PART V

Intellectual property and strategic decision-making

13. IP-valuation as a tool to sustain innovation

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1 INTRODUCTION

The creation of new knowledge, its commercialization and the ability to appropriate the economic benefits have increasingly become a competitive factor both for firms and, indeed, for economies. Therefore, initiatives that improve the conditions for the generation, diffusion and exploitation of new knowledge in the economy are increasingly sought after. In this light, this chapter considers how more efficient methods to value and capitalize intellectual assets might contribute to the main policy objectives of promoting and sustaining innovation in today's changing environment.

This chapter starts by exploring the role intangible assets (IAs) play in the emerging 'market for knowledge'. This theoretical discussion lays the foundations necessary to consider the need to improve conditions for valuation and capitalization of intellectual assets. The chapter then presents a brief survey of intangible valuation approaches. Finally, the discussion considers evidence of difficulties among smaller Norwegian actors in capitalizing on their intellectual assets, before deriving some implications about the need to improve conditions for the utilization of intellectual assets, especially through better valuation practices.

2 IAS IN THE EMERGING 'KNOWLEDGE MARKET'

We begin from the position that the valuation and capitalization of intellectual assets should be seen in terms of the growing need to improve the way economically important knowledge is generated and utilized in the economy. The argument is that the ultimate goal should be to promote and sustain innovation processes both at the firm and the aggregate level. The premise is that more reliable valuation techniques can lay the basis for better management of innovation processes within the firm, while at the same

time providing for better co-ordination mechanisms between innovating firms and the wider economy (vis-à-vis collaborators, funding agencies, users, and so on).

In this light, we start by briefly exploring the role IAs, especially those protected by intellectual property rights (IPRs), play in the innovation process at the level of the economy. The role of this type of intangibles can be seen particularly in terms of an emerging 'market for knowledge' (Baumol 2002). The idea of a 'market for knowledge' goes beyond the generally accepted premise that new technological knowledge has become more important to the economy. It emphasizes, moreover, that the way economic activities are organized is also changing and, in doing so, new challenges are emerging.

2.1 Three Illustrative Scenarios

Three basic scenarios can be used to substantiate the increasing relevance of valuation techniques, while also illustrating the sort of challenges that are in question. The first involves the changing way innovation activities are organized. Here it has been pointed out that the innovation process increasingly implies joint ventures, R&D collaborations and other multi-actor arrangements in which different interests become involved in different capacities for different durations (Arora et al. 2001). The increasing currency of such constellations and the changing division of labour they imply, require new tools in order to work well. One prerequisite for such arrangements is an agreed way by which to value IAs prior to the collaboration as well as during and after it. Here trusted techniques for valuation are becoming essential.

New challenges also emerge from the changing environment for financing innovation, not least in life-science research. This second scenario is characterized by innovators who are faced by particularly high investment costs, by long horizons for development, testing, and so on, as well as by undeveloped or under-developed markets. Measuring intangibles becomes an important basis on which to attract investment as well as other funding for these types of innovators, who generally lack of traditional forms of collateral and who face evolving funding needs during the course of the innovation process. Innovators of this type also find themselves faced by a wider variety of financing instruments from a variety of sources (business angels, venture capital, public grants, and so on). In general, there is a need for standard methods for valuing intangibles where more than one funder is involved, where funding needs are subject to change at different stages and where traditional guidelines for funding do not apply.

A third scenario emerges at the firm level, in cases where the challenge of proactively organizing company activities substantially involves IAs.

In firms that are are built around 'knowledge' and the hopeful creation of IAs, there is a recognized need (especially in times of uncertainty) to develop a well-reasoned expectation of the value of what may be the bedrock of the company. This is true of single technology firms familiar from the dotcom era but it is also true, to varying degrees, of other companies, including diversified companies who need robust and reliable ways to gauge the relevant importance of their different in-house activities. In a range of settings, standardized valuation tools are thus also increasingly in demand at the firm level.

2.2 Contribution of Valuation Techniques

Such challenges imply an overall need to adapt the conditions for the sustainable and equitable functioning of the quasi-market on which the supply and demand of knowledge meet. In a well-working 'market for knowledge', we expect that new knowledge can find the right complementary resources (not least funding); that knowledge creators and users can be brought together under conditions that are favourable for developing new ideas; and that the same goes for promoting collaboration between different developers, in order to co-ordinate larger projects based on different pieces of knowledge. In this setting, there may be scope to improve interactions within knowledge markets or to improve the interaction between 'knowledge production' (generation and utilization of new knowledge) and other parts of the innovation system, specifically financial markets.

