

ENHANCING INTELLECTUAL PROPERTY MANAGEMENT AND APPROPRIATION BY INNOVATIVE SMEs



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Enhancing IP Management and Appropriation by Innovative SMEs

This briefing paper is meant to inform policy-makers working to enhance the performance and thus positive economic impact of innovative small and medium enterprises (SMEs), in particular by supporting their effective intellectual property (IP) management.¹

The paper provides an overview of the various internal and external factors that may influence SMEs' approaches to IP management, presents the main types of strategies they adopt to this effect, discusses how they might improve their IP management, and articulates a number of recommendations for policy-makers. The analysis focuses on the protection of inventions and physical processes, drawing on academic literature covering a range of emerging and developed countries, and on interviews with business leaders from innovative SMEs in high technology sectors.

¹ Definitions of 'SME' vary. Small and medium enterprises may be defined based on annual revenue, number of employees, or both. For instance, the European Union uses both of these criteria, identifying SMEs as companies with fewer than 250 employees, annual turnover of less than Euro 50m, and an annual balance sheet total not exceeding Euro 43m (EU 2005). It must be noted that there is much heterogeneity among SMEs, even of the same size and in the same sector and market (Stam & van Stel 2011).

Introduction

Innovation helps individual firms to maintain their competitive edge, contributing to expansion of capacity and also generating additional capital investments, productivity, technological advancement, employment, and growth (Stam & van Stel 2011). It is not enough for a firm to create something new and useful. The firm must also succeed in appropriating the value of its innovation (Teece 1986).

‘Appropriation’, a term that is widely used in literature on innovation, refers to the act of capturing the value of one’s ideas and investments in developing and bringing them to market. If a firm is unable to appropriate, or capture the value of, its intellectual property, competitors may imitate its offerings without significant investment. This could eliminate its competitive edge, together with the incentive to continue to engage in risky innovative ventures (Teece 1986).

The main objective of IP management strategies is appropriation. In addition to this goal, sound IP management can help innovative SMEs achieve a range of objectives, including securing investment, identifying and attracting potential partners or buyers, deriving value from collaborations, and managing litigation risks. SMEs tend to work to a significant degree with external partners, in order to fill gaps in their own resources and expertise and also because their niche expertise is attractive to established players. Collaboration carries the risk of knowledge leakage to rivals and thus requires judicious management of intellectual assets. Given their limited resources, innovative SMEs need to develop strategies that are resource-effective to protect and manage their IP.

Overview of SMEs

In general, SMEs are significant contributors to employment and job creation across countries. According to a recent study, based on data from more than 100 developing countries,² firms with fewer than 250 employees were found to account for over two-thirds of employment in the median country (Page & Söderbaum 2012). In OECD countries, SMEs represent 99 per cent of all enterprises and are important drivers of job creation, accounting for two-thirds of employment (OECD 2010). For instance, in the United States (US), between 1993 and 2011, companies with less than 500 employees created 64 per cent of all new jobs, and more recent data shows an even greater impact (SBA 2011; ADP 2013). Low firm age, a feature generally associated with SMEs, is also correlated with job creation (Haltiwanger *et al.* 2010).

So-called ‘innovative SMEs’ represent a particularly impactful category of SMEs. These firms have a high propensity to experiment and to generate new inventions and processes, and they tend to be concentrated in high technology sectors. Innovative SMEs have the potential over the long-term to contribute substantially to improvements in productivity, competitiveness, and technological progress in their sector and the economy as a whole (Ohler *et al.* 2007; OECD 2010; Pederzoli *et al.* 2011). They may be identified based on self-reporting and surveys, patenting activities, and activities in the market (Filatochev *et al.* 2009; Pederzoli *et al.* 2011; Thomä & Bizer 2013; Tomlinson & Fai 2013). Success of innovative SMEs is underpinned by effective exploitation of intellectual assets, active involvement in networks, and access to adequate finance (OECD 2010).

2 Drawing on World Bank enterprise survey figures, Ayyagari *et al.* (2011) developed this data set in a study setting forth what is considered to be the most comprehensive analysis to date of the relationship between firm size, firm age, and job creation in developing countries.

This briefing paper focuses on innovative SMEs that develop and commercialise inventions in high technology sectors, such as life sciences and advanced manufacturing. The terms ‘innovative SME’ and ‘SME’ are used interchangeably in reference to such firms.

SMEs’ qualities and challenges

In general, innovative SMEs exhibit a higher degree of flexibility than larger firms, which allows them to respond more nimbly to signals from the market (Revilla 2012; Thomä & Bizer 2013). In fact, being small and – generally – young businesses, they are relatively unhindered by the bureaucracy and inertia that may characterise larger firms, which can lead to slower information flows, less flexibility, and less creative thinking (Revilla 2012). Hence, SMEs may have an advantage in domains with rapid technological advancement and disruptive technologies. What is more, especially in earlier stages of research and development (R&D), innovative SMEs are often close to sources of technological knowledge such as universities or research centers (Audretsch & Vivarelli 1994; Rogers 2004). Thus they tend to do particularly well when innovation depends on being close to science (Revilla 2012).

