

Strategic Management of Intellectual Property

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Abstract

The emergence of the pro-patent era in the US in the 1980s is symptomatic of a transition towards intellectual capitalism. As a consequence IP issues have entered the agendas of strategic management in industry at large, while being previously handled by specialists in the periphery of management attention. As a result there are often missing links between IP strategies and business strategies. This paper presents a conceptual framework for IP-strategies, technology strategies and business strategies, which can be used to link these levels of strategic management. In particular the paper illustrates various patenting strategies in technology space and over time, together with some results from a study of corporate practices in Japan. Finally the paper introduces the wider notions of multiprotection and total IP-strategies as an approach to analyze all elements of a business and how to match them properly with all available IPR types. The ultimate function of strategic management of IP is then to build up the total value of an IP portfolio as part of the company's intellectual capital.

Key words: Business strategy, management, R&D, technology, innovation, patents, intellectual property, intellectual capital, licensing.

I. The Emergence of the “Pro-Patent Era”

In order for a capitalistic economic system to operate properly, it is of decisive importance that markets for labor, capital, products, services, etc. are functioning. However, markets for ideas, knowledge, information and intellectual products in general have difficulties to function in principle. It is basically very difficult to sell or otherwise exploit an idea without disclosing it in a way that others can essentially use it without paying properly. From society's point of view, an underinvestment in creative work and knowledge production may then result, since creators and innovators do not get sufficiently rewarded by profits from exploiting their creations on proper markets. To compensate for the deficient functioning of such markets, technology markets in particular, a system of intellectual property rights with patents, trademarks, trade secrets, copyrights, design rights, etc. has been created by society.

Patents are granted as a temporary monopoly right which function as an incentive both for disclosure of technical information and for investments in generating and diffusing marketable technical inventions – granted then as an attempt to improve the efficiency of the capitalistic economic system. Alternative government policy measures for similar purposes may work more one-sidedly, e.g. public technology procurement that strengthens demand, or R&D tax deduction schemes that reduce the cost of supplying R&D. Such policy measures are usually nationally oriented and may have strong or weak effects.

Until the 1980s, the patent system had been considered by industry to have weak economic effects on a broad average (chemicals and pharmaceuticals being one exception), resulting in weak management attention. In 1982 a new court, the US Court of Appeals for the Federal Circuit (CAFC), specialized in patents, was created in the USA. At roughly the same time, but by and large for independent reasons, US antitrust policies changed in favor of strengthening the enforcement of patent rights. In parallel, US industry and US politicians started to push forcefully for a general strengthening of the IP system since US industry was perceived to have difficulties in protecting and exploiting its R&D investments in view of the competitive successes of several Asian economies, Japan in particular. A new era thus emerged, referred to as the “pro-patent era”, for various reasons and with far-reaching consequences. This development can be seen as an important symptom of the transition towards intellectual capitalism, and it has focused wide attention upon patents, intellectual property rights and intellectual capital matters in general.

The economics and management of intellectual property on the whole (thus including patents, trademarks, trade secrets, copyrights, etc.) have then changed considerably since the early 1980s. Both the use and abuse of the patent and litigation systems increased, and prompted the eruption in the mid-to-late 1980s of what some people referred to as “patent wars,” notably between the USA and Japan.

The importance of patents as a means for a company to exploit new technologies has increased, as have the resources companies devote to IP protection. Patenting and licensing have become more strategically managed, including a shift to more offensive rather than defensive patenting in a ‘patent arms race’. Several US and many Japanese companies have been particularly active in building up patent portfolios and cumulating skills in using the patent system, including using patent information for technology and competitor intelligence. Japanese large corporations have consistently dominated the list of top ten corporations in terms of the number of US patents granted.

For the years shown, the highest ranked corporations on the aggregate in descending order are Canon, Hitachi, Toshiba, IBM and Mitsubishi Electric. The European corporations Philips and Siemens have dropped out entirely. IBM has made the most remarkable comeback, and Motorola and NEC have entered the top.

II. The Rising Value of Intellectual Property

During the emergence of the pro-patent era of the 1980s, the economic value of patents increased in various ways. The probability of winning a court case as a patent holder increased, as did the patent damage claims. From being a relatively minor business issue on average, patents started to gain significance. Table 1 gives an illustration of this.

Not only patents have increased in value and sometimes reached astonishingly high levels. Table 2 gives examples of how high monetary values are also attached to trademarks.¹ Although the valuations are very uncertain, they still illustrate the possible magnitude of intellectual capital in the form of trademarks. The total value of the eight highest valued trademarks in 1992 amounts to 132 BUSD, which is in the range of GDP for a small country. Trademark values typically increase (unless they are mismanaged). The value of know-how, trade secrets and knowledge in form of human

¹ A similar list of the most highly valued patents in the world is not readily available. Such a list would most likely include the patents behind the top selling pharmaceuticals. The best selling pharmaceutical worldwide in 1997 was the ulcer drug Losec, developed and patented by the pharmaceutical company Astra in 1978. Astra management has estimated the (discounted to 1978) value of the basic patent to fall in the range 15–30 BUSD, that is of the same magnitude as the most highly valued brand names.

capital in general is also difficult to measure, but there are indications that such values have increased as well.

III. Conceptual Framework for IP-strategies

As the values associated with the market exploitation of intellectual properties increase, the need to foster and manage the development of these creations as well as protect their rights on an international market grows proportionately. In response to the realization of the importance of intellectual property in today's global market, different strategies have been deployed in order to reap the benefits. However, the integration of coherent IP and technology strategies with business strategies is not a simple matter and some kind of conceptual framework is necessary (although not sufficient).

For many economic theorists, management has paradoxically been somewhat of a big, dark box, perhaps even bigger than the black box of technology used to be. An important approach to explore this box is to represent the management factor by the formulation of generic strategies taken in a broad sense of target-related controlled courses of organizational action. Strategies can be formulated at various managerial levels for various sets of activities, and needless to say there are many possible typologies of generic strategies. Figure 1 gives an overview of some general types of strategies for a technology-based firm (TBF). These strategy typologies also serve as a conceptual framework for IP-strategies.

Through notably strong economies of four kinds, that is economies of scale, scope, speed and space (the "four S's") associated with the combination of different technologies and other resources, the TBF is subjected to specific dynamics in its growth and diversification and shifts in businesses and resources. In particular, a TBF tends to engage in technology diversification, thereby becoming multi-technological. As such the TBF has incentives to economize on increasingly expensive new technologies by pursuing strategies of internationalization on both input and output markets, technology-related business diversification, external technology sale and sourcing, R&D rationalization and technology-related partnering.

In order to realize the potential economies associated with new technologies, it is crucial to formulate and execute coherent strategies at corporate, technology, product and IP levels. Figure 2 gives a more detailed overview of general types of strategies at technology and product business level. Note that Figure 2 provides a break-down of first technology acquisition and exploitation strategies and then product commercialization strategies, which constitute a breakdown of the specific strategy 'internal exploitation'. Finally, Figure 2 also lists a number of patenting strategies as well as possible counter patent strategies of a competitor and subsequent litigation strategies in case the competitor infringes a patent. Figure 3 then illustrates the various patenting strategies in Figure 2 in a technology landscape or space, while Figure 5 illustrates how a patent portfolio could be built up over a product life cycle (PLC) through continuous patenting rather than through sporadic patenting with just a few patents as has been common in the past, especially in western companies (Figure 4). Strategies for other IPRs such as trade secrets and trade marks could be typologized as well but is left out here (see further Granstrand 1999).

Different IP strategies are linked to different product commercialization strategies. Moreover the various strategies are mostly complementary. A product business is also typically comprised of several elements that could be promoted or protected by different IPRs. Altogether these conditions surrounding a business prompts the concept of multi-protection, that is the use of not only a portfolio of patents but a portfolio of IPRs.

Patent strategies will be examined in more detail in the next section, and then multiprotection will be examined.

IV. Patent strategies

A. *Patent strategies in general*

The literature in economics and management on patent strategies is generally very thin, as was the case for technology strategies until that area grew popular in the 1980s (see Granstrand 1982). The popularity of the strategy concept has also started to grow in the IP community. Several works on IP strategy from mainly a legal perspective have appeared, see e.g. Anawalt and Enayati (1996) and Glazier (1995). A more management oriented work is presented by Momberg and Ashton (1986). Manuals and textbooks (as well as licensing strategies) for patenting, often discuss patent strategies in terms of when (in the R&D process), where (choice of countries), why and how to patent. Patenting strategies described by statistical indicators of patenting and the patent portfolios of firms and related to their economic performance have been studied by Ernst (1995). Patent strategies in Japanese industry have been studied by Rahn (1994). Various business history studies also account for patent strategies used in the evolution of an industry or a company. A recent example from the electronics industry is given in Takahashi (1994).

