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A FRAMEWORK TO ANALYZE PATENTS FOR TECHNOLOGY BUSINESS PLANNING

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IT is a fact that firms do have relatively poor objective information on how they are progressing technologically, or what technological strategies they should use for long run business success in today's ever changing global business environment. Managers and planners are often inundated with sales, production and financial information, but can not obtain much reliable information on their company's technological health because technological status is far less quantifiable. Through this paper, it has been argued that a systematic analysis of patents may provide some of the missing information. Many firms now conduct patent searches and use some patent information as part of their business activities. However such use is often limited to simply submitting patent applications, identifying the characteristics of a specific patent, or occasionally reviewing competitor's patents. The company's patent staff often does this work with some assistance from technical groups, but only modest attention from strategic planners. If a firm really wants to gain competitive advantage in today's global economy, a much more extensive use of the patents needs to be called in. It is in this context that this paper has been set with the specific objective of explaining a new framework for analyzing large sets of patent data for use in technology business planning.

Introduction

Basically, business planning requires two kinds of information to effectively set future business directions. One is to accurately assess the market needs and how these needs will change over the long-term planning horizon. The second is to anticipate, technological developments or breakthroughs that will either create a totally new market for new products or displace an existing product from an existing market. Assessing market needs and their evolution over time has received considerable attention. Great progress has been achieved in refining customer-surveying techniques and in analyzing market data. However, not much emphasis has been placed on formally monitoring technological progress or breakthroughs, particularly in development areas that are not directly related to the established technology base for a product or market (Wiseman, 1983; Adler and Fang, 1986; Newton, 1998). The present paper attempts to fill this critical gap by explaining a new framework for analysing large sets of computerised patent data for use in technology business planning. The results of the analysis can describe the nature, direction, and rate of change in any technology that has patents filed.

Today, new scientific and technological developments are emerging at an increasing rate; early signs of change are of great help to decision makers who need to anticipate significant technological progress. In fact, to survive and grow, business must anticipate these changes as early as possible to allow sufficient lead-time for necessary adjustments. Many companies have made bad investments, neglected to capitalize on strong opportunities, or failed altogether-largely because timely information on upcoming changes was not available or was not used wisely.

When a technology finally reaches the market, the consumer and sometimes even the competitors – may think it sprang from nowhere. In fact, it may have taken 10 to 15 years for a significantly different technology to move from initial laboratory experiments to routine customer deliveries. During much of these development phases, technologies are often protected by proprietary secrecy and are least visible to outsiders. Fortunately, many of

these technical improvements with competitive consequences are preceded by some important development in one or more key areas affecting a technology's cost or performance. Often the only way we can tell that something is going on during this period is from the information contained in patents.

Importance of Patent Information

Patents vary in scope, purpose and ultimate value. Most patents are never developed sufficiently to be commercialized, only a few ever lead to substantial economic return for their owners; the vast majority of patents are not ever economically significant. However, many patents are technically important because they lead, either directly or indirectly, to follow-on development, which also may be patented. The value of patents as sources of business information may be considered in view of their quality, bearing in mind that only 2% of patented inventions become commercial products (Newton, 1998).

Ideally, for strategic technology planning in business, we would like to measure the commercial and scientific importance or value of each patent (Liu and Shyu, 1997). However, direct measures of commercial or scientific value are very difficult to obtain, so companies often settle for 'indicators' of the value they want to measure (Wolff, 1998). For instance, the level of patent activity in an area provides good indirect evidence regarding the degree of interest by firms and inventors in securing property rights. High activity usually suggests high interest and consistent development progress in a technical area. Another example, the number of firms with recent patents in technical field of a particular area gives an indication of the mix of competitors and the particular business role (e.g. component vendor, low cost manufacturer) the firms are positioned to play in that area or field. The methods described in this paper emphasize the use of these types of indicators. Patent based indicators have been found by several firms to provide useful information for advanced technology planning (Campbell, 1983).

This work also relies on indicators using the patent references (from both the examiner and the applicant), which are required to accompany each issued patent document. It is found that the references on a patent to earlier patents provide evidence of a connection between the technical content of the patents and can suggest potential relationships between the firms holding the patent rights. More specifically, because new patents are required by law to reference the prior patents on which they were build, we can often get an indication of a patent's usefulness by counting the number of citations that it receives from later patents. (A patent is cited if it is listed as a reference on the cover page of a later follow-on patent document.). This approach is based on the grounds that a highly cited patent is probably more technically relevant in advancing the current state-of-the-art than a patent that is never cited.