In contrast, larger firms are better able to spread the cost of R&D over a more extensive and diversified sales base. They often have the resources, experience, and knowledge needed to successfully commercialise new offerings, which gives them an advantage where knowledge is cumulative (Revilla 2012). In addition, they are generally more sophisticated in protecting and managing their intellectual assets, in no small part due to experience and resources (Revilla 2012). Finally, they are less threatened by the impact of litigation, the cost of which can have a devastating impact on SMEs (Friesike 2011). While SMEs may be more nimble and, depending on the conditions, more innovative, larger firms enjoy a resource advantage.

Indeed, scarcity of resources, together with insufficient non-core expertise, is a key challenge for innovative SMEs. SMEs tend to lack not only physical assets but also a record of success and assets that banks can use as collateral (Rassenfosse 2012). New innovators often encounter early-stage financial stress, especially in places with inadequate venture capital (VC) systems, as they resort frequently to the more costly debt markets. Information asymmetries between entrepreneurs and investors, which result from the latter’s incapacity to adequately assess R&D projects, magnify these problems (Lerner & Hall 2011). Quality patents and a strong IP position can help innovative SMEs signal the value of their invention to the market in general and, specifically, to potential funders and partners (Pederzoli *et al.* 2011). However, SMEs are unlikely to invest in creating a strong IP position unless they are aware of the value of managing their intellectual assets and of the appropriate tools that can be deployed to this end.

In addition to lack of financial resources, SMEs may face a host of other – endogenous and exogenous – constraints, such as lack of scale, competition and market entry problems, poor infrastructure, and lack of distribution channels and marketing expertise (Lee *et al.* 2010; Diallo 2012; WIPO 2013). It has been suggested that international aid programs for SMEs be restructured to focus more on the provision of training for individual entrepreneurs, in addition to fostering ‘investment climate reforms’ that improve the overall environment for doing business (Page & Söderbom 2012). Targeted training, whether international, regional, or national, can help managers of innovative SMEs to address internal constraints and attract partners and investors, including through IP management. Training could also help them to obtain more value from their companies’ inventions and collaborations.

What is more, evidence increasingly points to the value of fostering SMEs' participation in innovation networks and collaborative ventures. Partnership can enable a smaller firm to leverage its competitive advantages while filling gaps in expertise and resources, by working with small and large firms with complementary skills (Lee *et al.* 2010; Zeng *et al.* 2010). For larger firms, collaboration with innovative SMEs is useful, enabling them to gain access to new technologies and state-of-the-art engineering talent, and helping them to obtain technology advantages in their competitive environments (Alvarez & Barney 2001). Sound IP management strategies are important to the establishment of partnerships, and to ensuring they benefit all parties involved.

Collaboration to intensify innovation and fill resource gaps

Often innovative SMEs display proficiency in a specific niche field, whereas they generally lack expertise in crucial areas outside of their core offerings. Therefore collaboration can be instrumental in bridging gaps in competence that may otherwise hinder an SME's success (Lee *et al.* 2010; Revilla 2012). SMEs use collaboration to shorten innovation time, gain complementary experience and resources, reduce risk and cost, and increase the flexibility of their operations (Lee *et al.* 2010). They may partner to get access to market and sales channels at the commercialization stage, thus relying on established firms to help bring new solutions to market. Larger firms also benefit from collaborative R&D and, in some sectors, innovative SMEs are an increasingly central part of the innovation pipeline of established players.

Collaborative innovation is particularly important for SMEs

To overcome disadvantages linked to their relative lack of resources and scale, as well as gaps in business expertise, innovative SMEs often engage with entities with complementary assets. SMEs and bigger firms alike benefit from flows of know-how resulting from formal and informal interactions, which can accelerate product development, improve the innovative process, and hasten the commercialization of new solutions. Successful collaborative, or 'open', innovation is underpinned by judicious management of IP to prevent unanticipated free-riding by partners or potential rivals.

- **Joint R&D with universities or research institutes:** Cooperate on research and on the search for commercial applications for new research.
- **Work with larger firms:** Leverage complementarity of resources, skills, and technology solutions to develop and commercialise new offerings.
- **Partner with other SMEs:** Work together to offset larger firms' size advantages, cross-licensing patents and know-how.
- **In-license:** Obtain needed technology without the cost of developing it in-house.
- **Out-license:** Access marketing channels, marketing skills, manufacturing expertise, or other complementary assets needed to bring an innovative product to market.

Networking among SMEs can help them to achieve economies of scale and to merge and integrate diverse and complementary technologies and competences (Yoffie & Kwak 2006; Williamson & De Meyer 2012). In many places, including Korea and China, localised networks have been found to help innovative SMEs to offset the size-related advantages of larger firms (Lee *et al.* 2010; Zeng *et al.* 2010). Within a network of several firms with complementary knowledge and expertise, an SME can benefit from the strengths of its partner firms, and the network can generate a greater total surplus than what each partner could generate separately (Lavie 2006). Working with other firms is associated with certain risks, such as technology and know-how leakage to potential rivals, but this risk can be lessened with judicious intellectual asset management. Overall, for SMEs, the advantages of partnership tend to outweigh the costs including investments in IP management (Gomes-Casseres 1997; Hsieh *et al.* 2011; Tomlinson & Fai 2013).

