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INDUSTRIAL PROPERTY INFORMATION AND ITS USEFULNESS FOR UNIVERSITIES: IN THE EDUCATION PROCESS; AS A SUPPORT FOR RESEARCH AND DEVELOPMENT ORGANIZATIONS; AS A OBJECT OF STUDY

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INTRODUCTION

Industrial property information has long been recognized and used by universities and research and development institutions in industrialized countries and also by an ever-increasing number of organizations in developing countries, as an important tool of technological and economic development. Many developing countries are aware that it is in their best interest to establish national industrial property systems and to strengthen and upgrade existing systems which were inherited from their historical past and are no longer adequately responding to new needs and priorities.

For a modern industrialized society to remain internationally competitive as an economic power, it needs scientists who do more than just live and research in their proverbial ivory towers. Scientists have to see their work in the context of the financial gain to enhance the economies of their countries. Universities and state-subsidized research institutions with their research and development activities is the spur for new products and facilitates more rational procedures and innovative services in the economy.

1. Investments in knowledge need to be made accessible to the business world, in keeping with the following definition:

- Research means transforming money into knowledge;
- Innovation means transforming knowledge into money.

2. Patent information

Patent laws require that an application for a patent for invention describes the invention with such clarity and completeness of all the technical details that anyone having ordinary skill in the art should, by merely reading the description, be able to carry out the invention, and that granted patents for invention be published. In other words, at least when the patent for invention is granted, the invention will be "disclosed", that is, its essence and mode of exploitation will be brought to the knowledge of anyone who cares to know. The utilization of information available through this disclosure avoids wasteful duplication of effort and the multiplication of costs that research aimed at finding solutions to technical problems can entail; it acts as an inspiration or catalyst for further inventions and this contributes to the advance of science and technology**.**

With the rapid strides in research and development (R&D) in industries and other public/private funded institutions, the volume of technical information is growing by leaps and bounds. Chemical Abstracts alone publishes over 10,000 abstracts each week, over 22 million to date; with disclosures of over 17 million compounds, currently about 25% relate to patents. There are thousands of scientific journals documenting contributions from researchers all over the world. In addition, there are over 40 million classified and well documented patents published world-wide and growing at a rate of more than half a million new applications per year. It is significant to note that 80% of these disclosures in the form of patent applications are not published elsewhere, i.e. in journals, periodicals, etc. Patent literature can, therefore, be considered to be a very large and well-structured source of technical/scientific information.

The relevance of patent information in identifying new business opportunities, creating business strategies, planning of R&D programs including technology and business forecasting

is gradually being appreciated. Proper use of patent information can help one to identify state-of-the-art technologies and global expertise, do technology shopping and investment planning, avoid duplication, monitor competitors, and avoid possible infringements. Patent documents can also help in planning technology transfer, striking joint ventures etc. The advances in information/communication technology (e.g. the Internet) already influence almost everything we do.

In this era, judicious management of patent information requires well-structured functioning of information centres. The appropriate and selective use of information aided by state-of-the-art tools of information technology will only aid in the management of this process. However, patent information scientists will have to be trained to make best use of information technology and international/local databases effectively and provide service to potential users in all sectors of business.

Here it must be mentioned that the World Intellectual Property Organization (WIPO) created the Standing Committee on Information Technology (SCIT) which also created the WIPOnet and Intellectual Property Digital Libraries (IPDLs) projects to make patent information readily available particularly on the internet, and developing countries will benefit most from both projects.

3. Organization of Patent Information

Having explained the nature of patents and their availability around the world, I will now show how valuable patent information can be used in practical ways for an improved commercial edge. More generally, use of this information should be an integral part of an ongoing strategic approach to developing new products from initial research and conception. The purposes of searching information from patents are multifaceted and these are illustrated below:

Main purposes of searching include:

- Patentability;
- Infringement;
- Avoid duplication;
- Finding new products;
- Finding solutions to problems;
- Finding state-of-the-art of technology; and
- Generating ideas for R&D.

4. Academic institutions and their use of industrial property systems and information centers

The level of involvement of Research Institutions in the system of industrial property is extremely low. In most universities, with very few exceptions, the patent system is not used at all. The reasons for this lack of interest in industrial property, include the following:

Scientists' work is oriented towards knowledge, not the market. That means that scientists generally see themselves as contributing to the increase of knowledge and disseminating it through an active publication policy. However, because research results are

published so quickly, they largely become unprotected public property and thus frequently fall into the hands of international competitors.