In this context, intangibles that have been codified in formal ways (such as in a patent, design right, trademark) or through contracts are seen as especially important. These intellectual assets[1] represent accumulated knowledge that is also quasi-transferable. They are less intangible, because of codification, and more of an asset because the firm has a basis on which to appropriate profits. The expectation that improved valuation methods for such assets can improve the market for knowledge is significantly based on the fact that information has a fundamental effect on the organization of markets, and on the perception of risks (Arrow 1999). In terms of improving the role of valuation reporting standards, it is necessary to focus on their potential effects on the micro as well as on the macro level.

At the level of the firm, valuation approaches based on intellectual capital models or business scorecard models are often broadened to include a large number of indicators encompassing all areas of business activity. This may cause information overload and reduce the efficiency of the new reporting standards. The OECD's International Symposium on Intellectual capital (1999) suggests that there is a need to concentrate on firm's innovation processes and how these generate value. It is important to appreciate here,

that understanding what determines the value of intellectual intangibles entails understanding the firm's place in the innovation system. Baum et al. (2000) found that the most important value-drivers in a company are (in rank order) innovation, the ability to attract talented employees, alliances, quality of processes, products or services, environmental performance, brand investment, technology and customer satisfaction. Hence, Baum et al. (2000) supports the argument that some firm-level aspects are more important than others. To be successful, a firm must know the potential value of its knowledge base, have a strategy for monetizing its intellectual assets and be effective in generating a return on these valuable assets.

In this light, improved accountancy practices for intellectual assets can have a variety of positive effects beyond immediate, actuarial tasks. For example, they can contribute to:

- making enterprises more aware of value-potential which might otherwise be overlooked (or under- or overvalued)
- sensitizing other actors in the innovation system to a more realistic understanding of the risks and rewards of through these values
- improving the working of different financial markets (including more accurate information) which are important to innovating small and medium-sized enterprises (SMEs)
- facilitate access to other markets (for example, the USA), including promoting different types of co-operation with foreign companies (mergers and acquisitions, also R&D collaboration)
- improve analysis of the workings of the economy in significant ways, which, for example, may lead to better economic and innovation policies.

At the level of the wider economy, the role of valuation reporting standards has implications for financial stability. The work of the Bank for International Settlements on financial risk measures and procyclicality (see Lowe 2002) notes, in particular, the possible effects of different methods and standards of intangible valuation on the aggregate economic conditions. The role valuation techniques of intangibles may play in this pursuit includes at least three general functions:

1. To enhance conditions for the generation of new knowledge. This entails the organization of markets for new knowledge, relative structures and appropriability mechanisms. The dissemination of knowledge and its spillover effects is also dependent on the existence of mechanisms for appropriability which can efficiently balance incentives to generate new knowledge against effective modes to spread it.

2. The (dynamically) efficient allocation of resources, such as financial, human and knowledge capital across economic activities. Given the importance of these factors to economic growth, their more effective utilisation becomes a major policy issue;
3. The uncertainty generated in the economy when there are systematic and large gaps between the market value of companies and the book value of their tangible assets. New reporting techniques on firms' intangibles may reduce this gap and contribute to more stable economies. It is not our intention here to discuss the complex interactions between institutions, such as reporting standards, the financial system and macroeconomic trends. However, it is important to recognize that reporting techniques help determine how the market factors-in risk during the course of a business cycle. It raises the question of whether it is possible to reduce macroeconomic instability and avoid procyclical tendencies by means of well-designed and new reporting techniques. In short, what may be the macroeconomic effects of the new reporting initiatives on market perception and distribution of risks?

A final issue that is perhaps underestimated in the literature relates to the potential costs of a mandatory standardization of information disclosure of intellectual assets. In general, there is reason to suspect that poorly designed accountancy standards may be detrimental to the functioning of intangible markets. This raises the question of what the potential dangers of this exercise are. This is an issue that we leave to future discussion (see, however, Chapter 3 in this volume). However, some important issues here would involve reporting incentives, macroeconomic effects, costs – particularly, for the SMEs, arbitrariness of what is reported and what is not, and so on. In any case, a bad standard for reporting may prove to be significantly worse than no standard at all.