In later stages of product development, as technology becomes more complex and cannot be realised completely within one firm, the ability to successfully engage in collaborative innovation (also called ‘open’ innovation) becomes a more important factor of success (Lee *et al.* 2010). SMEs involved in multiple collaborations have been found to be more innovative (Power & Owen-Smith 1999; Baum *et al.* 2000).

In the context of collaborative innovation, attracting foreign technology partners can be highly valuable for SMEs. Export orientation, together with active engagement in innovation networks, is a key factor associated with rapid growth and success of innovative technology SMEs (Filatochev *et al.* 2009). Exposure to the more intense competition in international markets can stimulate innovation among SMEs (Neuhäusler 2012). International orientation for smaller firms is also positively associated with the movement of people and therefore of tacit knowledge. Know-how moves with individual entrepreneurs, who can be powerful accelerators of internationalization and innovation (Filatochev *et al.* 2009). However, internationalization also introduces challenges for innovative SMEs, such as the need to develop more sophisticated and often costly strategies for protecting intellectual assets across borders.

Geographic proximity – through participation in clusters, for instance – can support SMEs’ interactions with other firms, positively impacting productivity and the capacity to innovate. Local concentration of quality human resources, needed inputs, and related services facilitates partnership and the formation of new firms (OECD 2010; Hsieh *et al.* 2011). Even informal interactions among entrepreneurs, resulting from physical proximity, can enhance the sharing of knowledge and spur innovation (Lee *et al.* 2013). Governments can catalyse innovation interactions and the sharing of knowledge by supporting the creation of incubators, innovation networks, and clusters.

Collaboration with customers is also particularly useful for innovative SMEs. This type of collaboration can provide SMEs with access to advanced technology, as well as access to knowledge from downstream customers, such as insights about standards, best practices, and lean operating strategies. Integrating customers’ competences and their feedback into the innovation process can provide valuable input and feedback, enabling an innovative SME to fine-tune its offerings and ensure that products develop in the most strategic direction (Tether 2002; Tomlinson & Fai 2013). It can also help an SME integrate process innovations that enhance operational efficiency and productivity. Close relations with their clients and suppliers can help innovative SMEs to combine and share resources, adapt and improve offerings and processes, and enhance knowledge flows, contributing to organizational learning for all involved (Tomlinson & Fai 2013).

Case Study: SME Innovation Network in Korea

The Korean Integrated Contract Manufacturing Service (KICMS) is an initiative of the Korean government aimed at enhancing collaboration among, and thus success of, innovative SMEs. Founded in 2004 by the Korean Small and Medium Business Administration, KICMS aims to achieve business synergies among SMEs across sectors through collaborative innovation, to enable them to successfully commercialise new technology solutions and compete against larger firms.

KICMS works by temporarily connecting venture firms and innovative SMEs in project-specific 'cross-sectoral consortium families', or CF². Each SME focuses on its area of particular expertise, leaving other specialised functions to be carried out by partner SMEs. This enables the participating SMEs to gain access to complementary skills and knowledge while leveraging their own competitive advantages, in order to commercialise competitively as a team. KICMS acts as an intermediary, helping to set up collaboration frameworks, identifying and connecting possible partners, supporting marketing efforts, and providing services such as advice on taxation and intellectual property management.

By 2007, KICMS had 4415 firms participating in the network, and it had facilitated the creation of 51 separate CF² projects. A 2010 assessment identified a number of successful R&D collaborations facilitated by KICMS, including one project involving five innovative technology SMEs that led to the successful global commercialization of an innovative antenna technology, the 'Wave Guide Horn'. In addition to successful business collaborations, KICMS has been credited with stimulating active technological discussions and knowledge exchange among its member SMEs, laying the foundation for future collaborative innovation.

Source: Lee et al. 2010; www.smba.go.kr/eng/index.do

Cooperation with research centers and universities is similarly advantageous for innovative SMEs, particularly in the initial stages of technology development (Zeng *et al.* 2010). Such interaction is also valuable in enabling academic research to be exploited and commercialised (Geissler 2009). Faculty involvement in spin-offs helps to ensure the sharing of tacit knowledge with a new firm (OECD 2010; Williams 2013). To engage with SMEs and other private companies, public universities and research institutes require adequate incentives and structures, as well as adequate funding for research, recruitment, and the establishment and operation of technology transfer offices (TTOs), which are not always profitable. Legislation that provides for the patenting and licensing of public universities' intellectual property can facilitate engagement with firms (Zeng *et al.* 2010).

To summarise, innovative SMEs' commercial success is often enhanced by collaboration with a range of public and private entities. Collaboration can reduce the time to innovate, increase the scope of innovation, and promote its diffusion in products and processes. The benefits of collaborative efforts are maximised when the parties are able to widely share information. However, the exchange of knowledge is not without considerable risk. This is particularly true for SMEs collaborating with parties with significantly more resources at their disposal, and which can more readily commercialise the results of joint work. IP management strategies can help innovative SMEs to manage such risks.