In these types of works, various ways are used to characterize and classify patents and patenting strategies. Below, a somewhat novel way to represent these strategies, based on the concept of a technology space, the product life cycle and the technology life cycle, will be used. Patent strategies could also be defined at the level of individual patents or at the level of the patent portfolio for a business or a company as a whole. Here, patent strategies will be discussed at the portfolio level.

1. **Patenting in technology space**

In order to illustrate various patent strategies it is useful to think abstractly of a general technology space in terms of a technological terrain or technology landscape, which is gradually explored by R&D processes. Parts of the terrain with (roughly) similar R&D difficulties in terms of costs could be delineated by R&D isocost curves, in principle resembling altitude curves. Various maps of this technology landscape could be constructed, revised and improved as R&D proceeds. A patent could be represented on such maps by a circle enclosing the technical solutions in the claims of the patent. The size of the circle could also be used to schematically indicate the scope of the patent. With this type of map a number of generic patent strategies could be illustrated as in Figure 3, based on the configuration of multiple patents. Of course, configurations in reality are not as “neat” as in the figure, which aims at illustrating different cases in principle. Moreover, patent strategies can obviously not solely rely on configuration considerations, but must also take into account the actual qualities of individual patents and patent claims as well as the company situation in general (whether the company is leading or catching-up etc.). With this in mind a number of generic patent strategies could be described as follows:

Ad hoc blocking and “inventing around”

Typically as a result of ad hoc efforts, small resources and/or disregard of small patents and portfolio effects, one or a few patents are used in this case to protect an innovation in a special application. The possibilities to invent around are many, and R&D costs and time for inventing around are low.

Strategic patent searching

A single patent with a large blocking power is (somewhat ambiguously) called a strategic patent. In other words, strategic patents have deterringly high or insurmountable invent-around costs and are therefore necessary for doing business within a specific product area.

“Blanketing” and “flooding”

In the case of blanketing, efforts are made to turn an area into a jungle or a minefield of patents, e.g. “mining” or “bombing” every step in a manufacturing process with patents, more or less systematically.² Flooding refers to a less structured way of taking out multiple patents, major as well as minor, in a field and may result from patenting-reward schemes as much as from a conscious strategy. Blanketing and flooding may be used as a strategy in emerging technologies when uncertainty is high regarding which R&D directions are fruitful or in situations with uncertainty about the economic importance of the scope of a patent.

Typically, blanketing and flooding make use of the possibilities to take out patents on minor inventions from a technical point of view. Such minor patents are often frowned on by engineers and inventors and sometimes referred to as “petty patents”, “junk patents” or “nuisance patents”. However, such judgements are surprisingly often based on the technical characteristics rather than the possible economic importance of the patent. Minor patents can be used as nuisance patents to slow down competitors. Minor patents may also be useful in building the bargaining power of a patent portfolio. Nevertheless, it must be kept in mind that not all patents are economically motivated and that a blanketing or flooding strategy is only economical up to a point.

“Fencing”

This refers to the situation where a series of patents, ordered in some way, block certain lines or directions of R&D, e.g. a range of variants of a chemical sub-process, molecular design, geometric shape, temperature conditions or pressure conditions. Fencing is typically used for a range of possibly quite different technical solutions for achieving a similar functional result. (“Fencing” is an old strategy, which actually was described already by Alfred Marshall³).

“Surrounding”

Typically this is the case when an important central patent of some kind, especially a strategic patent, can be fenced in or surrounded by other patents, which are individually less important but collectively block the effective commercial use of the central patent, even after its expiration. Often, surrounding patents pertain to different applications of a basic invention. Surrounding could be used to get access to the surrounded technology, e.g. through cross-licensing. This is an important possibility if a competitor gets a strategic patent. Other competitors can then hope to win a second patent race for application patents that could possibly block the exploitation of the strategic patent, which in turn would create possibilities for cross-licensing.

Combination into patent networks

This refers to the building of a patent portfolio in which patents of various kinds and configurations are consciously used to strengthen overall protection and bargaining power.

2. Patenting over time

The patenting patterns in Figure 3 are snapshots of the result from patenting activities over time, involving several races for patents of various types – product patents, process patents, application

² Various military terms and analogies are used among patent practitioners.

³ See Marshall (1994, p. 520 [1890]). See also Scherer (1980, p. 451) which describes how DuPont fenced in their invention of nylon by patenting a range of molecular variations of polymers with potentially similar properties as nylon. In this way, fencing in several dimensions may come close to systematic blanketing.

patents etc. Different patenting strategies over time can be considered as well. Two principal types of diagrams could be used, one showing the development over time of some economic variable (e.g. cash flow) and one showing some technology-related variable (typically of technical performance). A simple illustration of a cash-flow diagram is shown in Figures 4–5. Here two alternative patent strategies are illustrated in connection with the cash flow over the product life cycle (PLC) of one product generation. In the first case, called *sporadic patenting*, just a few patents at key steps in the R&D process are taken out. In the second case a conscious effort is made to build up a rich patent portfolio, and patents are applied for more or less continuously in the R&D process. This second strategy can be called *continuous or follow-up patenting* and results in the build-up of a patent portfolio for the product business in question. The portfolio is composed of a number of product patents, application patents, production process patents etc., reflecting the shifts of emphasis in R&D work in the different PLC stages. This is more costly and discloses more information as well as it requires more astute management of patent maintenance and expiration, but gives a broader and more long-lasting protection while reducing the risk for the innovating company to be foreclosed by a fast competitor. It should also be noted that continuous patenting is somewhat along the same lines as continuous improvement or “Kaizen.” However continuous patenting is not only applicable to continuous improvements of a product. In developing a product of a systems nature, for example a power transmission system, many technologies are involved with patentable advances on many fronts as R&D proceeds, while the final product may represent a radical step in increased overall technical performance.

Figures 4–5 illustrate two patenting strategies of a firm in the context of one product generation. Figure 6 then illustrates the patenting behaviour of different competing companies A, B and C in two competing product types or two subsequent product generations. These are predicated on two technology bases (sets of technologies), denoted I and II, with partly competing (substituting), partly complementary technologies. The shift from one product generation to the other thus involves a transition to new technologies, perhaps involving a radical innovation. The technical performance of the two product generations or types often improves over time, as shown by the schematic S-curves in Figure 6. An example would be digital technology superseding analogue in mobile telephony. Company B holds a major patent for technology base I and concentrates its R&D on further improvements in that area⁴, while company A builds patent positions in both technology bases. Company C is a new entrant in the area and focuses only on technology base II. Thus the competing companies have different patent shares in the different technologies for the competing product generations or product types, just as they may have different market shares. Typically, established firms with high market and patent shares for an established product generation are slow to build up strategic patent positions in a new competing technology, thereby risking the loss of market share in the new product generation. At the same time, new innovative firms get an opportunity to enter the market, which has often been the case historically in connection with a radical innovation or technology transition (see e.g. Schon 1967 and Utterback 1994).

Underlying investment strategies

Naturally, patenting behaviours or strategies are linked to the R&D strategies of the competing companies. For a single product generation, R&D strategies typically shift along the PLC from emphasizing product R&D to process R&D and application developments (cf. Figure 4). In connection with a product generation shift involving a technology transition, general R&D and technology investment strategies and responses are:

⁴ Cf. the so-called “sailing effect”, which refers to improvements in late stages of a maturing technology. These improvements are mainly made in response to a perceived threat of a new technology. The expression was derived from the performance of sailing ships, which was boosted in response to the arrival of ships powered by steam engines (see Graham 1956).

- 1) Investing in improvements of the old technology in the existing product generation (yielding the “sailing effect”)
- 2) Investing in a new product generation based on some version of the new technology.
- 3) Investing in a hybrid generation, based in parts on both the old and the new technology, as a “gap filler”.
- 4) Introducing the new technology in an evolutionary manner in the existing generation (e.g. piece-meal replacement of transistors with integrated circuits).
- 5) Abandoning the emerging technology and jumping to the next major new technology. (This is a risky strategy.)
- 6) Doing nothing (wait and see).

When and how to enter the new technology (if at all) and when and how to exit the old technology are thus crucial timing decisions for technology management. It is also easy to fall behind because of a failure to build up patent positions in the emerging technology, as mentioned. Thus there are not only races for product, process and application patents for a particular type or generation of a product, but for several competing products and technologies. The old saying that in patenting the winner takes all refers to a single patent race, while in a typical technology-based business there is a multitude of patent races, hence the notion of ‘patent portfolio races’. It should finally be noted that patent strategies are a reflection of R&D strategies, and to some extent patent information is useful to outsiders in tracking down these strategies (see Brockhoff 1992). R&D strategies can then be somewhat disguised by patent flooding or “decoy” patenting.