3 BRIEF SURVEY OF INTANGIBLE VALUATION APPROACHES

In other markets, such as those for products, it can be relatively uncomplicated to arrive at a 'fair market price'. One often has the advantage of being able to look to the sale prices of equivalent goods in order to get to get an idea of the 'going price' and value the good on this basis. Market surveys are also applicable in such situations. Determining the fair market value of an intellectual asset, however, is much more complicated. One point is that there is no market to survey for a new and unproven idea. Another is that the novelty implied in these assets means that such equivalent benchmarks

are not available, especially in the case of more radical ideas. Indeed, formal valuation of intellectual assets faces many challenges.

In view of the rising need for reliable valuation methods, a surprising diversity of approaches has developed in recent years (for example, Cañibano, et al. 1999). One investment-literature orientated survey (Sveiby 2002) identifies 21 approaches for measuring IAs. This section surveys several types of valuation methods for intangibles, especially those involving IPRs. The survey also takes into account that approaches also vary as to how they are designed to be used and by whom. We note that the applications for the different approaches range from designing econometric models, to improving accountancy standards for equity markets, to generating more specific tools for corporate management.

3.1 General Characteristics

There are basically two classes of approach: (1) the cost-based approaches which proceed from different methods to estimate the cost to develop the asset or an asset that accomplishes the same thing; (2) value-based approaches, which utilize discounted cash flow analysis or other approaches such as real option methods (familiar from financial theory) in order to predict market value. In addition there is a set of other tools that attempt more indirectly to estimate values not only prices. The individual approaches are characterized by different foci and different objectives. As a result they have different strengths in different contexts. In general, measuring 'intangibles' is done for a variety of different reasons. An accountancy/business management perspective wants to measure such assets in order to assist in decisions related to mergers and acquisitions or other investment decisions, to manage patent portfolios, to monitor the firm's performance/potential and report to shareholders, and so on. A financial analyst/investor perspective broadly wants to understand the same phenomena about companies, although their reasons for doing so are fundamentally different. In addition, theoreticians want to understand a wide range of phenomena, including more aggregate concerns, such as how such assets are allocated in the economy.

In addition to understanding why intangibles are being measured, there are differences in interpretation of what is considered to be an IA. As the motives for measurement suggest, there is a large range for what falls under the category. These vary in degree of 'intangibility' and the degree to which the company has control over it as an 'asset'. At the one end, we have 'IAs' that estimate human capital as a residual category of company value. At the other, we have intellectual assets as covered by patent, design right, trademarks or through contracts.

3.2 Distinguishing Patents and What is Patented

A first step to addressing the value of intellectual assets is to distinguish between the underlying invention – which might be called the underlying intellectual asset – and the IPR, which confers exclusive rights over that invention. This distinction implies that the direct financial value of a patent is the value of potential profits obtainable from fully exploiting the invention defined by the patent's claims that are in excess of those obtainable without patent protection.

On this basis, Pitkethly (2002; see also Chapter 14 in this volume) distinguishes the commercialization of inventions from the patents protecting such inventions on the basis that they hinge on one another, but are not co-dependent. In the one direction, the ability to commercialize an invention depends on many non-IPR factors, such as speed to market, control of complementary assets, and so on. In the other, IPRs may remain valuable even if the inventor no longer has any interest in direct commercialization. That is, a patent provides a right to protect anything falling within the scope of the claim, irrespective of whether the idea is commercialized and by whom. This gives the patent-holder the scope, for example, to use patents as a tool to measure internal technical staff, as a signalling mechanism in the market (for example, to potential collaborators), as a gate-opener in joint ventures or as strategic asset during standardization activities (see Chapter 10 in this volume).

In terms of valuation, the strength of the IP is nonetheless a critical factor in valuation approaches. The existence of a patent and its status provide important indications of the value of the asset as perceived by the applicant. Patenting can indicate that the applicant expects the invention's value to exceed the cost of filing for the right. The subsequent grant and the payment of maintenance fees provides further suggestion of the value even where there is no other indication of the invention's value reflected either directly on product or licence revenues or indirectly through value on the equity markets. The choices made at different points provide salient indicators of the asset's value environment. These information points have been picked upon especially by real option approaches, which we focus on in section 3.3. Another type of information that is developed by the process of patenting is patent citations. These have increasingly been used to identify important patents. We will feature approaches that use citations in section 3.4.