Scientists lack the necessary knowledge of the patent system, often failing to realize which of their achievements are inventions in the legal sense.

The terms of the financial backing provided by public sponsors have been orientated to marketing and not industrial property filings.

4.1 Recommendations for improvements to the use of the industrial property information in universities

It is proposed that intellectual property be included in syllabi at all universities and that they should pursue an active intellectual property rights policy. A three-stage approach is proposed:

- Deployment of inventor support at individual universities;
- Assignment of each university lecturer and researcher to a regional/national patent office and;
- Creation of a structure for patent exploitation through nationwide or Worldwide patent information centers;

The universities and scientific institutions must also adjust accordingly by undertaking some if not all of the following initiatives:

- The universities must be able to take advantage of employee inventions (this entails making necessary funds available in university budgets);
- Knowledge of the law on employee inventions must be improved among university heads and among scientists themselves;
- The universities must develop their own industrial property rights' strategies.

Once these requirements are met, the inventor support personnel at information centers should be recruited and trained. Their main duties should include the following:

- To advise and support the scientists at the universities;
- To introduce the scientists to the patent system;
- To liaise with the patent offices and
- To link between inventors, university administration and patent offices.

4.2 Patent information centers

Universities as a rule do not exploit their own research results, after filing for property rights, they are left with the only option of selling or licensing them to industry.

For that reason it is essential to set up a structure for the commercial exploitation of patents, e.g. involving patent offices and information centers (e.g. the IPDLs by WIPO).

These bodies should be able to undertake the following:

- Offering technological information and preparing other marketing documents and tailored exploitation strategies;

- Negotiating licensing terms; and
- Settling accounts between licensor and licensee.

Along with the quality and quantity of the inventions entrusted to the information center or IPDL, there are other factors that exercise a significant influence on the choice for making commercial use of scientific inventions and they include:

- Neutrality;
- Business confidence;
- The staff's level of expertise;
- Knowledge of the market; and
- Integration in functioning networks to marry demand from industry and supply from science on a regional and international scale.

5. Industrial Property Information for Research and Development (R & D)

As mentioned in paragraph2 of this paper, patent documents have mainly three further essential characteristics, which make them an excellent source of information namely:

- The patent document is an unchangeable written reflection of the R&D output. It describes a new technical development (design or technology), requiring patent protection;
- The patent document reveals the new trends in technology. Only by a patent can the inventor (a person or a legal entity: a company, agency, university, etc.) ensure protection for an invention. The legal system includes an assessment of its novelty, value and applicability, comparing the data from the application with the already published scientific and technological knowledge;
- The patent document provides considerable information about the applicants' approach to the R&D activity and marketing. The company's strategy is very important and it may be of interest when the patent statistics are used for measurement and comparison of the technological developments.

5.1 Patents as scientometrical indicators

One of the most important tasks for researchers in this field is to describe the R&D activities in qualitative as well as quantitative terms, so they could be explicitly included into models and combined with other economic variables. However, the main problem is that R&D activity can only be measured indirectly by means of entry and output indicators. Besides it is more difficult, in theory and practice, to estimate the return of R&D activities than the expenditures. The results of R&D activity and the possible combination of new products and processes with their successful market realization cannot be measured in the common scientific sense of "measuring" of a variable; there is not an eligible monetary or physical unit available. One of the solutions to these problems would be the use of indicators, which in such a context have been the patent indicators used for the measurement of the results of R&D.

The industrial R&D activity is a fundamental factor for the economic condition of a country, and therefore its exact measurement is quite important. The closeness of patents to the results of R&D activity is the main reason for their systematic use in economic analyses. No other indicator reflects, to a similar extent, the state of R&D. Even though the patent

indicators reflect a considerable part of the general innovation process for a variety of reasons they cannot be used in isolation. Firstly, they show only one aspect of an innovation so that a complete picture of the technology transformation could be obtained only by combination of various indicators. In the second place, patent indicators have some disadvantages, which could often be found by comparison with other indicators. This necessity of an integral idea for an innovation relates to other phases as well, and even such a classical phase as the expenditures for R&D must be considered in a broader context.