B. Patent strategies in Japan

Several of the patenting behaviours and strategies described above were found in the Japanese corporations, studied through interviews and case studies as reported in Granstrand (1999). In summary they were:

1. Patent blanketing (patent invasion of new technologies), flooding, fencing and surrounding.
2. Building of patent portfolios and patent networks.
3. Early-stage patenting, and continuous patenting, also of minor advances and variations (“Patent everything as soon as possible”).
4. Increased emphasis on the quality of patents (e.g. search for “strategic patents”).
5. Patenting also for licensing out, including accessing new technologies through cross licensing.
6. Building of patent power for deterrence, retaliation and bargaining.
7. Increased patenting in USA.
8. Use of patents for stimulation of R&D personnel.
9. Development and maintenance of a patent culture.

Several of these behaviours and strategies have also been acknowledged by patent offices, and some of them have occasionally been reported in the literature (see e.g. Rahn 1994). The rational aspects of these strategies should not be overplayed. Effective as many of them are, they have nevertheless evolved over time as historical products, rather than as a result of a few rational strategic decisions, as will be described below.

1. Evolution of strategy

For a long time, Japanese companies have emphasized the quantity of patents although well aware that the technological and economic importance of individual patents differs widely. There is also a

general feeling that many Japanese patents are of minor technical and economic importance,⁵ while Western patents are often more significant on an average. This may have been true in the past and is still true as far as Japanese patents in Japan are concerned. Although it may still be true as well in several technologies for Japanese patents in the USA and Europe, there are numerous studies indicating the relatively high quality of Japanese patents in many industrial sectors.⁶ The strategy of extensive patenting of minor improvements in Japanese companies evolved in connection with the catch-up process in the post-war era. A careful study of patent information was necessary in order to trace useful technologies and suitable licensors as well as to control the risk of infringing on patents of others when imitating and modifying products and processes. However, improvements were gradually made on imported technologies, aided by quality circles and suggestion systems. The urge both to improve the technology of others and to invent around the patents of others spurred small inventions, which were then readily patented. A patent was perceived among R&D personnel as a precious sign of world technical leadership. Patenting thus gained a prestigious value, probably more so in Japan than in the West. Methods such as patent mapping and patent reviews or audits were designed and developed over the years in order to cope with the patents of others and to build a patent position of one's own. Patent analysis in this way provided a "navigational map" for both reaching and advancing the technological frontier.⁷

Historical conditions in connection with a long process of catching up and competing with the West, including strong domestic competition at the same time, have given rise to different patenting behaviours (i.e. patent "flooding" or patent "blanketing" and patent "fencing"). As these behaviours have become functional for businesses, they have been more consciously refined and used, thereby gaining the status of conscious strategies. These behaviours and strategies in turn have become more and more relevant for technologically leading and innovative companies as new products and processes involve an expanding range of expensive technologies, forcing even leading companies now and then to play catch-up in some technologies. No one can afford to take (much less sustain) the lead on a broad range of technological frontiers. The IP management capabilities that Japanese industry built up during their catch-up phase also paid off in the subsequent phase of industrial development, giving Japanese industry a competitive advantage over many Western companies.

2. Strategic patents and licensing policies

The recognition in Japanese industry of the importance of achieving a high quality of patents has increased in recent years. This is due in part to the fact that Japan reached and advanced many technological frontiers herself in the 1980s, which led to patenting in new fields. The lawsuits from the USA and concomitant legal challenging of patents have also contributed to this recognition. The direct costs of patenting have also grown considerably, and since they are the same for both major and minor patents, any cost-cutting effort naturally aims at screening out (economically) minor pa-

⁵ It is important to distinguish between technical and economic aspects when talking about the level, importance, quality or "size" of an invention, technical advance or innovation. Although there may be a positive correlation between a high level of invention (i.e. technical quality) and its economic importance, the correlation may be weak and there may be many economically important but technically minor inventions, as well as many economically unimportant but technically major inventions.

⁶ A commonly used indicator of patent quality is citation rate, despite its many flaws. The quality of Japanese patents is indeed high in many industrial sectors, using this indicator. See Granstrand (1999).

⁷ Information gathered through personal communication with Mr. S. Saba.

tents. Finally, the adoption of a multi-claim system in Japan broadened the possibilities to increase the quality of a patent application.

Efforts have been made in Japan to focus more on the quality of patents and to increasingly obtain what are called “strategic patents”. Broadly speaking, a strategic patent is a patent of decisive importance for someone wanting to commercialize a technology in a product area.⁸ In other words, a strategic patent creates inhibitive costs for anyone wanting to invent around it.

Hitachi is a case in point here, as shown in Table 3. The clear definition of “strategic patent” and the clear, quantified objectives for acquiring such patents are noteworthy. Such patents can be acquired through one’s own R&D or through external acquisition. If successful over a number of years, such a patent strategy can lead to the build-up of substantial patent power for Hitachi with the possibility to block hundreds of product areas and companies.

Canon has a policy that a strategic patent⁹ should be acquired before commercialization starts in a new business area. The acquisition can occur either through Canon’s own efforts or through licensing in. If this cannot be ensured, the area is not entered. In addition, Canon wants to be the sole innovator in at least one respect. This latter policy of Canon is not typical for Japanese companies. Many companies rely upon the possibility of obtaining a license from a strategic patent holder. For example, Canon invested heavily in the commercialization of the ferroelectric liquid crystal (FLC) technology for flat panel displays, while many other companies were watching by and large, relying upon getting a license from Canon should FLC prove viable in the end. Relying upon the possibility that a license will be obtainable from someone who succeeds in a field is not an uncommon strategy among large companies. The current and possible future technological interdependencies among large companies account for this type of delicate and risky trust.

A certain industrial and nationalistic codex also comes into play, especially regarding licensing on foreign markets, but its importance should not be overplayed. In the early 1990s many leading-edge companies in Japan had an “open licensing policy”, meaning that every technology is in principle available for others to license if the terms are “right”. Hitachi, for instance, declared in the early 1990s that it had an open policy, making all patents available for licensing. NEC claimed they seldom refused to sell a license and perceived no risk in creating a new competitor with a single license. However, in the mid-1990s some of these companies questioned and modified this open licensing policy, thereby taking a step towards more selective licensing. Still, the technological interdependence between products and between companies force clusters of companies to license fairly openly among themselves to avoid retaliation.

Licensing policies may of course differ among companies. In general, since the Betamax-VHS systems battle between Sony and JVC Matsushita in the late 1970s and 1980s, there has become a recognition of the importance in some cases of building groups or families of companies through liberal licensing in order to support a new product or business system.¹⁰

This may be part of a business strategy to combine the promotion of buyer diffusion (i.e. market penetration) with the control of seller diffusion, i.e. the spread of the technology among competing and/or cooperating producers.

⁸ Some also use the terms ‘essential patent’, ‘basic patent’, ‘generic patent’ or ‘inevitable patent’. However, certain such terms are also used in other senses.

⁹ Naturally it is often not clear at once whether a patent is strategic or not, and the perception of a patent being strategic may have to be revised in light of later technological developments.

¹⁰ The Betamax-VHS battle has been widely reported. It now qualifies as a classic case of the importance of strategic licensing. Oddly enough and is far less well known is that the technological interdependence was such that had Sony won the battle, JVC would still have been rather well off through collection of royalties from Sony.

Licensing policies may also be declared open on other grounds: for image-building, for cross-licensing, for royalties etc. In general, the decision to license out or not is a matter of pricing. The cost of negotiating a single license agreement is increasing, however, which induces companies to enter more broad-based license agreements, perhaps also more multilaterally than bilaterally. This may stimulate new patterns of cooperation and competition, such as systems competition, i.e. competition between families of cooperating companies, linked to different technical systems.

The search for strategic patents in a new technology creates a race among companies. There is also a second race for the surrounding patents taking place in order to fence in any conceivably strategic patent. These surrounding patents are often linked to production processes or to different applications and may be identified through a systematic application analysis.¹¹ The surrounding patents may then be used by competitors when bargaining about the original strategic patent. In the extreme case, the strategic patent may not be able to be used without infringing a surrounding patent. To avoid this situation, the strategic patent holder is also compelled to search for surrounding patents. However failure to pursue follow-up patenting in this and other situations has been common among Western firms, large as well as small. The traditional engineering attitude has been to apply for a patent only in the case of inventions with high technical qualities. Technically minor inventions, to which category many application patents and surrounding patents belong, have been down-played and patenting has often been ignored. There has also been a belief, not least among inventors and small firms, that a single good patent is sufficient to protect a new business. Firms may also lack resources and management attention concerning patenting. Circumstances like these have resulted in the ignorance of follow-up patenting and failure to build-up patent portfolios over time.