3.3 General Approaches to Valuation

Against the background above, we explore some different approaches to intangible valuation currently being used. These range from the more

conceptual-based models that have emerged to address general management issues to the more technical approaches with roots in accountancy and actuarial work. We look first at the latter dominant tradition which can be divide into two sets of approaches:

- *Cost-based approaches*: these tend to proceed either from the costs related to the generation of the IA in question and/or cost estimates for a potential buyer to develop a solution which is the same or which accomplishes a similar result. Accordingly, this type is the more conservative approach and is favoured by some (especially in times of economic downturn) as providing relatively dependable valuation results at the lower end of what the asset may be worth. The issue is how they are used. They are arguably better at reflecting value to the asset-holder but less useful for financial markets, although they are rather limited in either case. One limitation in the latter case is that the market is interested in information about the value (not the cost) of internally generated intangibles.[2] In the former case, the approach can be useful to account for the accumulated development costs of a project or programme in cases in which these cannot be fully recouped for extraneous reasons.
- *Value-based approaches*: these tend to provide higher valuations than cost-based approaches. The basic approach attempts to establish what the market (especially the equity market) perceives the value contribution of intangibles to be when they asses company value. This set of methods is based on the strong assumption that capital markets are efficient, in other words that there are no imperfections in the market of IAs due to imperfect and asymmetric information. This is a serious limitation if the aim is to find the intrinsic value of the intangible. On the other hand, this approach provides tools to systematically investigate the shadow value (or marginal contribution) of each intangible relative to tangible assets (see Bosworth et al. 2000; Chapters 6–9 in this volume).
- Two recent developments are noteworthy within these traditions. The first involves what the valuation is used for. The assessment of patents donated to charities – which qualify for tax deduction in the US – has recently provided a surprising scene in which to test acceptable norms for patent valuation. The perception that donations were being overvalued led in Autumn 2004 to the introduction in new legislation in the USA, (HR 4825) of a provision to limit value setting either to a cost-based or a fair-market value estimation, whichever is smaller.[3] The bill has been signed into law.

- A more analytical development has taken place within value-based approaches where option-based methods have gained currency. These methods represent a relatively new and promising approach to the valuation of IAs, which involves option-pricing techniques. Here, real option valuation methods are used to factor-in risk and other properties that may be captured in the option element of the intangible. One of the weaknesses of this approach is that the determination of the parameters necessary for estimating the real option value may become somewhat arbitrary (see below).

3.4 Conceptualizing Tools

Another line of approach involves conceptual models which can function as management tools. Approaches such as the intellectual capital model or the balance scorecard can be characterized as belonging to 'the new reporting paradigm' (see Upton 2001: 21). The balance scorecard (Kaplan and Norton 1992) is one high-profile approach that addresses the limited applicability of financial reporting standards to firms with disproportionately high IAs. It tries to account for the aspirations of investors, customers, employees and suppliers in creating value, ultimately at the financial level. A further example is the Canadian Performance Reporting Initiative (CPRI). The fundamental premise behind CPRI is that the market and the firm need to acquire more insight into pre-transactional and forward-looking value-creation processes of the firm. The approach believes that traditional financial reporting is inherently limited in its ability to measure value creation. This suggests the need for a parallel reporting system to traditional cost-based financial reporting that enables measurement of value creation as it occurs.

3.5 Focus on Real-Option Based Approaches

Real-option based approaches offer some of the most productive ways to address the valuation question, so they deserve more attention. Option-based valuation approaches provide a particularly apt framework in which to consider the management of companies' patent portfolios and other IPR assets. These approaches are based on option pricing in financial markets. Option pricing theory (OPT) understands an option to be a financial instrument that gives a right but not an obligation, at or before some specified time, to purchase or sell an underlying asset whose price is subject to some form of random variation.

