

The Use of Patents in Dutch Biopharmaceutical SME: a Typology for Assessing Strategic Patent Management Maturity.

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Abstract

In this paper a typology is presented that ideal typically describes strategic patent management practices in four developmental categories. The underlying framework integrates patent functions with strategic planning attitudes. Policy makers can apply it to survey the actual use of patents in order to identify potential for improvement in SME owned patent exploitation. Managers of these organisations can use it to evaluate the current patent management practice for making a next step towards a more active use of patents. Operationalisation of the framework into a questionnaire is grounded in a pilot study of three biotechnology firms, differing in size and age. The result has consequently been applied in a case study consisting of sixteen small-sized biopharmaceutical companies in the Netherlands. After presenting results from this sample of patent management practices, we present our findings and discuss the validity and use of the typology for abovementioned purposes.

Author Keywords: Intellectual property; strategic patent management; typology; operationalisation; pharmaceutical biotechnology, SME.

1. Introduction

Ideal typically, all activities concerning intellectual property (IP) are organised in a purposeful and coordinated manner as to serve the long term interests of the owner. Not in all high-technology, but certainly in the life sciences, patent portfolio decision-making is pivotal to corporate as well as business level management. To quote a business unit manager from a large pharmaceutical company:

“Patents are the lifeblood of our business, a conditio-sine-qua-non for investing in new leads for product development.”¹

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However, success and failure in life science business development indicate that this may be a commonly shared view of the proprietary conditions to R&D, but it is certainly not standard managerial practice in small and medium-sized enterprises (SMEs). In general, the understanding of and the attitude towards the use of patents are in many SMEs blurred and are certainly falling behind that of their counterparts from large companies. Knowing that the Dutch academic biotech starter typically comes from a public environment, where there is little patent awareness,² that is understandable. Moreover, small companies are lacking the resources for managerial capacity to focus on such cost-producing activities. However, in commercialising proprietary technologies, they need to co-operate with and accept dependence on large companies. In such situations, strategically well-developed patent management practices contribute to a fair, equal and therefore more successful technology partnering playing field. Strategic patent management then is a critical success factor for SMEs in patent-intensive businesses. This line of argument implies that managers need to have a model of what a pro-active patent management practice looks like. Mature practices in large companies are in our view a valuable source of knowledge for SMEs in exploiting their patent portfolios. The typology presented in this paper is based on such knowledge.

In sections 2 and 3, a framework is presented and operationalised into an assessment tool for qualifying patent management practices. The framework consists of two dimensions: the first is based on Ackoff's well-known categories of strategic planning attitudes (section 2) and the second builds on knowledge of the functions that patents have in technology analysis, planning and research management activities of large companies in the pharmaceutical sector. These functions are described in section 3. In sections 4 and 5, we discuss the application of the resulting typology in the domain of pharmaceutical biotechnology SME, firstly in a pilot study of 3 firms and secondly in a case study consisting of a small-scale survey involving 16 firms. We describe outcomes from this case study, arguing for the validity of the typology to be used by SME and PRO managers as well as governmental policy makers. In the final sections 6 and 7, we summarise and present conclusions and issues for discussion as well as implications for further research.

2. Attitudes towards strategic planning and patents

In our view of building a corporate future, the science-based company's IP posture results from its cumulative technology and marketing efforts as well as from the attitudes of managers and researchers towards IP in general. Longitudinal consistency is critical for appropriation effectiveness and needs to be taken into account when planning and organising for a patent portfolio that is to secure future market positions that meet the company's scope and technological abilities, as built up in the past.³ Whether the scientific founder(s), managers and researchers are sufficiently aware of the ins and outs of patents will hardly depend on their experience in operational patent activities, such as searching patent databases, writing and filing patents, or even defending them with the help of patent attorneys. More relevant from a strategic perspective are a profound vision of and knowledge about business, future applications of existing technologies, relevant market developments and connections to international technology and business networks. Such managerial competencies are preconditions to planning that make the difference between creating and successfully exploiting patent positions.^{4,5,6}

As a consequence of this perspective, organising for planning preconditions is as crucial as managerial attention for patent filing processes in order to be effective in appropriating the knowledge. And it is not an activity that prescribes the strategy of a company and its products; it essentially develops managerial capabilities following from it.⁷ It is especially essential in dealing with the dynamics in technological as well as market developments. Originating from 'the design thinking era', in which corporate planning developed as a general management discipline, it combines the internal state (the organisation) with the external state (the environment) of the firm into a temporal framework for action. What scholars and managers have learned from the rise and fall of planning is that it needs to be valued as a learning process, more than for its prescriptive output, i.e. the plan itself. For that very reason the phenomenon of corporate planning seems to be in reviving. Despite such scholarly reflection, the actual use of planning as well as patenting brings about quite some controversy if not opposition.⁸ Though planning inhibitions may be legitimate to managers from the science world, in business there are no grounds for planning inactiveness, even when the business is research.⁹ Therefore, corporate strategic planning purposes and a corresponding attitude are considered an indispensable tool

for survival in a business environment, especially for newly entering SMEs in patent-intensive business.