The outcome of this second patent race determines, in principle, the distribution of bargaining power among the competing companies and their prospects for cross-licensing. To obtain surrounding patents is thus a case of fencing out or fencing in, depending upon whether the surrounding patent holder is the holder of the strategic patent or not. This is a stereotypical example but it illustrates the interdependence of patents. For instance, it should be noted that the two patent races do not necessarily follow upon each other neatly in time. An old patent may become one of the surrounding patents to a strategic patent over time. Since many companies start to explore a new field early and take out patents with parallel R&D approaches, the interdependencies among companies and patents might become quite complicated. Such interdependence is likely to become more important in the future as the number of technologies related to a product increases.

C. General counter-patent strategies

When confronting a blocking patent, a number of strategic responses are possible, as shown in Figure 2.

Similar response strategies apply when confronting blockages by a patent blanket or a patent fence etc. For example, when entering a new business a patent map may show a jungle of patents, in which case a company may allow its IP department the right to veto any further R&D in that area, or at least bring the matter to the attention of business management. Such patent clearance procedures become important as patents and technological interdependencies proliferate.¹² Needless to say, it is also important to pursue them early in the R&D process¹³, as well as it is important to

¹¹ An alleged case of this is described in Spero (1990), in which Mitsubishi was accused of having fenced in a strategic patent held by a small US firm, with the purpose of acquiring it through cross-licensing. (The article represents the small firm's view of the case.)

¹² For a good illustration of the legal complexities involved, see Merges (1994).

¹³ Patent clearance was unfortunately performed too late in the standardization work of the GSM system for mobile communications, (see Granstrand 1999).

make R&D management responsive to patent clearance. In relation to the validity search, one should note that such a search cannot be made conclusive in principle, unless a patent is litigated. Ultimately it is the courts who decide on validity, which introduces a chance element into patent clearance – as well as in patent enforcement, as is dealt with next.

D. Litigation strategies

Infringement monitoring in a large international corporation with a large, diversified product and patent portfolio may in fact be difficult, especially if products go into the production processes of customers. To pay off, infringement monitoring costs must not exceed expected benefits from patent enforcement, involving probabilities of deterrence, detection, favourable settlements by courts or otherwise, and damages or licensing payments. If this is not the case, patenting may not pay off either.

If infringement occurs or there are substantial grounds for suspicion, various strategies for legal enforcement of patent rights could be employed. Litigation strategies can be characterized in general terms, such as offensive/defensive, just like patent strategies but it is difficult to make a structured list of legal strategies that pre-empts all available possibilities in various legal systems. Before choosing an offensive litigation strategy one should also assess the risks of retaliation, which in addition to risks of counter-litigation include risks of losing some business.

Litigation processes also contain many stages and contingencies, from the filing of complaints to the ultimate appeals. Formal decision analysis using decision trees with subjective probabilities may be a useful tool for analysing such decisions as well as patent strategy decisions in general. However it must be kept in mind that many times reality is not easily cast into structured frameworks such as these.

V. Multiprotection and total IP strategies

During the 1980s a trend towards dealing with IP in a more comprehensive way emerged in Japanese “best-practice” companies. This was reflected both in how policies and strategies were formulated and in how IP-related activities became organized in the company.

There are many types of intellectual property or assets in a company – patents, trade secrets, trademarks etc. There are also many ways to create these assets jointly in connection with a particular business. These different ways are mostly complementary and raise the total asset value when used in combination. Thus it is justified to talk about the importance of creating **multi-protection systems** and **total IP strategies**.¹⁴ This idea seems quite natural and acceptable to people in industry. Nevertheless, patent matters dominate when dealing with IP. This is often reflected by work specialization, as well as by terminology, in a manner that is deceptive. The governmental organizations are called ‘Patent Offices’, consultancy firms are often called ‘Patent Bureaus’, experts are called ‘Patent Attorneys’, associations are called patent associations, company departments are called the ‘Patent Department’ with a ‘Patent Manager’ and company policies are called ‘Patent Policies’. In such circumstances it is easy to pursue an unbalanced approach to IP matters, perhaps placing too much emphasis on patents and too little on trademarks, trade secrets, copyrights, and designs, and above all to neglect complementarities among different IP elements.

If IP matters should be treated more comprehensively, how much more comprehensively? And if IP matters are important, what is the proper role of IP management in technology management, business management and corporate management? The question of how to “size” and position IP

¹⁴ This does not necessarily imply that IP activities should be centralized. However, in a decentralized IP organization, the need for comprehensive IP policies and strategies is even more emphasized. The term ‘multi-protection system’ has been suggested by Dr. A. Mifune.

management in the company is highly relevant. Intellectual resources, including general competence as well as technology, are pervasive throughout the whole corporation, but pervasiveness in itself is not an argument for putting IP management in the centre of the whole company organization. There are many pervasive activities in a company that should from time to time be placed at the centre of attention by means of organization, campaigns, culture building, management policies, management fads, etc.

Multi-protection is not only practised among leading Japanese companies. In fact, leading US companies have developed such practices long ago. Coca-Cola, for example, has skilfully built up and maintained multi-protection. The recipe for the Coca-Cola soft drink is a well-protected trade secret, as is well known.¹⁵ A patent has a limited lifetime, while a secret can possibly last forever, at least in theory. This is especially important for products with long lifetimes, which in turn may result from slow-moving customer preferences or slow-moving product technology. The machinery for the process technology, including the distribution process (e.g. vending machines), has been systematically analyzed and protected by patents. The unconventional Coca-Cola bottle has design protection and the Coca-Cola name and logo have trademark protection.¹⁶ The IPRs are strongly and systematically developed and promoted by R&D and marketing activities etc. and enforced by infringement monitoring and legal action. It is not an accident that Coca-Cola has maintained one of the most highly valued trademarks in the world (see Section 1 above), although its value was not initially clear to the company.¹⁷

Selecting and securing property rights for various elements constituting a business is not enough for multi-protection. The rights have to be enforced and infringers have to be deterred. IBM, for example, has pursued a very hard-nosed enforcement and litigation policy over the years through frequent litigation and the pursuit of the legal process to fruition, despite the legal costs and the prospect of losing (see Mody 1990). Thus IBM has apparently considered it more important to win a war than to win every battle.¹⁸ In this way IBM has kept competitors and inventors wary about infringement. IBM has also sustained its IPR-consciousness, which has been combined with a licensing policy, sometimes a quite generous one (although partly due to antitrust decrees).¹⁹

Japanese companies, on the other hand, have traditionally avoided litigation and court settlements.²⁰ This is well known, even to the extent that some inventors and companies accuse Japanese companies of infringement in order to have them settle for a license rather than risk going to court. However things are changing and many Japanese companies are becoming more litigious, at least when they are attacked. For example, when Motorola sued Hitachi in 1989 for infringing upon a number of Motorola's patents, Hitachi counter-sued Motorola for infringing upon Hitachi's patents.

¹⁵ Note that conventional food recipes are not protectable by patents, although early patent-like protection in Venice during the 15th-century Renaissance, as well as in Sybaris in ancient Greece, originally gave protection to recipes of famous chefs. This is not to say that the Coca-Cola recipe is not patentable (at least as a medicine in principle), or that Coca-Cola's preference for keeping it a trade secret is due to uncertainty about patentability.

¹⁶ The bottle has received US trademark protection as well, which was the first example of a 3-dimensional trademark.

¹⁷ According to Prof. F.M. Scherer the early development of the Coca-Cola image was quite accidental, and only after some time did the company realize what a valuable asset they had and took aggressive steps to protect it.

¹⁸ Note that although "hot" patent wars may break out now and then, the common patent war is "cold", with on-going deterrence and negotiations.

¹⁹ For further readings about IBM in these respects, see Mody (1990) and Grindley and Teece (1997).

²⁰ This has been true for many US companies too.

As a result, the court in effect stopped the sales of the corresponding products of both Motorola and Hitachi, a court decision that apparently hurt Motorola more than Hitachi (see Anawalt and Enayati 1996, p. 342). This also illustrates the retaliatory power of large patent portfolios as well as the vulnerability of being a large, diversified hi-tech litigator.

A business can be broken down into various constituent elements and product technologies that could be covered by various IPRs, resulting in an IPR package or multi-protection system for the business. In principle, this corresponds to an analysis of the elements in Table 4.

Different IP types sometimes substitute for each other at the business component level. The typical example being that patent protection and secrecy protection substitute for each other for a particular invention. In general, however, the different IP types can also be used to complement or reinforce one another. Altogether, the different business elements or components in Table 4 form a **business system** in a product area. A business system with its business components thus encompasses products and their components and technology bases, together with the other elements in Table 4. This concept thereby focuses on the total set of intellectual resources or intellectual capital needed to make a customer offering and conduct a business deal.