This basic concept can be applied to situations other than financial options. Such non-financial options are known as real options. An example of a real option may be an R&D project. The cost of an R&D project

BOX 13.1 BASICS OF OPTION PRICING

A call option is an agreement often associated with stock options, which allows the contractor to buy a specified volume of a security (often a certain number of shares of the underlying stock) at a predetermined strike price within a given period. In contrast, a 'put option' allows but does not oblige the party to sell a security according to the same conditions. There are two types of option contracts; the American and European. Their difference lies in the exercise possibilities or when value can be realized.

- European options: European options can only be exercised on the expiry date of the contract.
- American options: American options can be exercised throughout the entire term.

Valuation of patents has been estimated on the basis of pricing methods of American options given the fact that patents can be exercised throughout the entire period in which the patent is valid, including the expiration date

may be identified as the price of a call option (see Box 13.2) on the future commercialization of the project and the future investment needed to capitalize on the R&D programme with the exercise price of the option. This approach is particularly apt where choices are involved – such as the choice to patent, to renew a patent, and so on – and where different outcomes can be envisaged. Taking account of such choices and such potential outcomes can lay the basis for a much more realistic valuation of assets than approaches that do not factor these in.

Patenting involves several, largely sequential, types of choices or options and, therefore, it is theoretically possible to divide up the various stages of the life of a patent into a series of options. First, there are the options comprising expansion, deferral and abandonment of the patent rights. Second, there is the option of licensing the patent. Patent royalty cash flows may be then considered as a perpetual American option. Third, one also has the option to sell the patent and the option not to license the patent. This gives two additional options. In principle, it should be possible to value each of these options using some of the concepts from real option theory. To explore these possibilities, various approaches have attempted to link value to individual stages in the life of a patent. The comprehensive study

of Schankerman and Pakes (1986) is a notable example, which serves to establish the connection between the willingness of patent-holders to pay renewal-fees at regular intervals and patent value.

Real option theory predicts that early in a patent's or applications' life the option component is likely to comprise the major part of the patent value. This value is often considerable. The theory, in fact, supports the view that, early in their lives, one should usually renew patents even in the absence of any current returns. However, much work remains in developing the practical application of option pricing theory. On the other hand, pricing techniques of IPRs based on real option theories are already being used by market analysts in certain areas, and this approach deserves more attention. In fact, real option theories provide a new conceptual framework for a whole range of innovation policy issues (see Chapters 14 and 15 in this volume).

3.6 Focus on Citation-based Approaches

Another approach, which has increasingly been applied in theoretical analysis, relies on information found in individual patents. These approaches use the citations that patents make to antecedent patents. The expressed purpose of these citations is initially to distinguish the citing patent from the technological state of the art, as represented by the cited patent. This differentiation from other inventions provides trails of citations which then can be used at one level to establish the technological importance of the invention among its cohorts. At another level, the intensity of citations can be understood to indicate the commercial importance of the invention. In terms of 'valuation', this dynamic is thus indicative of the 'impact' of patented technology.

The association of citations with some 'impact' measure is based on different assumptions about what citation streams indicate. Sampat and Ziedonis (2003) indicate that, in general, citations can be interpreted to reflect entry into profitable areas of research and/or technological opportunities or market interest in a technological area. In this setting citing patents can be seen as reflecting knowledge spillovers from earlier inventions, thereby suggesting that some of the value spills over to subsequent inventions (that is, the citing patent: see Box 13.2). In the other direction, cited patents might also reflect a 'publicity effect' whereby economically successful patents are more widely known and therefore more often cited.

In different ways, the literature on this front has indicated that:

- citation counts are indicative of knowledge spillovers and, by implication, of the generation of higher levels of 'social value' (for example, Jaffe, et al. 2000)

- citation-weighted patent stocks are indicative of the level of firm-value (Hall et al. 2000)
- citations are a good indicator of whether a patent is licensed (Mogee 1997), but not of licence revenues (Sampat and Ziedonis 2003)

In addition, citations have been used as just one of a number of approaches to valuation, reflecting the complexity of the valuation question and the need for a range of different data. Harhoff et al. (1999) have combined citation analysis with interviews and surveys in the case of particularly important inventions. This combined approach is promising, and it confirms a relationship between citations and value. In addition, Lanjouw and Shankerman (1999) have analyzed patent citations in the light of other information to construct composite measures of 'patent quality'. Adjusting for quality in this way improves the analysis both with regard to R&D expenditure and to economic significance.