The above discussion point to the fact that citations to a previous patent represent evidence that current state-of-the-art developments are related to or were derived from the earlier invention. Moreover, patent references have legal and, hence, potential economic implications, which usually compel close scrutiny on the part of patent examiners and patent attorneys. As a result, citations can provide an indirect measure of the 'technological importance or usefulness' of an early invention to later inventors and to related developments.

An invention that leads to a number of follow-on patents may also have high business significance because competitors often try to "patent around" a key development owned by another firm to maintain or capture market position. This is a common practice in many technical areas. It will often require a reference to the original patent by any new patents. Thus, patent references and citations are sometimes useful empirical precursors to technology improvements in existing products and markets.

Patent citations are not a completely reliable indicator of a relationship between the firms and inventions represented. In addition to the fact that some highly cited patents are not particularly important, it is also true that some significant patents never receive a large number of citations (Carpenter, et. al., 1983); therefore patent citations are only an indirect "indicator" of the importance of a development approach. Moreover, several factors (which are difficult to separate) influence the total number of citations to a patent, like the age of the patent (older patents are likely to have received more citations than newer patents). As a result, informed judgement and experience regarding these factors are required in order to use citation indicators wisely.

Application for Business Planning

Tracking the patent activity and citation information, the patent data can be made extremely useful for addressing the issue of business planning. The Table-1 summarises five major application areas for business planning and analysis, where patent indicators provided valuable information on technology trends and competitor's positions.

Technology Competition Analysis

Patents indicate important technology positions of the major firms in a particular industry as well as characteristics of emerging technology for major products and services in the related business sector. Patent analysis thus can provide a business firm with a unique picture of the nature and strengths of its competitors (Lepkowski, 1998). Such an analysis could be approached in two fundamental ways. The first is to conduct the patent search "focusing on companies" to study all the patents held by particular firms regardless of the technologies involved. The second is a patent search "focussing on technology", which means studying all patents in a given technology area, without specifying which firms are represented.

Using a *company focus*, a firm can compare the patent position of several firms in its technical area of interest and can understand their corporate-level technology and business strategies. This can extend strong support to the firm's strategic planning exercise. In *technology-focused* studies of competitive markets, the firm can characterize the group of technologies and/or products that have a high potential of success. Often competing product strategies or developments can be compared.

Table 1: Patent Trend Analysis: Major Application Areas

Business Planning Application	User Benefits
Technology Competition Analysis	
Compare company positions and strategies	Improved product management strategies and decisions.
Characterize high and low growth - technologies for competitors	More focus on best long-term market gains
New Venture Evaluation	
Evaluate potential technology acquisitions	Better technology acquisitions
Analyse Joint Venture opportunities	Reduced investment risk and planning uncertanity
R&D Management	
Evaluate process/product plans	Improved R&D allocation (pick winners, avoid losers)
Define pacing technologies	Better inventive idea awareness
Patent Portfolio Management	
Identify valuable patents, product ideas, or spinoffs.	Improved returns from patents (through - - licensing, selling, and developing products)
Identify potential technology buyers	Early identification of potential new spinoff - businesses
Product Area Surveillance	
Review new patent content and ownership breakthroughs,	Early warning of potential development shifts, and new market entrants.
Check for infringements	Better protection of intellectual property

The patent literature, however, will not provide clues on why one technology is favored over the other. The resulting information only helps a product planner identify attractive product strategies or spinoff opportunities.

This can help firms define the best strategies for managing their new products. Also, by tracking both the high and low growth technologies of competitors, a firm can emphasise on market areas wherefrom superior long-term gains in productivity and profits may be expected.

New Venture Evaluation

Firms do undertake new ventures or go for the acquisition of new technology in order to improve their growth and/or financial health. Either approach involves a complex process (Liu and Lee, 1997), often heavily focused on financial, production, and sales information. Patent trend analysis can add valuable insights into the areas of diversification contemplated by any business as well as the technological health of firms and their intellectual properties. These insights could lead to better technology acquisition decisions, be it R&D or technology transfer.

R&D Management

One potential use of patent trend analysis is in evaluating the technological importance of product or process improvements. One can realize from patent trend data, the approach its competitors are emphasizing. Consequently, in managing an R&D program, the manager and his staff should seriously consider how their approach compares to others in terms of uniqueness, cost-effectiveness and market acceptance. Systematic examination of the competitor's patents and their prior art can help in making this comparison.