The validity of patent indicators depends very much on the extent to which they represent the results of industrial R&D activity, and this is a problem closely related to the economic value of the patents. The patent protection is not the only way to market success of innovations. Trade secrets, rapid promotion, low prices, etc., can complement and even replace the patent protection. Various empirical investigations on the relative significance of patents have brought, in principle, similar results. Patents are an important tool for competition, at least as significant as the other factors. Not all technical innovations result in a patent application, but the range is generally wide, because patents are useful not only for protection against imitation, but also for receiving of license incomes and contracting of transfer agreements. In practice all companies apply for patents at least for the most important results of their R&D activity, but there are great differences in applying for patent protection for the inessential products and processes.

The second advantage of patent data is their coverage of practically all fields of technology. The main exception is for example most software, which is not directly connected to technical processes or products, as well as most results from the fundamental studies, which could be better reflected by bibliometrical indicators. This comprehensive coverage of technology is very useful in analyzing the dissemination of most technologies, for instance, or in creating of specialized country-or company-profiles. Patents also have a wide geographical scope, simply because most of the countries have patent systems and in addition they are complemented by regional patent systems like ARIPO, EPO, and OAPI.

Another very important advantage is the highly detailed classification of patent documents, which gives an opportunity for almost unlimited choice of aggregation levels from broad fields of technology to single products. Here the patent indicators are better than the expenditures for R&D activities, or trade and production statistics, where the degree of desegregation is much lower. In order to obtain significant results, one has to combine the patent, trade and R&D indicators by working on high aggregated levels, while for making narrower analyses only patent indicators can be used.

Patent documents include very interesting details such as year of invention (priority year), technical classification, applicant (applying company), etc., which are a valuable source for various kinds of analyses. The statistical processing of patent data can be characterized by a high degree of reliability, because patents are legal documents, in which the details have been described very diligently. So, for instance, the mistakes in the names of companies occur much more rarely, compared with other publication databases and therefore the establishment of statistics for the applicants is rather easier.

Application of patents for economic analyses is very effective, because they contain detailed information about R&D activities. However, it is necessary to have a careful methodological approach in order to eliminate the possibilities of deviations. Research, based on patent indicators, has already revealed some interesting concepts about the innovation process, as well as some starting points for future investigations.

6. Patent statistics data for technology analysis

The data of patent statistics are very valuable for the measuring of R&D activity. They have been annually published in the national statistical manuals of most countries. They are also presented in the specialized publications of World Intellectual Property Organization (WIPO).

Simple patent counts, however, can be misleading for a variety of reasons, particularly with respect to the importance or value of inventions. Recently analysts have attempted to make use of other observable characteristics of patents to draw inferences about their underlying importance or economic value. These characteristics include the size and composition of a patent family and the number and timing of subsequent patent citations.

6.1 Patent families as indicators of technological activity

It is globally assumed and well known that the number of patent families reflects the level of technological activity. Technological activity is defined here as activity that is aimed at developing or improving technology, for example, in R&D or engineering. The year of the first priority is used to order the families in time series, because the priority application date is the closest date to the time the development work was actually done. It is further assumed that firms apply for protection first in their home country and that is the country in which the R&D was done.

Studies have shown that trends in technological activity, active areas within the technology, and the technological direction of specific firms based on counts of international patent families, received “quite high” conformance scores from expert technical specialists.

6.2 Patent family composition as indicator of commercial potential

The composition of the patent family reveals the countries in which protection has been sought for the invention. Since a patent generally only offers protection in the country in which it is issued, and it is expensive to pursue protection in multiple countries, it seems logical to assume that the more countries in which an invention is patented, the greater must be its perceived commercial value. Based on assumption, this analysis uses the number of foreign countries in which protection has been sought for a particular invention as a measure of the potential commercial value of that invention. Commercial potential is defined here as the potential that the technology will contribute to a business activity and create economic value.

It is also well known that external patenting indicates a greater level of commercial value than domestic patenting. It has been statistically proven that there is a significant relationship between the number of countries in which protection is sought for an invention and the number of citations received. Correlations have also been found between patent family sizes and patent renewal rates.