At the level of a business system the various IPRs should be complementary as a rule, forming effective multi-protection as a means for commercialization and enhancement of the business. Figure 7 illustrates how the value of a total IPR portfolio is built up in principle (although not all possible IPRs are illustrated), disregarding the difficulties to assign meaningful values to individual IPRs, values which moreover may not be additive as a rule. At this level the ultimate function of strategic management of IP is to build up the total value of an IP portfolio through proper (optimal) use of various strategies. Hence there is a close connection between IP management and intellectual capital management.

For a multi-business corporation there is a further need to coordinate IP protection across businesses (i.e. regarding company logos, trademarks etc. and licensing). Multi-protection in a multi-business corporation then necessitates the formulation of company-wide IP policies.

Literature References

- Aaker, D.A. (1996), *Building Strong Brands*, New York: Free Press.
- Anawalt, H.C. and E. Enayati (1996), *IP Strategy: Complete Intellectual Property Planning, Access and Protection*, New York, NY: CBC (Clark, Boardman, Callaghan).
- Brockhoff, K.K. (1992), 'Instruments for patent data analyses in business firms', *Technovation*, **12** (1), 41-58.
- Ernst, H. (1995), 'Patenting strategies in the German mechanical engineering industry and their relationship to company performance', *Technovation*, **15** (4), 225-40.
- Glazier, S.C. (1995), *Patent Strategies for Business*, 2nd ed., London: Euromoney Books.
- Granstrand, O. (1982), *Technology, Management and Markets*, London: Pinter.
- Graham, G.S. (1956), 'The ascendancy of the sailing ship 1850-85', *Economic History Review*, **IX** (1), 74-88.
- Granstrand, O. (1999), *The Economics and Management of Intellectual Property – Towards Intellectual Capitalism*, Edward Elgar Publishing Ltd, Cheltenham, U.K.
- Grindley, P.C. and Teece, D.J. (1997), 'Managing intellectual capital: licensing and cross-licensing in semiconductors and electronics'. *California Management Review*, **39** (2), 8-41.
- Marshall, A. (1994) *Principles of Economics*, The Macmillan Press LTD, London. (Originally published 1890.)
- Merges, R.P. (1994), 'Intellectual property rights and bargaining breakdown: the case of blocking patents', *Tennessee Law Review*, **62** (1), 75-106.
- Mody, A. (1990), 'New International Environment for Intellectual Property Rights'. in Rushing and Brown (1990), Ch. 10, pp. 203-39.

- Momberg, D. and A. Ashton (1986), *Strategy in the Use of Intellectual Property. A Guide to Managing Business' Most Valuable Asset*, Hong Kong: Gerundive Press.
- Rahn, G. (1994), 'Patentstrategien japanischer Unternehmen', *Gewerblicher Rechtsschutz und Urheberrecht, Internationaler Teil*, **5**, 377-82.
- Scherer, F.M. (1980), *Industrial Market Structure and Economic Performance*, Chicago, IL: Rand McNally.
- Schon, D.A. (1967), *Technology and Change*, New York, NY: New Heraclitus, Delacorte Press.
- Sirilla, G.M., G.P. Edgell and A.R. Hess (1992), 'The advice of counsel defense to increased patent damages', *Journal of the Patent and Trademark Office Society*, **74** (10), 705-28.
- Spero, D.M. (1990), 'Patent Protection or Piracy – A CEO Views Japan', *Harvard Business Review*, **68** (5), 58-67.
- Takahashi, T. (1994), *Intellectual Property Rights and Corporate Strategies: One Aspect of Competition in the U.S. and Japanese Electronics Industry*, Tokyo: Nomura Research Institute.
- Utterback, J.M. (1994), *Mastering the Dynamics of Innovation*, Boston, MA: Harvard Business School Press.