Innovative SMEs' IP Management Strategies

Businesses develop and execute IP management strategies in pursuit of four key objectives. First and foremost, all firms need to 'appropriate', or capture the value of, their ideas and their investments in developing and bringing them to market. Second, firms must protect their interests when engaging in collaborations with other companies and institutions. They must ensure that the intellectual property that results from joint projects is fairly distributed and managed among the participants. Third, firms need to ensure freedom to operate (FTO) and to avoid infringement of third-party IP rights (IPRs), notably patents, or violations of trade secret protections, so as to minimise the risk of unnecessary licensing costs and litigation. Fourth, firms can use IPRs to signal their value to investors, potential partners, competitors, and customers. These last three objectives are of particular relevance for SMEs, given their more limited resources and the extent to which they tend to collaborate with external partners.

A range of external factors, including competitive conditions, industry sector, and market location and legislation, influence an innovative SME's IP management strategy (OECD 2010). At the same time, the strategy largely depends on the firm's capabilities. Because SMEs rarely have significant in-house resources to monitor competitors or to participate in enforcement and litigation, they must manage their intellectual assets in the most resource-effective way possible (Friesike 2011).

In addition, an SME's approach to IP management often depends on the awareness and vision of its senior management. In fact, rather than focusing only on immediate concerns such as short-term commercial advantage, a company's leadership must understand the correlation between IP management and commercial success in order to formulate a sound strategy early on (Neuhäusler 2012). Failure to develop an effective IP management strategy, including a sound appropriation strategy, can create problems down the road, foreclosing partnership opportunities, preventing an innovative SME from securing investment, and exposing an SME to litigation risks.

IP management may represent a particular challenge for smaller firms that are active in several markets, as global activities require a more sophisticated approach that can be harder to develop (OECD 2010). To secure the firm's competitive position and manage IP-related risks, an SME's leadership needs to know whether the company's inventions are properly protected in each strategic jurisdiction – for instance, whether a patent claim has been appropriately drafted so as to protect the most valuable features of an invention – and whether it has FTO in relation to its most important products or processes. Training programs to inform managers of innovative SMEs about the importance of IP management while coaching them on the practical aspects are useful in this regard.

The following sections present the three main categories of IP management strategies used by innovative SMEs for appropriation and other objectives, namely: a) use of formal, registered IPRs including patents; b) reliance on alternative, or 'complementary', protection methods such as secrecy; and c) use of hybrid strategies that combine formal IPRs and complementary methods.

Use of formal IPRs

Formal IPRs include, *inter alia*, patents, industrial designs, and trademarks, and are granted by specialised government agencies. Being statutory rights, they are enforceable in courts, although, in reality, enforceability varies considerably across jurisdictions. Patents, on which

the present analysis focuses, are exclusive rights that governments confer to inventors or their assignees for a limited period of time, in exchange for disclosure of the invention. A patent prevents others from practising the invention claimed in the patent without authorization.

In addition to the key purpose of appropriating the benefits of their investments in R&D, innovative SMEs file patents for a range of strategic motivations, such as trade with other technology firms via cross-licensing, and the use of patents as bargaining chips in negotiations with other firms (Neuhäusler 2012). Also, patents play a key role in partnerships. A strong patent portfolio can help an innovative SME to attract the right partners, enabling it to obtain the funds and expertise, especially manufacturing and marketing capabilities, that it needs to bring a product to market (Rassenfosse 2010). As a matter of fact, established firms conduct due diligence prior to partnering, in order to ensure that solutions developed jointly could be commercialised without unexpected IP-related complications, such as inadequate IP protection or absence of FTO. Patents also enable collaborating entities to identify what each brings to the table, and to manage the results of their collaboration (Hsieh *et al.* 2011).

Moreover, firms may utilise patents for standardization, for international market extension, or for increasing the new firm's reputation and technological image (Neuhäusler 2012). As demonstrated in a recent study on China, new market entrants often rely on a strong IP position to communicate to competitors as well as to potential partners that they possess a valuable technology solution (Keupp *et al.* 2012). Together with the relative legal certainty provided by formal IPRs – which varies depending on the enforcement regime and each SME's ability to manage its IPRs – it is this signaling function that explains the particular value of patents for internationalised SMEs.

Monetary motives for filing are also strong for innovative SMEs. Patents are important tools for indicating the value of an R&D project to investors, thereby mitigating the problem of information asymmetry between new firms and investors, which can undermine access to financing. Overall, the quality of an innovative SME's patent portfolio is positively correlated with the willingness of investors to support its projects (Pederzoli *et al.* 2011). Research in the biotechnology sector indicates that venture capital financing occurs earlier in the presence of patents and that the signaling effect of patents tends to be stronger in earlier financing rounds when less is known about the innovation and its potential (Rassenfosse 2010). Moreover, SMEs resort frequently to licensing in order to generate revenue (Rassenfosse 2010).