BOX 13.2 THE CITATION-BASED APPROACH USES THE EXTENT OF CITATION STREAMS AS AN INDICATION OF THE VALUE OF THE PATENTED TECHNOLOGIES INVOLVED

- Citations made by a given patent (so-called 'backward citations') can imply something about both the quality of the citing patent and the degree of extra value that it derives in the form of a knowledge spillover from the cited patents. The number of citations made is thought to represent how much of the extra (social) value from previous inventions is being captured by the citing patent. By citing earlier patented technology, the citing patent is to a certain degree capturing excess value (a dividend on the social return) of the unappropriated value of the cited patents.
- Citations made to a given patent (so-called 'forward citations') can indicate how important the cited patent is, and therefore indicate something about its value. The citations streams can indicate an important new technology and/or market.
- Limitations: patent citations take years to develop, so they are best used retrospectively and not in real time. Nonetheless, they can contribute to more comprehensive analysis, for example, in association with interviews.

4 IMPORTANCE OF ACCURATE VALUES: EVIDENCE FROM NORWEGIAN PATENTING

The successful transformation from IAs to value in competitive markets is contingent on a multitude of factors, many of them external to the firm. How do IAs fare as firms attempt to navigate these contingencies? In light of the theoretical discussion above, this final section explores Norwegian patenting behaviour for indications as to how the knowledge market functions in Norway. It is based on a study sponsored by WIPO to understand how SMEs use the IPR system in Norway (Iversen 2003). This glance through a patent lens[4] suggests that some firms in particular have difficulties navigating the contingencies along the way from new knowledge (that is, the patent application) to IA (that is, a valid patent grant). In this exercise, we observe how different size classes of firms enjoy different levels of success in terms of grants – the smaller the firm, the higher the probability that it withdraws the application. Withdrawal rates reveal something about the way individual firms evaluate the worth of their IAs and their ability to realize that worth.

4.1 Patenting and Value

The premise for this exercise is that a patent application represents accumulated knowledge, as well as some economic return or other value. The fact that an economic agent applies for a patent indicates that the firm believes that it has accumulated novel knowledge, which it considers to be an asset with commercial possibility. We recognize, of course, that this mode of formalizing one's IA is neither equally attractive nor equally pertinent to all new economic knowledge in all firms in all industries. Nevertheless, those who do apply dedicate resources (both in time and money) in the quest to derive some value from new knowledge that they presumably have developed.[5]

In the light of this, we interpret withdrawal to mean that, in one way or another, the initial value expectations by the applicant are disappointed. The fact that an applicant withdraws their own application may be due to a number of reasons. There are two main types of interpretations. The first is that withdrawal indicates something about the quality of the invention and/or of the application. In other words, withdrawal can indicate that the application was poorly framed and the applicant had reason to believe that it would not be granted in an acceptable form. Alternately, withdrawal can be interpreted in line with a renewal approach, as an early indication of doubt about the invention's realistic potential value; indeed, many would assume that the quality of these patents is at the lower end of the scale.

The interpretation that immediately relates firm-size with quality may well seem plausible on a case by case basis. However, since value is ultimately established on the market, such an interpretation ignores the fact that new technologies are inherently difficult to value in the face of comprehensive uncertainty. Furthermore, it tends to discard out of hand the role that other complementary factors may play in generating value from new technology. The second type of interpretation therefore involves accessing these complementary assets, or more to the point, the inability to do so. One likely reason for why an applicant does not follow up the application (following a fee schedule) is that the funding necessary to bring the idea to market is insufficient or has run out (see the discussion of the capitalization process above). Another scenario is that the small firm withdraws its application before publication due to uncertainty about its ability to defend itself against the threat of litigation by larger more powerful firms.

4.2 A Decade of Domestic Patenting in Norway

The WIPO study indicates several aspects about the Norwegian knowledge market. The first is largely anecdotal. In raw terms, innovative Norwegian firms tend to be less active in protecting their IP than firms in other European countries (Eurostat 2004). Whether this is due to their failure to recognize the value of their IAs or to some other reason[6] is not known. One can assume a problem (especially among some firms) in recognizing IAs and formalizing them. As indicated, one potential advantage of improved valuation exercises is that they might encourage firms to take stock of their IAs.