Based on Ackoff,¹⁰ we distinguish four prototypical planning attitudes for patent management, representing an increasing level of activeness:

1. Inactive

Management does not take any initiative in identifying the relevant innovation environment by gathering information about scientific and technological developments in it. There is interaction with third parties, on a (co)incidental basis if that is perceived to be helpful in commercialising proprietary inventions. Young companies with this planning mode aim for in-house development, whereas older ones are also focussing on third party involvement. There is no systematic use of external proprietary information in developing the company's technology and business. No IPR policies have been erected in the sense that the internal organisation of the company is equipped with incentives and guidelines for the appropriation, protection, and dissemination of research results.

2. Reactive

Management is pre-occupied with maintaining the 'steady state' and, in doing so, adapts its activities if necessary for the survival of the company as it is, most preferably by neutralising its effects. Patent positions are built solely on the basis of in-house technological capabilities and exploitation of them is dependent on competitors' patenting and in-licensing activities. Technology is considered the primary source of change and circumvention the strategy for bypassing rivalling proprietary positions. The emphasis in IPR policies will be on the protection of patents, much more than on the dissemination of patent information. Cross-licensing deals result from third party initiatives that initially will be regarded as threats, more than as opportunities.

3. Active

Management does not only react to, but is also involved in scanning the relevant innovation environment for the necessary information about external in(ter)ventions and opportunities that can be related to exploitation of the existing portfolio. Technology and the market are equally believed to be sources of changes to be

adapted into the in- and external organisation of the company. Proprietary information is used to identify potential partners in exploiting the company's existing as well as co-operating in related technology areas. The company's patents are actively enforced, but based on the perception of technological rivals as providing opportunities, compensating for weaknesses. So, licensing activity means not only focussing on out-, but also cross- and in-licensing opportunities.

4. Proactive

Management is not only actively engaged in matching the external with the internal state, but also in developing options arising from existing and future knowledge in the networks the company is involved in. Management has an internally as well as externally communicated vision of where the company is technologically heading for. This means that intellectual property is very much a collective responsibility in the company and not only management, but also researchers are involved in decision-making. Science, technology and (potential) buyers' needs are believed to be the principal sources of change. Not only the inherent functions of patents are used to the full, but also attributed functions concerning patents as a portfolio component, performance indicator, and as an asset in the company's financial policies.

The latter two planning attitudes, i.e. active and proactive, are basic to what Chesbrough¹¹ calls the logic of Open Innovation, a mode of innovation involving alignment of internal as well as external innovation activities as to strengthen a firm's innovation capacity. In contrast, an inactive and particularly a reactive planning attitude towards patent strategy show very similar characteristics with the logic of Closed Innovation. This view largely concentrates on the control of internal resources, exploits internally established proprietary results from research, and regards the external environment as hostile.

3. Patent functions from a managerial perspective

Our starting point is the view of patents as "intermediate products of innovation representing a sanctioned behavioural relation among men that arises from the existence of goods and pertains to their use".¹²

In regarding what patents effect in the behavioural relations within and between companies, we adopt a managerial perspective. The use of patents for early stage bio-business development is often connected to typical corporate concerns of finance and marketing, as much as to the proprietary technology base. Securing finance for working capital, technological positioning, building exclusiveness for competitive advantage as well as reputation for partnering purposes are all served by patents in corporate strategy. So, these are typically functions that management attributes to patents for corporate purposes as a basis for planning activities in order to materialise them. The attributed functions are to be considered as interpretations of the purposes patents have in establishing and maintaining relations in business, other than the inherent functions as they are intended by the designers of patent systems (the legal environment to managers).¹³ Both function categories are related to the managerial purposes of patents in the figure below.

<INSERT TABLE 1 HERE>

This logical construct follows from the pilot study in which we learned that the eight functions were perceived as being of a different order. The utility purposes as defined in the table are central to the managerial perspective of building a corporate future, i.e. planning, to which patents are only instrumental. Since we focus on the role of patents in planning for a corporate future, we consider the inherent functions as mainly relevant to proprietary knowledge creation and the attributed functions as mainly relevant to its exploitation. We operationalise them as following:

1. Incentive

This function represents the patent as an input motivator to R&D efforts. The quote in the first section illustrates the importance of this function to R&D investment decision-making. When patents are an imperative in the business, also small research-based companies can on the basis of these assets take part in the large scale drug commercialisation programmes controlled by 'big pharma'. By introducing incentive schemes, management can raise awareness of the importance of patents as a basis for business and stimulate researchers to make their knowledge proprietary as soon as they can. Such awareness can also be materialised by a more structural reward system which would be based not only on the patent when it is granted, but also when it is

exploited relating, for instance, an incentive to corporate royalty incomes.