Patent citations

Patent citations are the count of a patent on subsequent patent or non-patent literature. The count of citations is an indicator of the technological impact of the patented invention. Generally, citations per patent have been used as an indicator of relative importance of the

patent. Patents related to significant innovations are more highly cited than any other group of patents. Fewer citations mean less importance of patents to the developmental process. Patent citation networks reveal key patents and important clusters.

Patent citations allow the analyst to assess the quality and impact of cited material, as well as the linkages between cited and citing countries, between cited and citing companies, and between cited and citing scientific and technological areas.

7. 1 Highly cited patents

There are valid reasons for believing that highly cited patents are patents of more than average technological impact. Highly cited material, tend to be important inventions. As a result, these citations are used as indicators of technological quality. They are also important as indicators of linkage between the citing and cited material. Patents associated with outstanding new products are normally highly cited. However, highly cited patents occur relatively infrequently. As mentioned above, only very few are cited very heavily.

7.2 Number of non-patent links (NPLs)

The "other publications" cited in a patent might be used to quantify the dependence of technology on science. The number of other publications or "other references" are its non-patent links. Non-patent links show how closely linked patent is to scientific literature. That is, such technology, yielding a measure of how science intensive or how "high-tech" a particular firm or country is. Citations are indicators of science dependence of patents and vice versa. In general, a patent has on average, about one non-patent reference.

7.3 Identification of leading-edge technological activity

Based on the assumption that a patent, which is highly cited, contains a technological advance of particular merit, leading-edge areas of technological activity are identified. In one study patents associated with outstanding new products have been shown to be highly cited. Similarly, studies on the automotive, electronics, photographic and pharmaceutical industries have demonstrated the areas of leading edge Japanese technological activity based on the study of the most highly cited US patents are of Japanese origin. Yet another study suggests that highly cited patents are often those that would be recognized by technological experts as major innovations.

7.4 Technological mapping

"Maps" of technological domains are constructed by examining the inter-relationships of heavily cited patents. This helps in assessing relative positions of companies and/or countries within each domain. This information is also used for keeping track of "hot" technological areas.

Links between cited and citing patents enable one to map the relationship between companies to determine which companies are original producers and which companies are subsequent users of specific technical innovations. If there is a company whose patents are cited by many of the other companies, it will show up as the center of a dense cluster of arrows. If no individual company shows up in this manner, it indicates that one company does not dominate the technology.

7.5 Competitive intelligence

Patent citation analysis is a useful competitive intelligence tool. It has been shown how to use the patent citation counts to identify technical complementarities and competition among patenting firms. In fact many of the techniques of competitor assessments like citing and cited patents, citation impact, technology profiles and maps. Patent citation analysis however, is more controversial. When used correctly it can have a valuable role to play in competitive intelligence work.

7.6 Technical impact index (TII)

This is the percentage of patents in a particular period, which are the most highly cited 10% all patents. The expected value of the TII has been normalized to be equal to 1. A TII below 1 indicates that patents are not especially highly cited.

7.7 Current impact index (CII)

The current impact index is a measure of how often patents are cited in other patents, which shows how frequently they are used as the foundation for other inventions. It is calculated on the basis of how highly cited the past five years' patents in a particular field are. For example, a company's 1991 index is computed by first calculating the average number of times the patents it was granted in each of the previous five years were cited in new patents granted in 1991. Those figures are divided by the average number of 1991 citations for all patents in each of the previous five years, which yields a citation ratio for each year. A ratio of 1 indicates that the company's patents were cited as often as the overall average. A ratio of 1.2 indicates that the company's patents were cited 20% more often than average. Finally, the citation ratio for each of the five years is averaged to obtain the 1991 rating. A CII below 1 indicates an area of modest citation activity.

7.8 Technology cycle time (TCT)

This is the median age, in years, of the earlier patents references cited in the company's new patents. This varies quite widely, from four to five years for some of the rapidly moving electronics areas to more than fifteen years for some for the slow moving mechanical areas of patenting. A company with very short technology cycle time is certainly a major player in its area. The lower the number, the more quickly the company is replacing one generation of inventions with another.

7.9 Technology strength

The technology strength is a product of the number of company patents and current impact index. That is, the number of patents multiplied by the current impact index.

Patent citation indicators are used in (i) construction of technological performance indicators for R&D, companies and countries, (ii) construction of technology profiles of companies; and (iii) characterization of the patent activities of R&D, companies or countries.