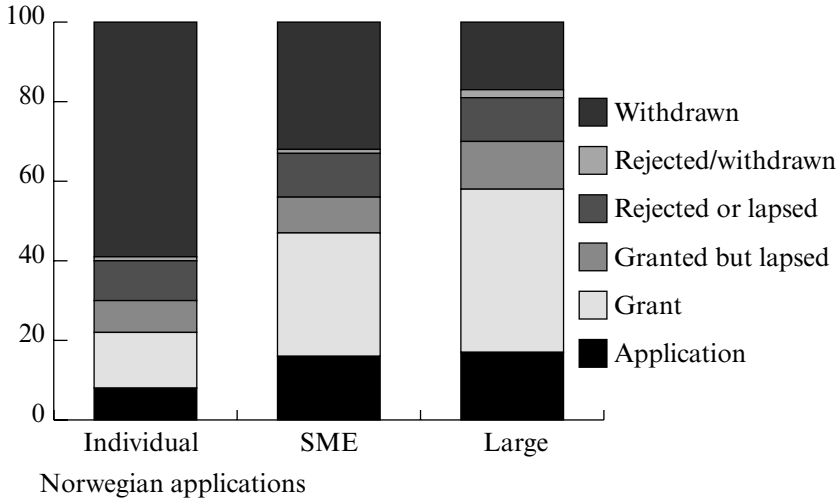
A second observation, however, is that Norwegian actors, not least SMEs, have used the patent and trademark systems more actively in the course of the 1990s. This suggests that the knowledge base is growing, the propensity to formalize intangibles is growing, the propensity to use the IPR system is growing, or a combination of these. In this situation, it is important to make sure that all actors have realistic expectations about the innovation process and that they have equal chances to derive value from it.

A final general observation is that the propensity to get as far as a patent application is strongly dependent on the size of the firm, for whatever reason. Smaller firms, on average, are much less likely to apply for patents than larger ones, even in the same industries. For example, large firms (over 100 employees) in the electrical equipment industry filed on average 1.6 applications in Norway, while medium-sized firms (50–99) on average filed 0.25 applications in the same period; the smallest are almost off the chart (0.03). This suggests that large enterprises tend to be more innovative, are better at recognizing the potential of IPRs to make the most of their new knowledge, are in a better position to capitalize on formalized IAs, or a combination these factors.

More generally, there are grounds to expect smaller firms to produce inventions more infrequently than larger ones. As a result, less experience and expertise accumulates in the smaller firms and this, in turn, puts them at a potential disadvantage when pitted against firms who are accomplished users of the patent system and who build up this competence in house. (see Bosworth and Wilson 1978).

4.3 Size-dependent Patent Withdrawal

A more specific point from the WIPO report is that SME patents are more often withdrawn than those of large entities. This raises the suspicion that smaller entities find it more difficult than larger ones to follow through on their attempts to capitalize on formalizing IAs. In this vein, Figure 13.1 shows that 'success' in Norwegian patenting is indeed dependent on firm size. There may be many factors behind the differences in success rates, where 'success' is measured as non-withdrawal. Part of the explanation is probably to be found at the firm level: larger firms have a better working understanding of the IPR system, they have internal resources (and, thus, staying power and fighting power in litigation), and they have a more conscious and better informed policy about IAs built into the enterprise's business strategy.



Source: Iversen, 2003)

Figure 13.1 Norwegian applications by size-class and status (per cent, N = 12,277)[7]

The reason that a much larger proportion of SME applications have been withdrawn (one-third), compared with large enterprise applications (one-sixth), has to do both with such internal factors. However, it presumably also involves factors that are external to the firm, especially access to funding at critical stages in the development process. In general, the differences in withdrawal rates suggest several types of factors might be at play, including:

1. Smaller actors, especially independent inventors, tend to overestimate the value of their IAs going into a formalization process.
2. Smaller applicants are forced to cut losses during the long development process because of difficulties in accessing complementary assets – especially funding. This suggests that many, perhaps good ideas, are not developed because of the capitalization problem and the functioning of investment markets.
3. Smaller applicants have a poorer working understanding of the patent system and could use a greater degree of assistance when approaching it.

4.4 Some Implications

In terms of valuation and capitalization of IAs, this exercise indicates that there is potential to raise the efficiency of the utilization of IAs, not least in a country with a large population of small enterprises. Here, the domestic patenting record illustrates that the value of IAs is by no means predetermined or constant. The fact that smaller firms patent less often, on average, than larger enterprises indicates that something about the generation and/or utilization of new knowledge and/or that the propensity to utilize the patent system is subject to scale.