The usefulness of a patent depends on several factors, including the strength of the enforcement regime and the complexity of the object to be protected (OECD 2010; Neuhäusler 2012). For obvious reasons, patents are only of value where they can be enforced. Also, they are particularly important in highly regulated sectors, in the context of long product life cycles, and in relation to products that are highly susceptible to reverse engineering. Compared with products, processes tend to be more difficult to understand and harder to replicate (Thomä & Bizer 2013). Products and processes are thus associated with different propensities to patent. Indeed, as research has shown, for novel processes, innovative SMEs may prefer secrecy to patenting, since the latter requires disclosure and also because infringement of a proprietary process is generally hard to spot (Dupré & Smith 2011; Thomä & Bizer 2013). Firms working with discrete technologies and with higher research intensity tend to patent more actively (Neuhäusler 2012).

Case Study: PipeWay Engenharia, Brazil

PipeWay Engenharia is an innovative SME that evolved from a joint R&D project involving Petrobras and engineers at the Pontifical Catholic University of Rio (PUC-Rio). Both collaboration and judicious IP management have enabled the firm to grow and to succeed on the global stage.

In 1986, the CENPES (Petrobras Research Center) and the CETUC (Research Center of PUC-Rio) launched joint work aimed at developing a pipeline maintenance technology that would help Petrobras to increase the cost-efficiency of its operations, while also avoiding environmental damage caused by leaks. Engineers from the institutions worked together and ultimately developed a technology that uses electromagnetic sensors and devices for the inspection, rehabilitation, and cleaning of pipelines. They called their solution, which roots through pipes to locate and repair defects, the 'Pipe Pig'.

The Pig was patented jointly by CENPES and CETUC. Despite the potential of this new solution, which provided a dramatically cheaper and more effective approach to maintaining the thousands of kilometers of pipelines operated by Petrobras, neither Petrobras nor PUC-Rio committed to take steps to commercialise the Pig. The researchers who had developed the Pig, led by Jose Augusto Pereira da Silva, in-licensed the patents, paying royalties to Petrobras and PUC-Rio, and established a company in 1998 with the objective of refining and commercialising the Pig.

With support from FINEP, an institution created under the Ministry of Science and Technology of Brazil to foster innovation, they created PipeWay Engenharia and developed a business plan that included an IP management strategy combining registered and unregistered rights. PipeWay initially focused on the customer relationship with Petrobras, which operated 70 per cent of the pipelines in Brazil. This relationship provided critical feedback that enabled PipeWay to improve upon the technology. The company grew and successfully exited incubation.

PipeWay accessed the know-how associated with the Pig by hiring the team that had developed it at PUC-Rio. The company protected the team's tacit knowledge through secrecy, developing and testing everything in-house, and manufacturing only in Brazil. At the same time, PipeWay protected its improvements to the basic Pig technology solution using patents, which became especially important as the company internationalised (expanding into Argentina, Chile, Uruguay, Bolivia, Venezuela, Colombia, the US, and Nigeria). To enter the US market, PipeWay formed a joint venture with a North American company, capitalising on the value of its technology and its strong IP position.

Source: Magacho et al. 2010; interview with Jose Augusto Pereira da Silva (November 2012)

Patents have the benefit of enabling an innovative SME to appropriate the value of an invention without necessarily engaging in manufacturing, which may be beyond the capabilities of some entities. In fact, SMEs are more likely than larger firms to engage primarily in licensing (Rassenfosse 2012). An SME may out-license in order to access assets

and expertise it needs in order to bring a solution to market, such as distribution channels, expertise, or manufacturing facilities (Martinez 2010). Or, it may in-license a technology it needs that is readily available, thus enabling it to reach the market earlier and more cheaply without reinventing the wheel. Where formal appropriation regimes are stronger, this helps small firms in particular by reducing imperfections in technology markets that might hinder licensing transactions and collaboration (Park & Lee 2006; Rassenfosse 2012).

To summarise, in addition to providing relative legal certainty and enforceability, patents have two advantages that are of particular interest to innovative SMEs. First, they can assume an important signaling function, to the market in general and to potential investors and partners in particular. Second, registered IP rights can be used to manage collaboration with other companies, which is a necessity for many SMEs in part due to their limited internal capacities.

Despite these advantages, innovative SMEs across sectors and markets consistently report lower reliance on formal IPRs, compared with larger companies (OECD 2010; Neuhäusler 2012; Thomä & Bizer 2013). One impediment appears to be lack of knowledge or training about IP management. An additional, clear impediment is cost. Filing a patent in a single jurisdiction such as the US requires, according to a conservative estimate, between USD 5,000 and USD 15,000. More resources are needed to file, maintain, and defend a portfolio across multiple jurisdictions (OECD 2011).

When deciding whether to patent, innovative SMEs must undertake a cost-benefit analysis. In certain situations, the costs associated with obtaining and maintaining a patent, including the cost of enforcement, may outweigh the perceived value of that IPR as a means to retain competitive advantage, influence competitors' behavior, or derive licensing or other revenues. A key risk is litigation. SMEs are less financially able to withstand an expensive legal challenge, for instance from a non-practising entity. Furthermore, with only a limited portfolio, a small firm may have less bargaining power to settle with bigger players (Lanjouw & Schankerman 2004). Hence depending on the circumstances, an innovative SME may decide not to pursue a patent (Friesike 2011).