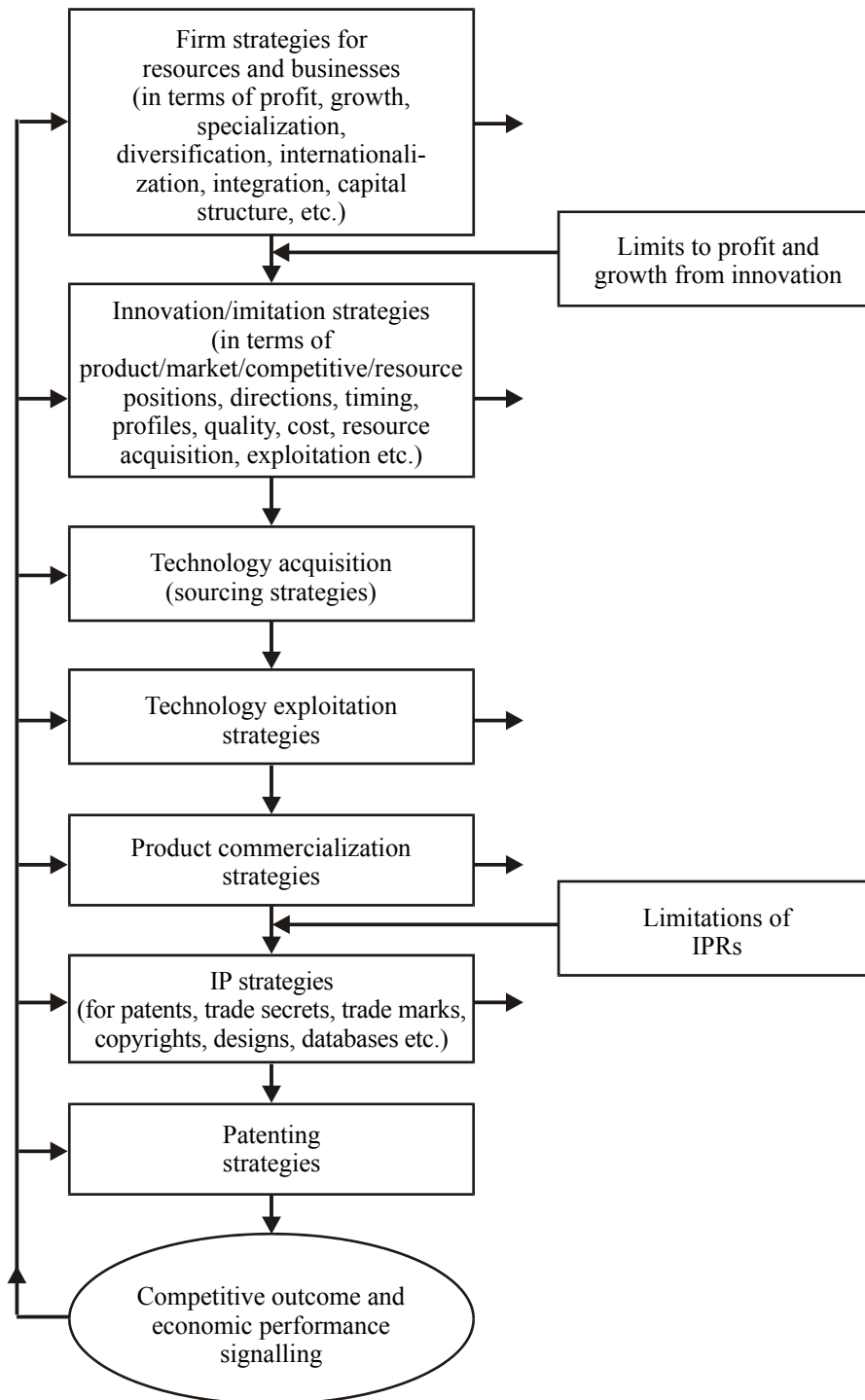


Figure 1. Types of management strategies for the technology-based firm

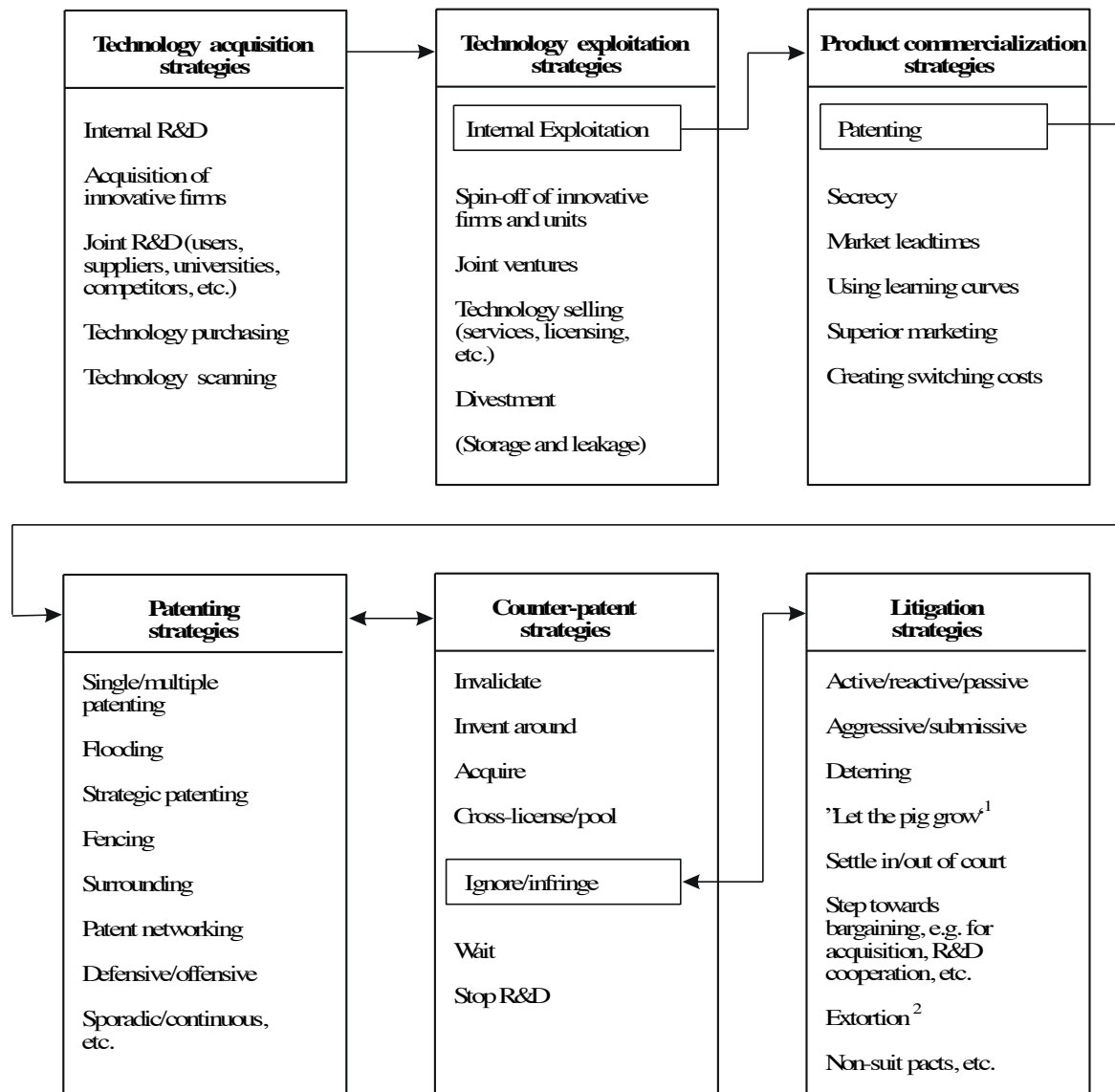


Figure 2. Summary of technology and patent strategies

Notes:

- 1) Refers to postponed filing of complaints in order to increase bargaining power. This strategy may backfire in court.
- 2) Litigation used as a primary business idea for collecting damages or royalties, exercised by some inventors or patent brokers or lawyers, possibly acting on behalf of inventors on a commission basis (e.g. getting 30-50% of any collectable damages). This strategy may also backfire in court.

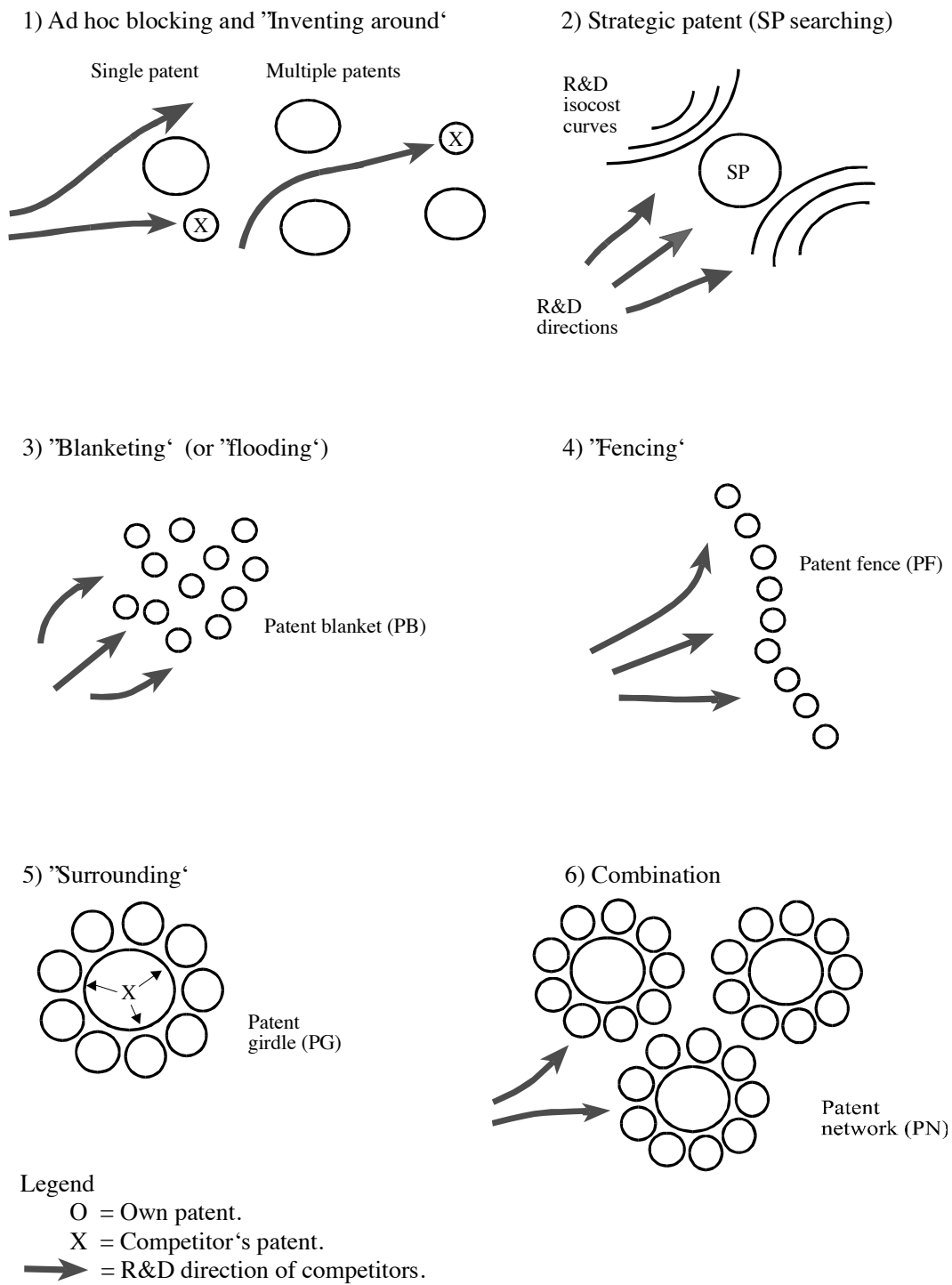


Figure 3. Various patent strategies in technology space.