Entrepreneurial researchers as inventors to patents that are not considered strategic to the company could also be more or less stimulated to start-up their own business, whether or not maintaining a financial relation with the former employer, particularly in the public domain (i.e. PROs).

2. *Appropriation*

This function represents the patent as a mechanism providing functional exclusiveness to an invention. The purpose is to retain returns from commercialising the idea. There may be no legal barriers involved, since an alternative to patenting is secrecy, which is hardly maintainable concerning product inventions. Process inventions however can more easily be maintained secret. Making in-house knowledge proprietary helps positioning the company technologically, which is crucial for the exploitation of biotechnological inventions. In the pharmaceutical industry, misappropriation of product inventions can be a reason to terminate a drug development project. So, patent management practices will vary in their level of appropriation activeness as expressed in the following questions:

- Are there guidelines for secrecy, authorisation for publication, etc.?
- Who takes the initiative for patent filing procedures?
- To what extent is it a subject in:
 - Regular meetings within the company
 - Labour or outsourcing contracts, and
 - Research proposals?

3. *Protection*

This function represents the patent as the legal ability to exclude others from gaining returns on investments the proprietor made to create the invention. This is the most commonly known, but not necessarily the most important function of patents. That depends on the efforts made by management to enforce them. Excluding others implies identifying actors by scanning proprietary information outside as well as inside the company. Externally focused technology intelligence is to serve patent enforcement and, eventually, litigation purposes. Internally focused intelligence is in a much earlier stage to prevent or screen for potentially appropriable knowledge to be

presented in other forms of publication than as a patent, such as scientific papers and in oral conference presentations. This internal function serves to prevent losing the option of protecting appropriable knowledge as a result of which commercialisation is in many cases blocked (misappropriation). In operationalising this function we are interested in the activities companies engage in focusing on ‘proprietary friction’:

- Prevention (detecting and informing about potential infringement);
- Negotiation (investigating and settling disputes outside court); and
- Litigation (initiating and pursuing legal proceedings in a court of law).

4. *Dissemination*

This is about the patent as a source of information open to rivalling companies (as a consequence of being a publication), often inducing ‘circumvention’, but also to be shared between researchers within the company as a source of inspiration for or even as an inducement to terminate research. Management therefore need to find out to what extent information on patents of rivals is used (external patent information). To what extent information on its own patents is used, can not be assessed by the subject company other than by newer, rivalling patents. Operationalisation of this function therefore focuses on the following two questions:

- How is the internal dissemination of patent information organised?
- To what extent is the use and interpretation of patent information subject to regular meetings?

As attributed functions we distinguish:

5. *Liability*

The financial meaning of patent liability is that of securing a loan, for instance when working capital is needed for the company’s future operations. We learned from the pilot study that, at least in The Netherlands, this is not regarded an option. Dutch tax policy prohibits sale & lease-back constructions with patents as securities ever since the so-called ‘technolease’ deal between Philips and the Rabobank was disapproved of.¹⁴ Market valuation problems and claw back clauses that would prevent patents to be sold to third parties in case of insolvency would be the reasons.¹⁵

The patent as a corporate risk increasingly needs to be included in a strategic patent management conceptualisation. Large companies are required to incorporate patent risk management into their administrative organisation as a consequence of the Sarbanes-Oxley act, the new regime for Corporate Governance. But, the financial meaning of this patent function will not be part of SME patent practices.

However, the legal meaning of patent liability concerns the prevention of patent infringement and can result in either precluding the infringing company from using the specified technology or causing it to pay a toll for that use.¹⁶ Since we are interested in both creating and exploiting patents, this managerial activity would have to be organised for and is to generate freedom-to-operate not to risk infringing rivals. In that sense it is the other side of the same coin of protection, but relating to third party ownership and, thus, a relevant illustration of our starting point of the patent as a sanctioned behavioural relation between rivalling technology producers.

6. Portfolio component

The patent considered as part of a set of more or less related proprietary technologies that serve the corporate future. The two defining characteristics of patents as intermediate products that imply relations between owners make them strategic not only in their external role, but also in their internal role. In that sense they represent inventions that should be related through their future translation into products that the organisation intends and is able to market. Portfolio management is in that view aiming at building coherence between the creation and exploitation and/or commercialisation of proprietary technologies; turning technology into business as effectively and efficiently as possible. In market terms this longitudinal relation is often expressed in the patent and market positions of the company.

Apart from such strategic coherence, decision-making about the patent portfolio will result in either one of these options for a particular patent: selling or out-licensing it or keeping it with the intention of further investing in the commercialisation of the technology under own or shared risk. In the exploitation of patents by smaller biotechnology companies, selling the patent is usually not an option, since young companies are first of all interested in building their portfolio rather than rationalising it. Selling a patent usually is an option to bio-pharmaceutical companies when there is a proper scale achieved in the portfolio and when there is sufficient longitudinal experience with the in-house capabilities to create patent positions. Moreover, in the

human health area, small companies often lack the resources to enter into lengthy and expensive developmental trajectories and therefore need to enter into co-operative modes of prolonged development and commercialisation of new product technologies.