Complementary strategies

Complementary, or alternative, strategies employed by innovative SMEs include a number of approaches, such as: secrecy; capitalising on first mover advantages and innovating faster than competitors; building complexity into products and processes, making them difficult to imitate; defensive publishing; focusing on achieving a large market share in niche markets; building strong brand recognition; and creating strong commercial channels and relationships with customers (Friesike 2011; Neuhäusler 2012).

Certain alternative approaches to appropriating, and thus maintaining competitive advantage, can be viewed as substitutes for formal, registered IPRs. For instance, the more complex a technology solution, the less likely it is that a competitor will succeed in replicating it. Patents and design complexity may sometimes be considered interchangeable in the sense that both methods make imitation less likely. It is thus hardly surprising that innovative SMEs operating in know-how intensive sectors, which tend to produce complex products that are harder to reverse engineer, generally find it less necessary to rely on registered IPRs such as patents (Thomä & Bizer 2013).

Some innovative SMEs may choose to emphasise a defensive strategy to protect their niche and ensure FTO, relying, for instance, on the strategy of defensive publication. Through the

disclosure of an enabling description of the invention, defensive publication destroys novelty and hence prevents competitors from patenting it. Similarly, a firm may rely on a defence of prior user rights in some countries, through proper recordkeeping, to limit the applicability of patents procured by a competitor. Needless to say, these approaches are most effective where there is an IP office that systematically conducts the necessary research on novelty.

Secrecy is relatively more important for innovative SMEs than for larger firms (Neuhäusler 2012). A strategy emphasising secrecy is reliant upon a type of unregistered intellectual property right, 'trade secret', which can be used in many jurisdictions to protect any valuable, confidential information. Certain strategies, such as product complexity and reliance on lead time advantages, can be considered a form of trade secret protection. Depending on the jurisdiction, trade secrets are often less expensive to use than IPRs that require registration or other formalities. The firm must invest in efforts to keep the confidential information secret, for instance by executing non-disclosure agreements with employees and vendors, and investing in the security of systems and facilities (Dupré & Smith 2011).

National laws that protect trade secrets can encourage sharing and partnering, by ensuring that parties who learn of a trade secret, either legally through collaboration or by criminal means, cannot appropriate the information – provided reasonable measures to maintain secrecy have been employed by the owner. At the same time, it must be noted that trade secrets are not exclusive rights and do not protect against independent discovery. If independently derived by a competitor, the subject matter of a trade secret can lose its economic value (Dupré & Smith 2011). Also, trade secret laws vary significantly between countries and may be insufficient in certain places to adequately protect innovative SMEs.

Trade secrets are a critical tool for SMEs

Trade secrets are often the default mode of protection for innovative SMEs, which tend to rely on a small group of individuals to innovate and commercialise, maintaining secrecy within the group. While there are differences across jurisdictions, trade secrets generally require no registration or other formalities, and they can be used to protect a wide variety of information for a potentially unlimited duration as long as the information remains confidential. Moreover, trade secrets can be used to protect inventions that do not meet the criteria for patentability. Especially at the early stages of product development, trade secrets may be useful as solutions materialise. A drawback of reliance on trade secrets is that, if discovered independently, another entity may use the subject matter of the trade secret. Thus, trade secrets are generally not the best strategy to protect inventions that can be readily reverse engineered.

Examples of information that may be protected by trade secrets, depending on the jurisdiction:

- Manufacturing processes, formulas and recipes, blueprints;
- Repair techniques, software source code, databases; and
- Marketing strategies, customer lists, business forecasts.

Source: Maskus 2000; Dupré & Smith 2011

Business context, market environment, degree of research intensity, and type of innovation are prime considerations in the formulation of an IP management strategy, including the extent to which secrecy and other complementary strategies will be relied upon (Neuhäusler 2012). For instance, where knowledge is tacit, secrecy may be the method of choice – as opposed to patenting, which requires disclosure (Dupré & Smith 2011; Thomä & Bizer 2013).

In some cases, it may be judicious for an innovative SME to combine several complementary protection measures. For instance, defensive publication can be used in relation to a core invention, together with secrecy to protect the technological details that can optimise the solution. This approach could prevent competitors from patenting the same invention while also protecting the part of the invention with the most important know-how. In other cases, one complementary strategy could suffice, for example, building strong networks with customers that understand the superiority of the product and therefore will not accept substitutes from competitors (Friesike 2011). Combining such an approach with formal IPRs may help further convince customers of such an advantage.

Alternative protection methods have the advantage of being relatively resource-effective. They are often the default strategy for innovative SMEs, whether due to resource constraints or because the SME's leadership lacks a clear strategy for its IP management (OECD 2010; Friesike 2011). Key shortcomings, however, include their limited formal enforceability and the generally more precarious protection they offer, especially if used alone or exclusively with other alternative approaches. In addition, precisely because of their generally informal character, such approaches often cannot be used to signal the value of an R&D project to potential investors or partners. The exception may be trade secret protection, as trade secrets can be licensed and effectively enforced in certain jurisdictions. In general, exclusive reliance on alternative approaches may not represent the best appropriation strategy for innovative SMEs.