Patent data can also be used to carefully define the 'pacing' technical problems or subsystems in a complex development program. Pacing problems are those areas where needed improvements control the rate of development for the whole technology. In fact, analyses on the technical subcategories of an area using patents may stimulate new technical solutions from within a research staff. Patents are a unique source of innovative ideas.

These activities can lead to a better awareness of creative ideas and improved effectiveness of R&D resource allocation. Picking the technological winners and avoiding the losers as early in the R&D process as possible provides an overall competitive advantage to a firm.

Patent Portfolio Management

Many firms have extensive holdings of intellectual property that could be used to gain competitive advantage at the marketplace. This is possible only if the intellectual property is better managed using an improved understanding of opportunities for generating economic returns. Generally speaking, a firm may license, sell, develop, or discard its technologies. Patent trend analysis can act as a valuable tool for exploiting a firm's portfolio of patent holdings in order to provide timely information to the technology decision-makers regarding the commercialisation choices. For example, a firm could apply patent indicators using references or citations to identify the most attractive patents or business opportunities among its own patent holdings. It could also explore opportunities for spinoffs.

Given attractive holdings of intellectual property, the resulting patent indicators could identify the potential technology seekers or buyers. The benefit from this type of analysis could also be expected in terms of new product development at the firm itself (Liu and Lee, 1997). Also, with patent maintenance fees increasing, routine costs to hold patents can be reduced by eliminating unproductive patents or recovering costs through some form of commercialisation. More importantly, the patent trend analysis helps establish relevant linkages with firms for future business ventures.

Product Area Surveillance

This major application area for patent trend analysis differs generically from the previously discussed four areas, and it emphasises on the need to go for the time studies of a specific technical area or group of firms. Using some of the quantitative patent indicators, surveillance studies entail periodic examination of new patent issues on a continuing basis. Hence the product area surveillance application represents the use of the patent indicators for technology monitoring, usually in several technical areas of long-term interest to

a firm. This monitoring of new patents, as they are issued, provides early warning of future changes like development shifts, potential breakthroughs, and new market entrants; and also identifies significant new thrusts in technical direction, spot new business partners, and track changes in the competitive positions (Saji, 2000).

The above-discussed five application areas of patent trend analysis may be exploited to address both the fundamental business planning requirements - assessing potential market needs and anticipating emerging technological developments. Traditionally, good business practice requires that new product development usually begin with a market study. It is believed that, in addition, a firm should systematically and objectively measure its own internal technological strengths and weaknesses to compete successfully at the marketplace. Patent trend analysis can provide an effective methodology to understand these critical aspects of evolving business plans in a better way.

Limitations of Patent Information

Although patent data are a unique and beneficial source of information regarding certain important technology characteristics of firms, their usefulness for forecasts is also limited in two important ways. First, regarding the timeliness of patent information: the analysis of patents is restricted because the patenting process itself will take a few years to get completed. This means that by the time many patents are available to the public, product or process changes may have already been implemented, thus making near-term business forecast unwise. Second, for the purpose of assessing competition, patents as a data source could provide very limited information as many technological improvements in products or processes are not patented. A large number of firms protect their technology through trade secrets and, thus, these firms would never show up in a patent trend study. This means that the analysis of the competitors in a market would be incomplete if only patents are used. These limitations imply that patent information by itself is not sufficient for effective technology business planning. It is very beneficial to include other data sources too, such as sales records, economic trends, or R&D investment estimates, for a successful competitor or market analysis study.

Conclusion

The patent information can be expected to provide a unique planning resource for managing a firm's technology or product development and for systematically evaluating its competitive position relative to other companies in a market area. The analytical framework presented here suggests that studying patent trends for business planning can be a valuable activity for firms. Although not yet used widely, I do expect that the analysis of patents would increase in the future both as more firms apply the same, and as firms who now use it consider for analysis improvements. Since ready access to computerised patent databases is now possible (Sandman, 1997), patent analysis seems to have the potential for being applied more routinely by a larger population of users in India too.

I also anticipate that the business community will apply patent trend information to a wide variety of business functions and decisions. In addition to the current applications mentioned in the paper, there are several areas wherein the patent trend analysis is likely to be useful when combined with other types of business planning information. Examples to this context include, international market studies, technology forecasting, mergers and acquisitions, new product planning, R&D investment evaluation, and R&D productivity assessment. These areas will begin to be affected by the patent trend analysis as more firms start applying the same and as the analysis costs decline. Thus, we can expect this emerging technique to play a valuable role in the future corporate technology decision-making.

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