7.10 Linkages to science

Patent citations may quantify the dependence of technology on science and provide an indicator of how near a set of patents is to science. They also show the economic utility of

basic research. Patents in highly scientific areas of technology contain as many citations to the basic research literature as the scholarly literature does. This illustrates how closely related some technologies are to science and gives a useful description of the interaction of science and

8. Main users of industrial property information

Users that bear directly on the value of the technological information contained in industrial property documents and patent documents in particular can be divided into four types:

(i) *Solutions to a technical problem.* A search in the patent literature can potentially identify a solution or solutions to a technical problem previously sought. Patent documents often will discuss difficulties of a particular process or design, which often can be avoided or will include advantages of a particular process or design.

(ii) *Alternative technology.* A solution to a problem may be known but is less than satisfactory for a number of reasons. A search of the patent literature could identify an alternative solution that is more desirable, more economical, more effective or efficient, or more environmentally beneficial. The economics are a major concern of inventors and statements concerning the economic importance of the invention are routinely included in the patent document; such things as the use of cheaper materials, streamlined manufacturing techniques, use of fewer parts, less opportunity for damage or wear or even use of materials and skills more readily available in a particular part of the world are often included.

(iii) *Knowledge of activities in a specific field* of technology can be gained through a search of the literature. Valuable information about raw materials, procedures, processes or by-products in order to choose the most favourable conditions under which to implement a new solution or an established solution to a slightly different problem. Such information would also be valuable when entering into negotiations for production skills or for processes and procedures.

(iv) Another problem closely related to both finding alternative technologies and negotiations for products are the *evaluation of a specific technology that is available for licensing and offered for acquisition.* In this case an evaluation is needed to choose between two or more technologies about which much information can be gained through a search of the patent literature and a review of both present and past technologies and currently used and unused technologies in like and unlike fields.

(v) Patent documents are frequently a *cheaper, faster and better source of information* than that found in the journals or in other media. They provide their information in a standardized format, can be easily associated with previous inventions and their corresponding information, can be selected at the appropriate level of advancement and degree of sophistication. Patents are not just another source of technological and scientific information for developing nations, they are the source of information necessary for the industrial development process.

9. Utility Models

One of the main advantages of a patent system is the encouragement of indigenous inventiveness and the stimulation of creativity among the peoples of the country. Such encouragement and stimulation could result in a large number of inventive products, some of which might not, however, meet all the stringent requirements for patentable inventions. Creativity of this kind, nevertheless, deserves reward and should be encouraged. The protection of utility models serves this purpose by providing for a type of industrial property with less stringent requirements and a relatively shorter duration in comparison with a patent.

It is for this reason that in November 1999, the Administrative Council of ARIPO introduced the protection of utility models in its regional industrial property system.

10. Industrial Designs

Many developing countries are extremely rich in traditional art and folklore, which stimulates creation of local craftsmanship. These creations usually fall within the ambit of the term “industrial designs”. By providing recognition and material benefits to the creator of an industrial design, an effective system of protection stimulates creative activity.

11. Trademarks

A well-selected trademark is an asset of substantial economic importance to an enterprise because it enables that enterprise to establish a market position based on the trademark. Thus, the effective protection of trademarks is an important aspect of commercial activity in any given country.

Developing countries are increasingly concerned about what consequences the advertising and promotion of marks might have on consumption in their countries**.** In formulating and applying industrial property policy and laws, the competent public authorities must, of course, as in any other field, take into account the particular realities of their country and the public interest at large, which, in the case of industrial property, must include the interests of consumers.

12. Conclusion

No industrial property system, however elegantly its basic laws are drafted and however efficiently they are implemented, can make an effective contribution to economic and technological development unless the system is known to, and used by, those for whose benefit it is established. An industrial property system is established to serve the needs of traders, manufacturers, industrialists, R& D researchers, universities, and consumers. The list of potential users and beneficiaries is inexhaustible, and the benefits to be derived from an effective use of industrial property cut across sectorial lines within an economy.

An essential task is to promote, among owners and users, as well as among potential owners and users, of industrial property, within the government, universities, research & development institutions and in the private sector, awareness of the nature of industrial property, and how its main components can be developed and successfully exploited in commerce and industry to enable the industrial property system to serve better the national interest and national goals of development.

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