business* (3rd edn.). London, U.K.: Collins.
- 32 Keinonen, T. (2006). “Introduction to concept design.” In Keinonen, T. and R. Takala. *Product Concept Design*. London: Springer. p. 24.
- 33 Keinonen (2006). p. 20.
- 34 The product concept is the basis for the Product Innovation Charter (PIC). The PIC states why the NPD project has been started and other key information that defines the “who, what, where, when and why” of the NPD project. It contains sections for Background, Focus Arena (markets and technologies involved and current and potential competitors), Goals and Objectives, and Special Guidance for the team conducting NPD. The PIC defines what is an acceptable outcome for NPD, and possible challenges and known solutions or ways these challenges can be approached to ensure solutions are economically viable and technically feasible.
- 35 U.S. patent no. 5,913,629 granted in June 1999 to inventor Tom Hazzard of ttools Inc.
- 36 “Product concept” in C. Pass (ed.) (2006).
- 37 Hartung, A. (2015). “The reason why Google Glass, Amazon FirePhone and Segway all failed.” Available at www.forbes.com/sites/adamhartung/2015/02/12/the-reason-why-google-glass-amazon-firephone-and-segway-all-failed. Accessed on September 10, 2019.
- 38 Conley, J.G., P.M. Bican and H. Ernst (2013). “Value articulation: A framework for the strategic management of intellectual property.” *California Management Review*, 55(4), 102–120.
- 39 Burrone, E. “New Product Launch: Evaluating Your Freedom to Operate.” Available at www.wipo.int/sme/en/documents/freedom_to_operate_fulltext.html. Accessed on September 10, 2019.
- 40 Osterwalder, A. and Y. Pigneur (2013). *Business Model Generation: A Handbook for Visionaries, Game Changers, and Challengers*. Wiley & Sons.
- 41 Blank, S.G. and B. Dorf (2012). *The Startup Owner’s Manual: The Step-by-Step Guide for Building a Great Company*. Pescadero, CA: K&S Ranch.
- 42 Source: strategyzer.com. Designed by Strategyzer AG.
- 43 See also Chapter 2, “IP Brokerage and IP Auctions,” in Escoffier *et al.* (2016). *Open Innovation Essentials for Small and Medium Enterprises: A Guide to Help Entrepreneurs in Adopting the Open Innovation Paradigm in Their Business*. Business Expert Press.
- 44 Murphy, C. (2006). “Competitive intelligence: What corporate documents can tell you.” *Business Information Review*, 23(1), 35–42.
- 45 Murphy (2006).
- 46 Murphy (2006).
- 47 Murphy (2006). Note copyright and mask work filings are also relevant. Mask refers to the layout of circuits on a chip or printed circuit board. Masks may be on one plane or several depending on the complexity of the board or chip. The category of IP was established in the United States of America after courts found that masks were not creative enough to qualify for copyright protection.
- 48 FTO search has been discussed in Module III of this guide under section 6, “Finding if there are available technologies you can exploit to identify market opportunities.”
- 49 Kerr, C., L. Mortara, R. Phaal and D. Probert (2006). “A conceptual model for technology intelligence.” *International Journal of Technology Intelligence and Planning*.
- 50 Kelly, B., D. Papanikolaou, A. Seru and M. Taddy (20172018). “Measuring technological innovation over the long run.” 1–60. p. 2. NBER Working Paper 25266, National Bureau of Economic Research, Cambridge, MA. www.nber.org/papers/w25266.pdf. Accessed on September 10, 2019.
- 51 Schuh, G. and M. Grawatsch (2004). “TRIZ-based technology intelligence.” *13th International Conference on Management of Technology*. 1–10. Available at www.researchgate.net/publication/288034712_TRIZ-based_technology_intelligence. Accessed on May 15, 2018.
- 52 For more on internal and external IP strategies, see Pitkethly, R. (2007). “IP Strategy” in *Intellectual Property Management in Health and Agricultural Innovation: A Handbook of Best Practices* (eds. A. Krattiger, R.T. Mahoney, L. Nelsen, *et al.*). Oxford, U.K.: MIHR, and Davis, U.S.: PIPRA.
- 53 WIPO Directory of IP Offices and Regional Offices (see Annex).
- 54 Available at <https://medium.com/quantify-ip/tapping-into-the-potential-of-independent-inventors-5ea6b381e5e0>. Accessed on September 10, 2019.
- 55 Fine, L.G. (2010). *The SWOT Analysis: Using Your Strength to Overcome Weaknesses, Using Opportunities to Overcome Threats*. Charleston, WV: Kick It, LLC.
- 56 Terninko, J., A. Zusman and B. Zlotin (1998). *Systematic Innovation: An Introduction to TRIZ*. Boca Raton, FL: St. Lucie Press.
- 57 Genrich Altshuller was a German national in the former USSR who developed the method between 1946 and 1985. Altshuller created a new method for invention by studying thousands of author certificates (USSR’s IP right comparable to patent right). An author certificate comprises a cover sheet, a single page sketch and a brief description of the invention. From 1946 to 1948 he studied 200,000 patents, out of which 40,000 patents

- were selected as representatives of the most effective solutions.
- 58 The obviousness can only be seen once you know what it is. It stimulates the feeling that occurs when you hear something and think, "Of course, why didn't I see that." Otherwise it would fail the non-obvious requirement for a patent.
- 59 Kotler, P.T. and K.L. Keller (2016). *Marketing Management*, 15th Edition. London: Pearson.
- 60 Sawhney, M. (2017). "Lecture on foundations of product management." Kellogg School of Management.
- 61 One particularly interesting story showcasing how an inventor used patent literature and external resources of information (outside experts) to conceive and eventually conceptualize, prototype and produce an idea is the story of Sarah Blakely who invented Spanx. You can listen to her story on the National Public Radio (a non-profit U.S. radio station funded publicly and privately) available at www.npr.org/2017/08/15/534771839/spanx-sara-blakely. Accessed on September 10, 2019.
- 62 This assumes you can ship the product to the desired market without triggering infringement, as might occur when a product is patented in a country where transshipment occurs, like Singapore, and in going from the country of origin to the country of destination there is a contract in the transshipment country which results in a sale, triggering an infringement.
- 63 For more information on NDAs, see Irish V., "Disclosing Confidential Information." Available at www.wipo.int/sme/en/documents/disclosing_inf_fulltext.html. Accessed on September 10, 2019.
- 64 Thota, H. and Z. Munir (2011). *Key Concepts in Innovation*. Basingstoke: Palgrave Macmillan.
- 65 Dolan, R.J. and J.M. Matthews (1993). "Maximizing the utility of customer product testing: Beta test design and management." *Journal of Product Innovation Management*.

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