However, in building an unsurpassable proprietary position, coherence in technology and business makes patents as portfolio components a pivotal part in strategising.

7. Asset

The patent as a financially valued means of producing gains to the owner. Though patents are bought and sold, the institutional conditions of valuation and accounting of immaterial assets are more problematic than to their material counterparts. There are three accounting bases for patents: their costs, potential revenues and as so-called real options. The main problems concern cost allocation and revenue recognition. Despite the shift in attention of business, policy makers and scholars, from material to immaterial production and monetisation in economics, there is no consensus between accounting standards organisations as how to formalise such immaterial assets as patents. As a result, companies that report on their proprietary technology yearly vary in the degree to which they activate patents. Some depreciate annual spending within the year in which they are incurred as costs; others do so over a maximum of three years. The statutory accounting principles applied vary as well (e.g. historic). And, if not activated, patents can be valued for other purposes. But, not all companies deal with their patents from a financial perspective. Therefore, in the questionnaire this function has been operationalised as a measure for the awareness of this financial perspective.

8. Performance indicator

The patent considered as an informational medium to represent the company's research performance and technology marketing potential. Analogously to publications in the public domain of science, patents are the predominant indicator for technological achievements in the private domain of science-based business. This brings important advantages to, in particular young, biotechnology firms as it can help them in building a trustworthy image towards potential investors, research partners and clients. Our operationalisation focuses on the two related questions:

- Are patents used to assess one's own and other companies' technological achievements? And
- To what extent are patents used in communication and strategic decision-making (for instance, in partnering)?

At the time when patent systems were erected through laws and treaties, patents were not granted to (large) companies to the extent that they are now. In the last two decades, patents are increasingly understood in the corporate context of management. Moreover, the changing innovation regime adds another dimension to increasing business interaction: patents as a subject to market transactions.^{17,18} Despite the 'knowledge economy discourse', valuation practices have not yet been adapted in accountancy standards in the sense that such immaterial assets have become equivalent to material assets. At the moment that intellectual property would be valued not only for consolidation but also for transaction purposes, at least one pre-condition for the marketing of intellectual property rights would be met (intellectual capitalism¹⁹). As long as such institutional reform is lacking, the patent functions of 'asset' and 'liability' are more or less hypothetical in their interpretation for the managerial purposes as described above. Nevertheless, we believe that for analytical purposes this distinction should be made to enhance thinking about IP management and policy more in general.

4. The typology in a pilot study

For the purpose of improving the operationalisation of the conceptual framework, we performed a pilot study consisting of three interviews with four people, representing three Dutch firms active in the domain of pharmaceutical biotechnology. These are described in table 2.

<INSERT TABLE 2 HERE>

The first aim was to improve the scales we had defined up to then for use in a written questionnaire, in such a way that it would meet the 'discourse' in which managers think and communicate about patents. Because the planning dimension of the

typology is sensitive to socially desirable answering, we avoided using these categories in formulating the item scales of the questionnaire.

One of the main lessons we learned from the pilot was that the Liability function was not recognised by respondents for reasons explained in the previous section. We dropped this function from the questionnaire we used for our Dutch biopharma case, but decided to maintain this function in the typology framework since countries already differ in their tax regimes for valuation which may also change in the long term to meet demands of IPR markets in a knowledge economy.

Comments from respondents led to a fair number of essential reformulations of answer categories in the questionnaire. For the majority of items in the questionnaire, we used an almost one-to-one translation of the scales formulated in the typology framework. The items that we have addressed for each of the patent functions in our framework can be found in table 4. A full representation of both the framework and questionnaire (in Dutch) is available upon request.

5. The typology in a case study

For a ‘proof of concept’ of the typology the questionnaire was sent out among Dutch biopharmaceutical SME. A large part of Dutch Biotechnology consists of firms in the area of human health, including therapeutics/pharmaceuticals, diagnostics and preventive solutions.²⁰ By the end of 2003 there were 138 so-called dedicated biotechnology firms^{II} in the Netherlands, of which 44% were active in human health biotechnology. About one-fifth of all dedicated biotechnology firms in the Netherlands consider therapeutics/pharmaceuticals as their primary or secondary target market.²¹

In order to reduce sectoral differences the sample was restricted to dedicated biotechnology firms involved in therapeutics/pharmaceuticals. Furthermore, we focussed on dedicated biotechnology firms that are R&D-driven and aiming at translating their R&D outcomes into proprietary therapeutical applications. Particularly such firms rely on the creation and exploitation of patents as their core business.²² So, firms with contract research as their main activity were excluded.

^{II} Dedicated implies that these firms are concentrating all their efforts on biotechnology research and commercialisation. Dedicated biotechnology firms are often relatively small- to medium-sized firms that have started to pursue the exploitation of a piece of proprietary biotechnology.