Hybrid strategies

Hybrid appropriation strategies combine formal, registered IPRs with alternative appropriation methods, predominantly secrecy. Recent research has revealed that the most successful innovative SMEs strategically blend formal and alternative mechanisms, according to their specific resources, needs, and business environment (Friesike 2011; Neuhäusler 2012). These results, at least partially, refute studies claiming that SMEs use fewer formal IPRs solely due to resource constraints and lack of knowledge, as well as the work of certain authors equating relatively lower use of formal IPRs with ineffective appropriation. Depending on the case, the decision to de-emphasise use of formal, registered IPRs may be entirely rational and effective (Thomä & Bizer 2013).

As a matter of fact, different appropriation methods appear to complement each other. As mentioned, some approaches, such as use of trade secrets, can be a strategic alternative to patent protection. However, it may be most efficient for innovators to use different strategies together. Clearly, the right 'blend' ultimately depends on the context. In certain situations, formal IPRs may be too costly or merely ineffective. For instance, in sectors with very fast product cycles, patents alone may offer only a small amount of real protection. Similarly, service innovations related to an existing technology solution may be difficult to patent, thus requiring other appropriation strategies (Hsieh *et al.* 2011).

An innovative SME may therefore tactically and selectively forgo formal IPR protection, or it may combine use of registered IPRs with other approaches to appropriation. For instance, a firm may patent a part of an invention, and protect the most important know-how as a trade secret (Dupré & Smith 2011). It may also increasingly secure patents as it enters the commercialization stage, but rely on secrecy earlier in the process (Thomä & Bizer 2013). Or an innovative SME may use patents to protect a radically new technology, and further disclose follow-on approaches via defensive publication to prevent competitors from patenting in ways that block FTO (Friesike 2011).

Cooperation strategy may influence the choice of appropriation mechanism (Friesike 2011). Collaboration with a research institute or a university generally calls for a different appropriation approach than collaboration with firms that are potential competitors, a type of engagement known as ‘co-opetition’ that is widely used by innovative SMEs but relatively risky (Tomlinson & Fai 2013). A research institute is generally seen as less likely to compete directly with a private sector partner. In contrast, when working with enterprises that compete in the same sector, innovative SMEs may choose to employ several complementary strategies at once, such as conducting the collaboration within strict parameters, relying on lead time, and also using trade secret protection (Friesike 2011).

Case Study: ActoGeniX, Belgium

ActoGeniX is an innovative SME from Belgium that attributes its growth and success to date to judicious IP management and to collaboration with public and private entities.

ActogeniX was spun out from the Vlaams Instituut voor Biotechnologie (VIB) in Ghent, a research institute with a rich history of incubating technology solutions in-house before spinning them out. VIB researchers had been exploring the expression and delivery of proteins via bacteria since 1995. They pioneered the development of a platform for the oral delivery of proteins, which VIB protected by filing several patent families. ActoGeniX was created in 2006 to commercialise this proprietary platform. At this time, VIB made a contribution in-kind of the patents, in return for shares in the new company.

ActoGeniX continued the VIB strategy of building a secure IP position, filing extensively for patent protection in order to protect the company’s niche and to prevent competitors from free-riding on its R&D investments. Besides the attractiveness of its technology solution, it was its strong IP position that enabled ActoGeniX to attract investment and also to engage in partnerships with larger players seeking to use its proprietary platform to orally deliver their products, such as antibodies.

Fully capitalised, ActoGeniX is today the only company developing an oral delivery mechanism for proteins via bacteria, working at the clinical stage. Effective valuation and management of IP remains a challenge, particularly in the context of collaborative product development. The company continues to rely significantly on defining and protecting its niche, using patents, and it structures engagement with third parties through tailor-made licence deals. Another challenge is managing a global portfolio as the company’s activities become increasingly internationalised.

Source: www.actogenix.com; interview with Emil Pot (July 2013)

Conclusion

In the presence of suitable external conditions, innovative SMEs can provide considerable stimulus for innovation, growth, and job creation. Governments can support innovative SMEs to achieve their potential through a range of measures, including actions to facilitate access to financing, remove regulatory and tax burdens, and improve the formal IP system. Actions to improve the formal IP system include those aimed at enhancing patent quality, and reducing costs and pendency.

To offset their limited resources and relative lack of non-core expertise, innovative SMEs tend to engage in various forms of cooperation to accelerate growth. In order to attract the right partners, as well as extract value from their innovations and partnerships, innovative SMEs must develop adequate IP management strategies drawing from these categories: formal, registered intellectual property protection; alternative strategies including secrecy; and hybrid strategies.