If we interpret this observation to mean that scale can influence the degree of formalizing IAs, we can posit two implications for improved valuation methods. The first is that standard methods need to take into account this type of difference. The second is that, as small firms become acquainted with valuation methods, there is the possibility that they might become more aware of the potential value of their IAs. A positive side effect might be that they will more actively integrate a policy of formalizing IAs into their business strategy.

The size-related tendency to withdraw patent applications emphasizes the importance of improving firm-internal processes. The large proportion of SME withdrawals indicates that we face a need not only to increase awareness, but also to increase expertise about formalizing IAs. Here it is important that the smaller enterprises also have a realistic expectation of

the potential value of IAs in the face of great uncertainty. The routinization of valuation exercises can promote this at the firm level.

Establishing accepted standards for IP valuation may have a more instrumental affect in terms of factors external to the firm. We need also to increase awareness and expertise not only in other companies, but in the institutional framework surrounding these companies. This wider recognition and more nuanced view of IAs, especially among banks and funding agencies, might improve the way financial markets work in relation to innovating firms.

5 CONCLUSION

Value creation in the economy is connected to knowledge creation, dissemination, and utilization in its constituent enterprises and institutions. Methods to improve the way intangibles are recognized and valuated via accountancy methods can improve the way the market for knowledge functions and, moreover, the way that emerging knowledge market interacts with established financial markets. The purpose of this chapter has been to explore the relationship between valuation of intangibles and innovation processes, which was done both in theoretical and empirical terms. The ultimate goal is further off. The goal facing us is to improve the way intellectual assets are generated and utilized in an environment in which IAs have become more important.

The discussion above suggests that, in order to improve the efficiency of the changing market for knowledge, it is first necessary to develop a finer-grained understanding of the problems different types of firms currently face in capitalizing on their intellectual assets. Better diagnosis is needed to assess the degree to which such problems tend to originate within the firm (for example, breakdown in their innovation management) and to understand this component within the context of problems that stem from outside the firm (for example, funding conditions, threat of litigation, uneven playing fields in collaboration, and so on). Improved modes of recognizing potential value, of attracting capital, of improving interfaces with collaborators and users, and of levelling playing fields between rivals can then lead to improvement in the overall conditions for the generation, diffusion and exploitation of new knowledge.

Given an improved understanding of the problems that SMEs in particular face, a next step would be to consider the applicability of the many instruments that already exist in different national and regional settings. These include measures designed to improve awareness and expertise in dealing with the IPR system, to improve the support structures,

to differentiate the patent system to include 'petty patents' for lower-quality inventions, to develop insurance schemes against the threat of litigation, and so on (see Iversen 2003, for a set of recommendations). Such measures could be systematically assessed both in terms of their potential success to remedy the problem as well as in terms of consistency with the overall innovation system into which they are introduced.

NOTES

1. The term used by the UNECE High Level Task Force on Valuation.
2. Cost-based models may provide third parties with important information in certain cases, such as establishing the amount eligible for tax deduction for patent donations in the USA. See note 3.
3. See http://www.thomas.loc.gov/cgi-bin/bdquery/z?d108:h.r.04520. The donor can furthermore claim a percentage of the profits generated by the charity from the patent as a tax deduction. For a presentation, see www.independentsector.org/programs/gr/inkinddonations.htm#Patents.
4. Based on the WIPO study, the patent lens used here picks up 6,303 Norwegian entities who, together, were involved in 14 319 'active' domestic patents during the 1990s. By 'Active', we mean any patent that was applied for and/or granted during the 1990s *and* any patent applied for before then but granted during the 1990s.
5. We recognize that the 'value' of patenting will differ among these actors and across time. Primarily, the value is seen in terms of aid the competitive position of the firm by affording it the room to cultivate its distinct qualities without threat of direct competition from imitations. In addition, there are other ways in which patenting can hold 'value' for the assignee which do not immediately involve dollar sign: for example, signals to the market, strong-fences in R&D collaborations, and so on.
6. That is, related to the competitiveness of their markets, the relevance of patenting to their markets, and so on.
7. 2,042 unknowns and unregistered applications have been removed.

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