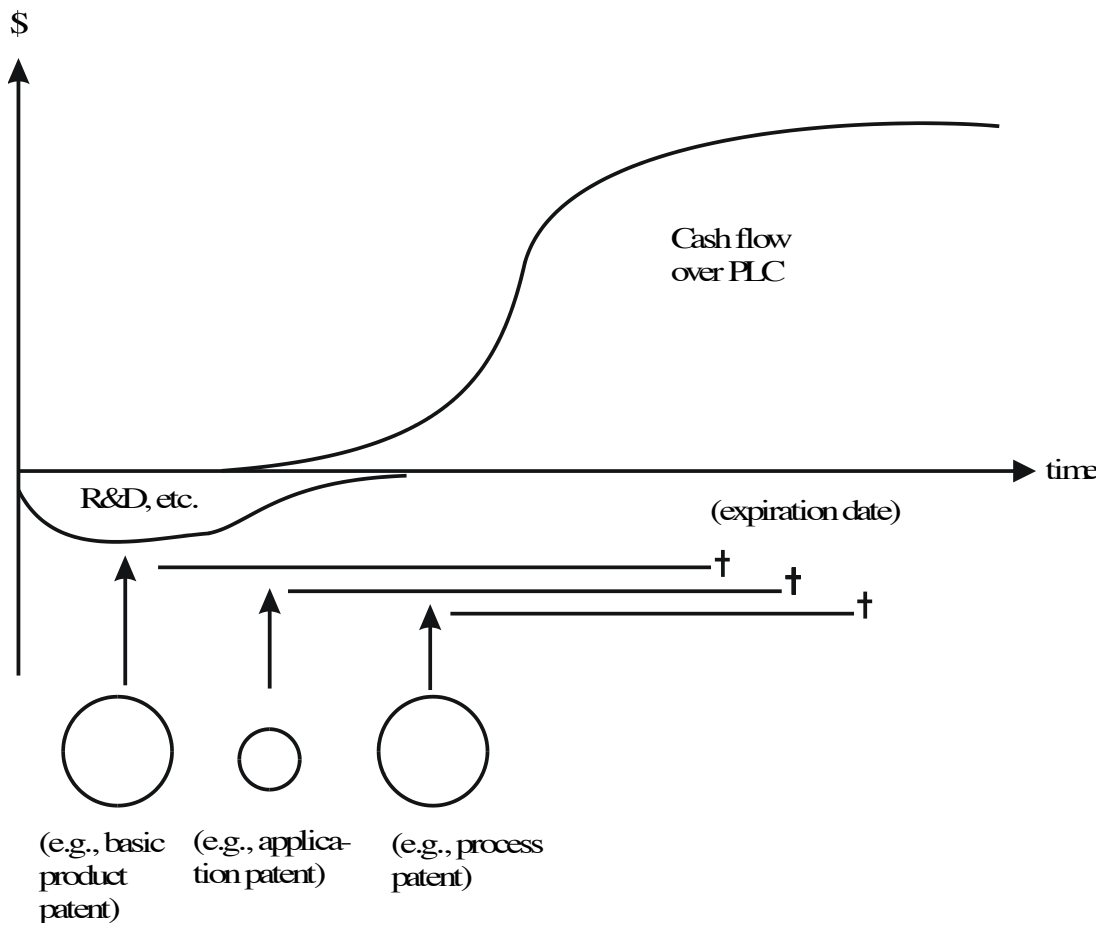


Figure 4. Sporadic patenting in the product business development process.

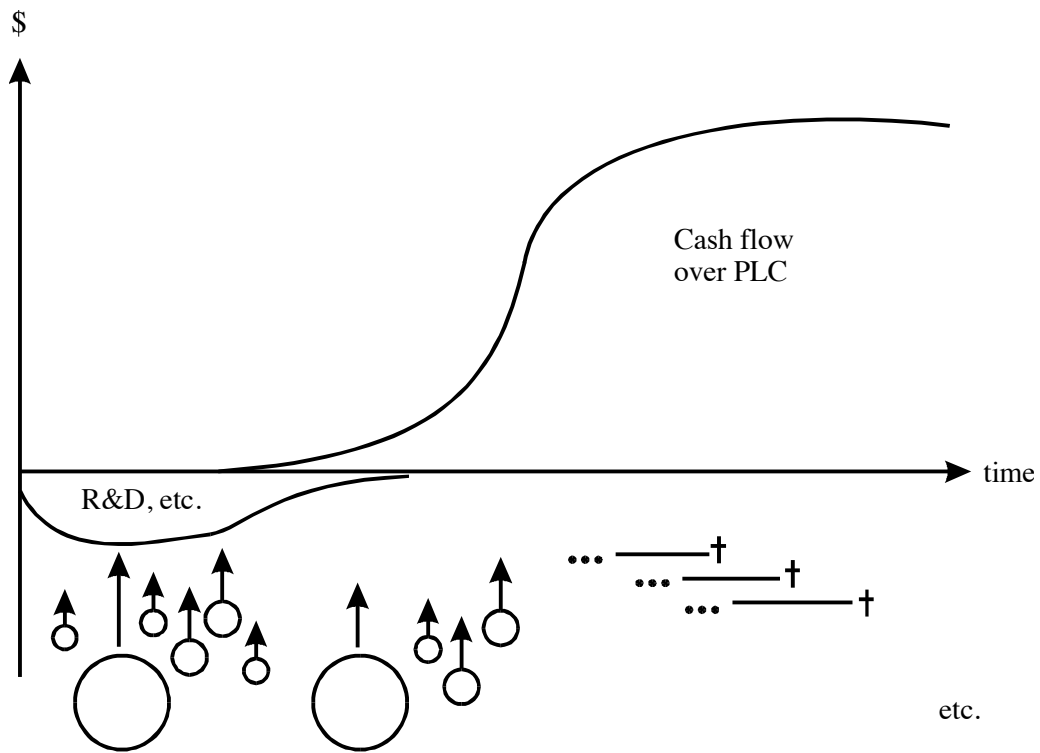
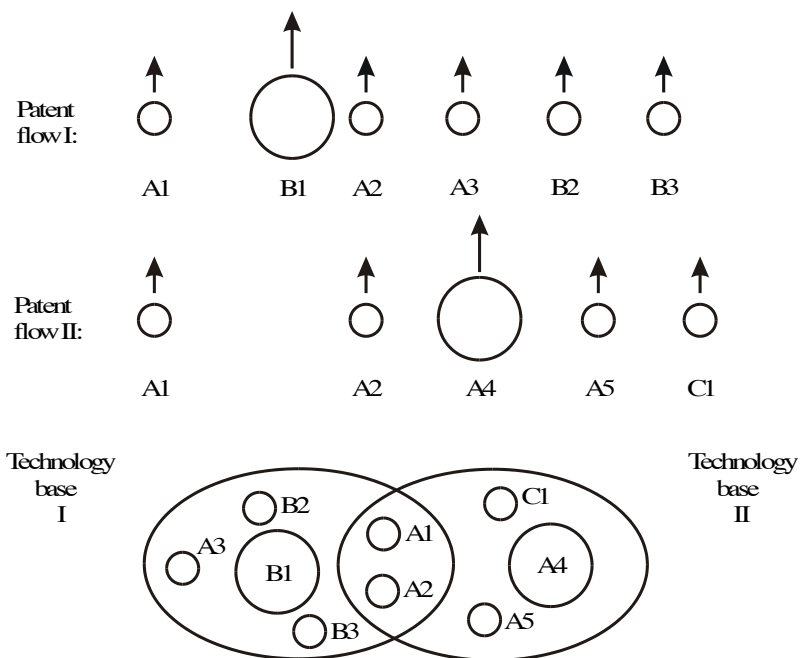
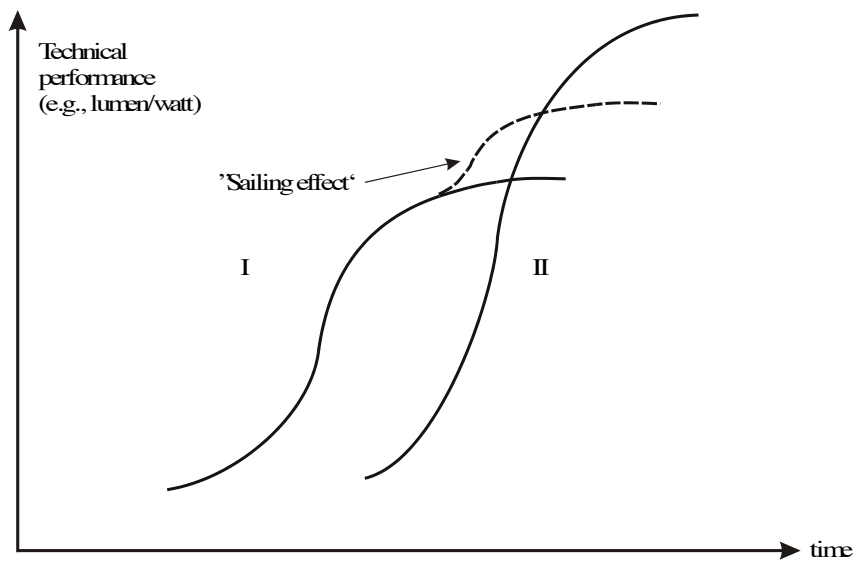
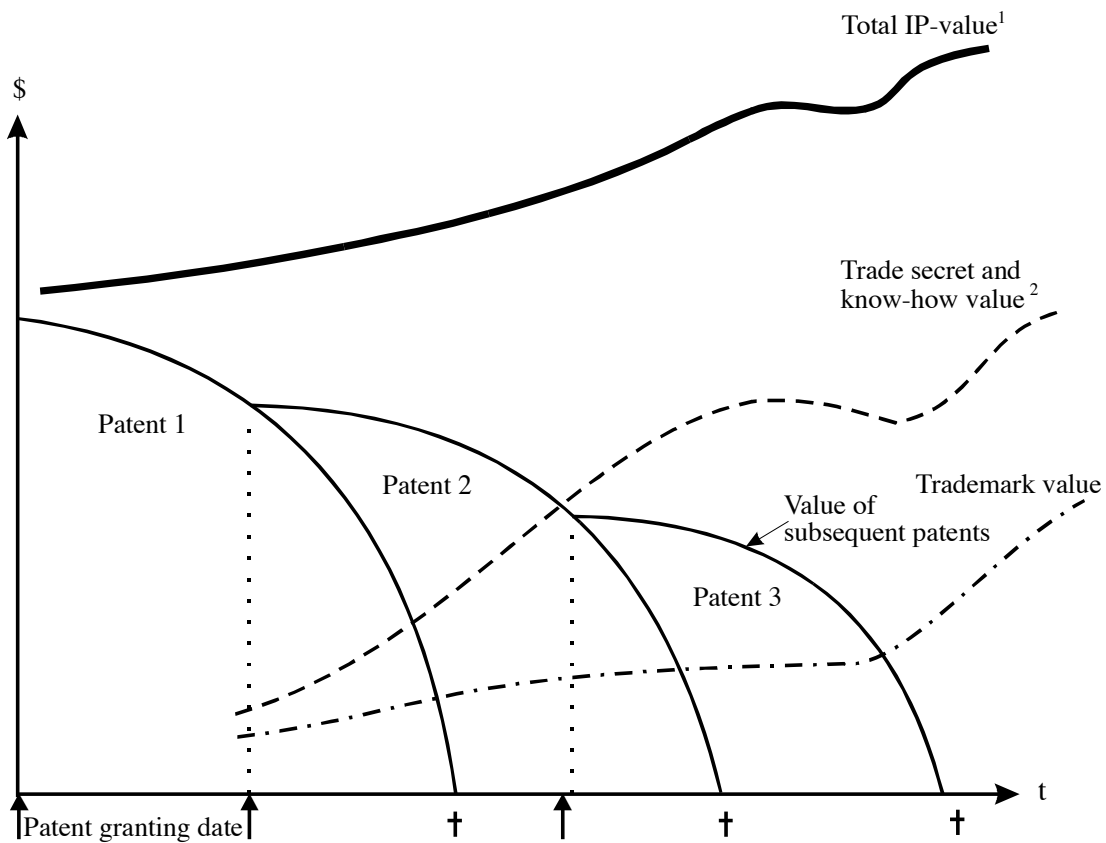