Finally, not only firms that already had patents granted or filed were included, but also firms without patents, but in the process of creating patent positions. We consider their perceptions and opinions of interest to this study as well. All together, a selection was made of 40 dedicated biotechnology firms in the field of therapeutics and/or pharmaceuticals. This set represents 29% of the total population of dedicated biotechnology firms in the Netherlands.

The questionnaire consists of twenty-three multiple choice items, complemented with eight questions concerning the year of foundation, firm size, the number of employees involved in R&D, the number of staff involved in IP management, the size of the patent portfolio, and general data about the firm and the respondent. Prior to sending the questionnaire, the firms were contacted by phone in order to identify the most appropriate staff members as respondent. The questionnaire was sent to the firms in June 2004. After three weeks a reminder was sent, followed by contact over the phone. In August 2004, a total response was gathered of twenty questionnaires of which four had to be excluded, because these were either part of a holding structure in which all IPR matters were dealt with at the corporate level abroad or firms that appeared to be too service-oriented, not involving patents in their activities at all. The included firms are relatively young, as the majority of them were created after 1996. Furthermore, the firms are relatively small in terms of total employment – only 3 firms have more than 10 employees – and thus also in terms of R&D efforts. Only two firms have no patents granted or filed yet; the others have patent portfolios consisting of at least one patent family. Most firms have appointed 1 or 2 staff members responsible for IPR matters; three firms have no formal IPR staff at all. Table 3 presents an anonymous description of the response to the mailing.

<INSERT TABLE 3 HERE>

Table 4 presents the item results per patent function differentiated to planning type.

<INSERT TABLE 4 HERE>

Incentive to innovate

The majority of firms in our sample show an inactive attitude towards the patent as an incentive, as they have not implemented any kind of reward mechanism for patenting

by their personnel. Furthermore, most stated that they are averse to spinning out research results with commercial potential, but not regarded as part of their core competency.

Appropriation of an invention

The overall picture of this function is fuzzy, as the respondents show considerable differences concerning the process.

First, the initiative to patent research results is in most cases a combined effort of managers, researchers and an (external) patent agent. This implies a predominantly active attitude, as the initiative to patent is not assigned to a single functionary which could increase the chance of non- or misappropriation.

Second, patenting is within six firms not a standard subject on the agenda of internal meetings, indicating inactiveness. Six others claimed a pro-active attitude, as patenting is a standard issue in their internal meetings in which all relevant actors are involved.

Third, a small majority reported not to have patentability included as a standard item of research proposals. But, six firms have made it mandatory and three of them also include exploitation or commercialisation prospects to be explicated in proposals.

Fourth, almost all have arranged the rights of ownership and exploitation of IP by means of contracts, mostly through standard formats and in consultation with the most relevant stakeholders and experts (active). However, only two indicated to also oversee compliance of their contract partners (pro-active). Three reported to have no contractual arrangements at all for ownership and exploitation (inactive).

Fifth, nine stated that they arranged secrecy issues by means of labour contracts or non-disclosure rules for both internal and external researchers, such as Ph.D. students employed by a university. They also reported that these arrangements and rules are well-known among employees and that they are supervised (pro-active). Six are used to arrange secrecy and non-disclosure with employees, indicating that no arrangements are made when hiring external researchers. One explicitly mentioned that no formal arrangements are made, nor that anyone had been appointed responsible for contractual affairs.

Finally, also relating to secrecy is the issue of publishing research results at conferences or in scientific journals. One firm reported having no arrangements at all, nor staff appointed to supervise publishing. Six reported relying on informal

agreements, having no staff responsible for supervision of publishing. But these also stated that such would be implemented if necessary (reactive). The majority has arranged publishing procedures and staff explicitly appointed the responsibility for supervising compliance. Most also reported that the procedures concerning secrecy are actually known and complied with by the firms' researchers (active).

Protection of intellectual property

To understand the following, it needs to be stated that all respondents but one reported never having been confronted with infringement, neither actively (another firm's rights) or passively (the rights of respondent's firm).

Ten of the sixteen firms reported not to have the responsibility for identifying infringement appointed to any internal staff or external agents. This means that the majority of firms is inactive and highly vulnerable. Given limited human resources, SMEs should consider outsourcing the identification of infringement to specialised agents. However, no respondent reported having done so.

Six stated not to do anything when infringement occurs or is likely to occur (inactive). Two others would react if a third party officially warns for infringement. Another six reported that they would provide as well as react to (early) warnings of infringement. Only one indicated to offer a license in such a situation.

Finally, firms' attitudes towards prosecution vary considerably. Three stated that they would never prosecute in case of infringement, thus staying inactive at all time! Four would only prosecute as soon as the firm experiences economic consequences resulting from an infringement. Two indicated to prosecute in any case, and six stated to prosecute only when no other solutions are left.

Dissemination of patent information

The majority show pro-activeness concerning the use of patent information, as they claim to use patent information for:

- Assessing the patentability of their own research,
- Generating new ideas and input for their research, and ultimately
- Gaining insight into their competitors' research strategies.

Two firms indicated not to use patent information at all. Five indicated not to have any source of patent information, such as freely accessible patent databases. Another

five reported to have access to patent information which is used mainly incidental and is not stimulated nor supported by the organisation. This is surprising as most firms claimed to use patent information pro-actively; how can you do so without having systematic access to patent information? Only six firms disseminate patent information on a more structural basis.

Patents as assets

Seven firms reported not to value their patents at all. Five indicated to value patents only on the basis of historical cost price or procurement price, and only for external purposes (e.g. a firm's annual report). Two claimed to use valuation principles for internal and external purposes. These firms value their patents for external purposes on the basis of cost price, but also on the basis of the expected returns or market potential for internal purposes.

The patent portfolio

Six firms indicated to start application procedures as soon as patenting seems feasible, however without evaluating it in relation to the existing portfolio. The majority reported to evaluate all potential patents on their technological and commercial merits in relation to the portfolio. However, no respondent reported to perform such evaluation ex-ante, i.e. before an invention occurs, for example by including patent paragraphs in new research proposals. This indicates a low level of technology analysis for patent decision-making.

Most of the firms stated to evaluate their patent portfolios on financial potential and perceived strategic value (pro-active). Furthermore, three evaluate their portfolio mainly on the basis of costs, while another three perform portfolio evaluations on the basis of financial value. Only one indicated not to perform any kind of portfolio evaluation at all.

The attitude towards licensing is operationalised by the number of licensing agreements (both in- and out-), in combination with the type of actor taking the initiative. None of the firms in the sample can be characterised as inactive with regard to licensing. However, two show very small numbers of licensing agreements and in these cases respondent firms were approached (reactive). Another eight were involved in multiple licenses where the initiative was taken by partners, but also by the firms' management, implying a more active role of the firm in exploiting its patent portfolio.

Finally, six reported that the identification of licensing opportunities is also done by the firms' researchers, together with management and external agents.

Patents as performance indicator

The use of patent information for assessing a potential partner's patent portfolio varies strongly in our sample. Four firms indicated not to use patent information at all when identifying and/or selecting potential partners. To another four this has only a limited priority. However, six indicated to use this kind of information with a high priority and two even with the highest priority.

The majority use patents (granted and filed) as a means to communicate about the firm's technological performance. Four firms do not communicate at all about their patents (inactive). Three only do so after they have been granted the patent and only to external parties (reactive). Three others communicate about their patenting after having filed a patent as well as after the patent has been granted (active). Five firms communicate both about patent filings and patents granted to external parties as well as within their own organisation (pro-active).

6. Conclusions

What we can learn from this study is not so much how biopharmaceutical SMEs in the Netherlands manage the creation and exploitation of their patents in general. The data gathered do not allow for generalisations. So, empirical insights presented here can only be considered indicative. In our view, the value of this study is rather in the typology itself. Operationalisation of the framework underlying it provides a rare conceptualisation of the organisation of strategic patent management, leveraging knowledge of large companies' practices to use for SMEs.

The typology can be used as an instrument for surveying patent-intensive sectors for policy making purposes. For instance, it could serve more targeted campaigns to promote the use of public patent databases. The same would go for tax regime changes as to stimulate innovation in a national or regional economy.

But it could also be used by venture capitalists for participation decisions. Not knowing whether an investment in the commercialisation of a proprietary technology is liable to infringement claims poses a business risk that is unacceptable to many investors.

The pilot study confirmed the relevance of seven of the eight functions. Except for Liability, respondents in these companies acknowledged each of the functions as relevant to both the creation and exploitation of patents (see also section 3.5). The typology as a whole was reported an eye-opener to respondents in the pilot study. However, not all respondents considered each patent function relevant in the sense that they also acknowledged a need to plan and organise for it. Such differences seem to vary strongly with firm size, age and technology ('organisational contingency').²³ We believe this variation is to a large extent also a consequence of differing levels of awareness and attitude towards patents and planning. Though awareness is generally low in SMEs, developing such managerial capabilities is particularly essential for biopharmaceutical companies because of the immense lead times of developing and commercialising new technologies.

The case study seems to validate the choice of dimensions of the framework; patent function and planning attitude. Concerning patent functions, we believe results confirm the relatively underdeveloped use of the patent to its full extent.²⁴ An example relating to Dissemination is this inconsistency: the majority of the respondents claimed to use patent information as input to innovation and strategic decision-making although only few respondents also reported to stimulate the use of patent information or to provide structural and free access to patent information sources in their organisations. In the last section, we will discuss this apparently contradicting phenomenon.