Figure 5. Continuous patenting and build-up of patent portfolio.



Legend: A1, B2 etc = Company A's first patent in the area, Company B's second patent in the area etc.
 I, II = Two technical performance curves, corresponding to technology base I and II, represented by two overlapping sets of technologies, being partly protected in technology space by two patent flows over time. The 'sailing effect' refers to improvements in technical performance in response to threats from new technologies.
 Circles denote scope of patents
 Arrows denote patent granting dates

Figure 6. Patenting strategies in the case of competing product generations.



Legend

- ↑ Patent granting date.
- † Patent expiration date.
- Total IP value.
- Patent value.
- - - - Trade secret and know-how value.
- · - · Trademark value.

Figure 7. Total value of an IP portfolio.

Note:

- 1) The total IP value is not necessarily the sum of the values of various individual IPRs since the latter may not meaningfully be added.
- 2) Cumulating through R&D, external technology and know-how acquisition, plus training and learning (experience) in personnel in general. While the stock of know-how may cumulate (although not necessarily so, due to e.g. hire-overs of personnel and spin-offs) the value of the stock may fluctuate, e.g. due to obsolescence and new substituting technologies, and also due to new valuation methods.

Table 1. Largest patent infringement damages in the USA (up to 1995)

Patent right holder ¹ (nationality, size)	Damages ² (MUSD)	Infringer (nationality, size)	Year
Litton (US, large)	\$ 1,200	Honeywell (US, large)	1995
Polaroid Corp. (US, large)	\$ 873.2	Eastman Kodak (US, large)	1991
Alpex Computer Corp. (US, small)	\$ 253	Nintendo (Japan, large)	1994
Smith International, Inc. (US, medium)	\$ 204	Hughes Tool Co. (US, large)	1986
Honeywell (US, large)	\$ 166	Minolta (Japan, large)	1994
Stac Electronics (US, small)	\$ 120	Microsoft (US, large)	1994
Hughes Aircraft (US, large)	\$ 114	United States	1994
3M (US, large)	\$ 106	Johnson & Johnson (US, large)	1991
Lubrizol I Corp. (US, large)	\$ 86	Exxon Corp. (US, large)	1988
Pfizer, Inc. (US, large)	\$ 55.8	International Rectifier (US, large)	1983
Shiley, Inc. (US, large)	\$ 44.8	Bentley Labs (US, large)	1985
Jan R. Coyle (US, individual)	\$ 43	Sega Corp. (Japan, large)	1992
B&H Manufacturing (US, medium)	\$ 36.5	Owens-Illinois Glass (US, large)	1991
Syntex (US, medium)	\$ 36.5	Paragon Optical (US, medium)	1987
Trans-World Manufacturing (US, medium)	\$ 31.3	Dura Corp & Kiddie (US, medium)	1986

Notes: 1) Courts have increasingly ruled in favor of the patent right holder during the past 15 years. A patent right holder's probability of winning an infringement lawsuit in the USA has increased from 30% prior to 1982 to 89% after 1982 (see Sirilla et al. 1992).

- 2) Excluding legal fees. These may run between US\$ 0.5–5 million with some extreme cases like Texas Instruments, believed to have spent over US\$ 10 million in its litigation over DRAMs, involving 347 lawyers and 29 law firms. TI's Japanese opponents were believed to have spent nearly US\$ 100 million in preparing their defense (The American Lawyer, March 1992, p.56).

Table 2. World's most highly valued trademarks¹⁾
 Source: Financial World (1993, 1996)

Rank	Trademark	1992 Value (BUSD)	Rank	1995 Value (BUSD)
1	Marlboro	39.47	1	44.6
2	Coca-Cola	33.45	2	43.4
3	Intel	17.81	10	10.5
4	Kellogg	9.68	7	11.4
5	Nescafe	9.17	9	10.5
6	Budweiser	8.24	8	14
7	Pepsi-Cola	7.50	14	8.9
8	Gillette	7.15	11	10.3

Notes: Valuation of trademarks may be done in several, mostly subjective ways, all of which produce uncertain results. (For an overview, see Aaker 1996.) The astounding magnitudes of trademark values do not result from valuation errors although the precise figures in the table may be in error. Trademarks may be kept valid permanently, and their value is built up over time through various means, primarily through advertising and positive exposure to consumers. They are thereby subjected to increasing returns or cumulative advantages, although volatile. Thus old, consistently well-managed trademarks for consumer mass markets could be expected to accumulate the highest values. This is also shown in the table although there are exceptions like Intel, being a relatively young company (formed in 1968) with a component product. The volatility as well as the consistency of value rankings are also shown in the table. The dominance of US trademarks is noteworthy. The most valuable Japanese trademark is Sony, valued to 8.8 BUSD in 1995, and thereby ranking 15th.

Table 3.
Example from Hitachi of patent policy and objectives
(“The third term campaign to increase strategic patents” as of 1992)

1. Contents		
Action policy		<ul style="list-style-type: none"> • Enhancing quality of patents (Integrating business and patent strategies)
Basic measures		<ul style="list-style-type: none"> • Specify rivals and acquire five cases of strategic patents for each major product item’s technology. • Strengthen activities to acquire basic patents that capture in advance the future needs of society markets.
Specific examples of measures		<ol style="list-style-type: none"> 1. To establish patents on a sales point that allows the company to defeat others 2. PAS1) and special R&D project aimed at acquiring leading-edge patents
2. Level of Strategic Patent* and Number of Cases Annually Certified (Summary)*		
Level	Corporate Target	Salient Points of Certification
Gold	25 cases	Basic invention top level in the world
Silver	75 cases	Basic invention top level in Japan
Copper	200 cases	Inventions that can be aggressively used as a sales point for Hitachi’s mainstay products

* Strategic patents mean basic and inevitable patents that must be used by our company and others in major products of the present and future.

Note:

1) PAS = Patent strategy system.

Source: Documentation provided by Hitachi.

Table 4.
Analyzing the business element - IP connections

Business element/component	IP type (example)
1 Business idea	Trade secret
2 Business plan/model/method	Trade secret, patent
3 Product technology (equipment, materials, ancillary products)	Patents, utility models
4 Production/process technology	Trade secret plus a know-how license
5 Component technology	Maskwork protection
6 Systems configuration	Open information, prophylactic publishing
7 Software, orgware, data	Patents, copyright, trade secret, database
8 Auxiliary services	Trademark, trade secret
9 Distribution technology	Patents, utility models, trade secret
10 Marketing concepts	Copyright, open PR information
11 Packaging design	Designs
12 Company and business names, logos, slogans and symbols (“company aesthetics”)	Trademarks Copyright Designs