Overall, it seems that the companies in the sample are not aware of the opportunities offered by patents and the necessity of installing proper mechanisms and organisational arrangements in order to meet the demanding processes of creating and exploiting patent positions. We believe that companies in sectors that are highly science and technology driven, and in which patents are a condition-sine-qua-non to business, need to be fully aware of the strategic value of patents and act upon it by organising for it! In our experience, there is much professionalism to gain in the area of strategic patent management in SMEs that can be learned from their large counterparts in patent intensive businesses.

7. Discussion

A number of issues emerge from the study we have presented here:

1. The small size of the sample. As a result, no proper statistics could have been performed to test the validity and consistency of the typology. In the methodology used measures taken have therefore been extensively explained to build validity.
2. The influence of firm size. Since findings indicate that Dutch biopharmaceutical SMEs have an incomplete awareness of the functions that patents can fulfil, it could be argued that these firms can not manage the creation and exploitation of their patents professionally. However, one could also argue that our findings are mainly related to the limited means of SMEs. Filing and maintaining patents can be very expensive, and monitoring of infringement and protection of patents may well be beyond their financial stretch. But then the question also arises why firms want to own patents if they do not invest in their future value?
3. Sectoral or national differences. Such differences are caused by factors like laws and regulations, entrepreneurial spirit, technological regimes, patent awareness, public R&D, innovation policies, etc.^{25,26} Undoubtedly, these factors will determine outcomes of surveys using this typology crosswise. And even within 'the biotechnology sector' differences might appear; we concentrated on the biopharmaceutical sector as a subset. Biotechnology companies serving agricultural and food markets have different patent management practices.
4. Value for universities and other public research organisations (PROs). The typology has proven to be useful in analysing patent management practices in patent intensive SMEs. PROs are increasingly expected to exploit their inventions by having them commercialised. This brings PRO management into a very similar position. To regard patents solely as a means of appropriating technologies will then harm the potential to give societal value to public research spending, risking loss of third party commercialisation for lack of activeness in their patent management practices.²⁷ Like most SMEs, such organisations are not in a position to market products at their own risk and expense, but certainly are supposed to exploit the rights to their inventions by actively marketing them.²⁸ A typology like the one we present here could help them in this process.
5. Lack of patent awareness. The question arises whose problem it is when a lack of awareness exists about patent management within companies, and even whose responsibility it is to take action in improving such practices? Is there a role for public policies or should it be left to competition and the capital market? First of all, this is a problem of any organisation that aims to create and exploit intellectual

property, regardless if it is a private or public one. Second, we believe that a lack of patent awareness in PROs can be detrimental to inventions with good potential that would be published about before patenting, making future investments in developing the technology senseless. The risk of not having such a usually immense investment paid back is too high for any pharmaceutical company and the societal value of possible improvement in quality of life would be lost.

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² Biopartner, *The Netherlands Life Sciences Sector report 2004: Moving forward*. (Drukkerij Damen, Ede-Wageningen, 2004).

³ A. Ries & J. Trout, *Positioning: The Battle for Your Mind*. (Revised Edition, Warner Books; New York, 1986).

⁴ Van Reekum, *op. cit.*, Ref.1.

⁵ O. Granstrand, *The Economics and Management of Intellectual Property: Towards Intellectual Capitalism* (Edward Elgar; Cheltenham, 1999).

⁶ H. Chesbrough, *The Logic of Open Innovation: Managing Intellectual Property*. California Management Review, 45 (3), Spring 2003.

⁷ Referring to Chandler's famous adagio: "Structure follows Strategy", which is acknowledged to be of crucial importance by e.g. Henry Mintzberg. See his *The Rise and Fall of Strategic Planning* (The Free Press; New York, 1994).

⁸ R.L. Ackoff, *Creating the Corporate Future: Plan or Be Planned For* (John Wiley & Sons; New York, 1981).

⁹ Ackoff, *ibid.*

¹⁰ Ackoff, *ibid.*

¹¹ Chesbrough, *op. cit.*, Ref. 8.

¹² E.G. Furubotn & S. Pejovich, *The Economics of Property Rights* (Bailinger Publishing; Cambridge (Mass.), 1974).

¹³ Thumm, *op. cit.* Ref. 5, refers to this distinction between inherent and attributed functions as the primary and secondary use of patents: p. 529.

¹⁴ W. Hulsink & H. Schenk, 'Privatisation and deregulation in The Netherlands', in: D. Parker (Ed.), *Privatisation in the European Union: Theory and Policy Perspectives* (London, Routledge, 1998), p. 251.

¹⁵ Algemene Rekenkamer, *Financial relations with major companies*. Report to Parliament (Tweede Kamer der Staten Generaal), TK 25 080, nr. 2, Sdu, The Hague, 1996, p. 38.

¹⁶ A.L. Miele, *Patent Strategy: The Manager's Guide to Profiting from Patent Portfolio's* (John Wiley & Sons; New York, 2001).

¹⁷ Chesbrough, *op. cit.*, Ref. 8.

¹⁸ M. Dietz & J. Elton, *Getting More from Intellectual Property*. McKinsey Quarterly, issue 4, 6-8, 2004.

¹⁹ Granstrand, *op. cit.*, Ref. 7.

²⁰ S. Kern, C. Enzing & A. van der Giessen, *National report of the Dutch biotechnology sector*. Background report to the EC project Effectiveness of public policies in high tech sectors in Europe (EPOHITE), published as Annex to the Final Report 2003.

²¹ Biopartner, *op. cit.*, Ref. 2.

²² N. Thumm, *Management of Intellectual Property Rights in European Biotechnology Firms*. Technological Forecasting and Social Change, 67, 259-272, 2001.

²³ Between different sectors or technology areas such variation would likely be explained by the relevance of patenting in the sector, technology dynamics etc, which would not necessarily have much relation to the strategic orientation of management of companies that rely on IP as a crucial means for conducting business (Taylor & Silberston, 1973; Pavitt, 1984; Wyatt et al., 1994).

²⁴ Chesbrough, *op. cit.*, Ref. 8.

²⁵ Enzing, C. & S. Kern, *Structure, Dynamics, and Performance in National Biopharmaceutical Innovation Systems*. In: OECD, *Innovation in Pharmaceutical Biotechnology; Comparing National Innovation Systems at the Sectoral Level*. Paris, 2006.

²⁶ S. Wyatt, G. Bertin & K. Pavitt, *Patents and Multinational Corporations: Results from Questionnaires*. *World Patent Information*, 7 (3), 196-212, 1985.

²⁷ Unfortunately, the term valorisation has been adopted by many managers, policy makers and consultants in the public domain despite the fact that it is not known in English and is used as an equivalent for 'exploitation'.

²⁸ N. Thumm, Strategic Patenting in Biotechnology. *Technology Analysis and Strategic Management*, 16 (4), 2004, pp. 529-538.

TABLES

Table 1 - A managerial logic of patent functions

Inherent function	utility purpose	attributed function
Incentive	investment	liability
Appropriation	positioning	portfolio component
Protection	exclusion	asset
Dissemination	reputation	performance indicator

Table 2 - The pilot study composition

Case (firm)	Foundation year	Employees	Patents/families
AM Pharma BV	Merger in 2002 between AM Pharma BV (2000) and PharmAAware (2001)	15	-/6
Kreatech BV	1990	30	150/9
Crucell NV	Merger in 2000 between Introgene (1993) and Ubisys (1996)	200	390/80

Table 3 - General characteristics of the firms that responded

Year of foundation	1 firm before 1991	1 firm in period 1991-1995	6 firms in period 1996-2000	8 firms in period 2001-2003
Total employment	5 firms with 1 to 5 employees	8 firms with 6 to 10 employees	1 firm with 11 to 25 employees	2 firms with more than 25 employees
R&D employment	10 firms with 1 to 5 employees	3 firms with 6 to 10 employees	3 firms with 11 to 25 employees	0 firms with more than 25 employees
IPR management staff	3 firms with no IPR staff	8 firms with 1 or 2 IPR staff members	4 firms with 3 to 5 IPR staff members	1 firm with 6 or more IPR staff members
Number of patents (pending and granted)	2 firms with no patents	6 firms with 1 to 5 patents	6 firms with 6 to 15 patents	2 firms with 16 or more patents

Table 4 – Case study results (in absolute numbers)

<i>Item IP management</i>	Inactive	Reactive	Active	Proactive
<i>1 Incentive</i>				
1.1 Stimulating spin-out activities	12	2	1	1
1.2 Presence of reward mechanisms	11	1	3	1
<i>2 Appropriation</i>				
2.1 Mix of staff taking initiative for patenting	-	3	9	4
2.2 IP as standard subject of internal meetings	6	3	1	6
2.3 IP as subject of research proposals	4	6	3	3
2.4 IP arranged in contracts	3	1	10	2
2.5 Arrangement of secrecy	1	6	2	7
2.6 Arrangement of the publication of results	1	6	2	7
<i>3 Protection</i>				
3.1 Identification of infringement	10	-	5	1
3.2 Way of preventing infringement	6	2	6	1
3.3 Moment of prosecution in case of infringement	3	4	2	6
<i>4 Dissemination</i>				
4.1 Use of patent information	2	1	4	9
4.2 Ways of disseminating patent information	5	5	2	4
<i>5 Asset</i>				
5.1 Valuation of patents	7	5	-	2
<i>6 Portfolio</i>				
6.1 Evaluation of potential new patent in relation to existing portfolio	6	-	9	-
6.2 Evaluation of existing patent portfolio	1	3	3	9
6.3 Licensing-in and licensing-out	-	2	8	6
<i>7 Performance/Communication</i>				
7.1 IP as criterion for partner identification/selection	4	4	6	2
7.2 Communication on patents	4	3	3	5