Amongst these three categories, formal, registered IPRs are of pivotal importance, provided a firm has the knowledge and financial resources to manage them effectively. First, such protection constitutes an appropriation instrument in its own right, producing legal certainty and benefits that are particularly significant for innovative SMEs. Second, by definition, formal, registered IP protection is an ingredient of hybrid appropriation strategies, which have been demonstrated to be especially valuable for smaller innovative businesses. Third, formal IP systems form the necessary underpinning of certain complementary strategies used by SMEs, for instance defensive publication.

Actions to improve the formal IP system and to make it more accessible to smaller firms can support innovative SMEs in more effectively capturing the value of their intellectual assets. Governments can:

- Take steps to improve patent quality, which can increase legal certainty and help to ensure that IPRs can be used to signal value to potential investors, partners, and competitors;
- Ensure that IPRs are available and enforceable at reasonable cost, including by reducing official fees for patent filing, prosecution, and maintenance by SMEs;
- Facilitate patent filing and prosecution by SMEs, including by providing for expedited review of applications from SMEs;
- Institute outreach and training programs for SME business leaders, in order to raise awareness about the importance of sound IP management, improve SMEs' intellectual asset management, and increase opportunities for them to engage with IP officials;
- Consider enacting policies that support the provision of insurance for SMEs to offset the costs associated with defending their IP positions in litigation, which represents a significant risk for smaller firms; and
- Enact modern trade secrets laws to bolster the protection afforded by resource-effective secrecy strategies, which are often the default protection mode adopted by innovative SMEs.

In addition, governments that provide subsidies for innovation can direct funds towards solutions that have been appropriately protected and managed in accordance with a sound IP strategy. This can help ensure that funds are wisely invested in those inventions that are best positioned for further development and commercialization.

Finally, to catalyse innovation interactions, partnerships, and the sharing of knowledge, governments can:

- Support the establishment of clusters and innovation networks, on their own or together with industry groups, whether directly or indirectly through incentives;
- Develop frameworks that enable patenting and subsequent licensing of publicly-funded research, and that enhance collaboration in general between the private sector and public research institutes; and
- Support the creation of incubators, whether government-run or for-profit, which can deliver access to services that innovative SMEs need, such as coaching on business skills and IP management strategies.

References

- ADP (2013) *National Employment Report May 2013*. Roseland NJ.
- Alvarez SA, Barney JB (2001) Creating Wealth in Organizations. *The Academy of Management Executive (1993-2005)* **15**, 139-148.
- Audretsch DB, Vivarelli M (1994) Small firms and R&D spillovers: evidence from Italy. *Revue d'Economie Industrielle* **67**, 225-237.
- Ayyagari M, Demircug-Kunt A, Maksimovic V (2011) Small vs. Young Firms across the World Contribution to Employment, Job Creation, and Growth. Policy Research Working Paper 5631. The World Bank, Washington.
- Baum JAC, Calabrese T, Silverman BS (2000) Don't go it alone: alliance network composition and startups' performance in Canadian biotechnology. *Strategic Management Journal* **21**, 267-294.
- Beck T, Demircug-Kunt A, Levine R (2005) SMEs, Growth, and Poverty: Cross-Country Evidence. *Journal of Economic Growth* **10**, 199-227.
- Bruton GD, Ahlstrom D, Obolaj K (2008) Entrepreneurship in emerging economies: where are we today and where should the research go in the future. *Entrepreneurship Theory and Practice* **32**, 1-14.
- Busenitz LW, Gomez C, Spencer JW (2000) Country institutional profiles: unlocking entrepreneurial phenomena. *Academy of Management Journal* **43**, 994-1003.
- Cravo T, Gourlay A, Becker B (2010) SMEs and regional economic growth in Brazil. *Small Business Economics* **38**, 217-230.
- Diallo O (2012) Small and medium enterprises (SMEs) as drivers of productive capacity and job creation in Africa. Background Paper for Regional Preparatory Meeting for Africa. ECOSOC, New York.
- Dupré, JL, Smith, JM (2011) When to choose trade secret protection over a patent. *Intellectual Asset Management*, 74-77.
- Economist Intelligence Unit (2012) SMEs capture growth in expanding markets. The Economist, London.
- European Commission (2005) *The new SME definition: user guide and model declaration*. Office for Official Publications of the European Communities, Brussels.
- Filatovchev I, Liu X, Buck T, Wright M (2009) The export orientation and export performance of high-technology SMEs in emerging markets: The effects of knowledge transfer by returnee entrepreneurs. *Journal of International Business Studies* **40**, 1005-1021.
- Friesike S (2011). Profiting from Innovation by Managing Intellectual Property. PhD thesis. University of St. Gallen.
- Geissler M, Jahn S, Kaminski, S, Zanger C (2009) University-SME Co-Operation: Benchmarking the Best. In: Proceedings of the 54th ICSB World Conference, Seoul, South Korea, 21st-24th June, 2009.
- Gomes-Casseres B (1997) Alliance Strategies of Small Firms. *Small Business Economics* **9**, 33-44.
- Gupta VK, Guo C, Canever M, Yim HR, Sraw GK, Liu M (2012) Institutional environment for entrepreneurship in rapidly emerging major economies: the case of Brazil, China, India, and Korea. *International Management and Entrepreneurship Journal*.
- Haltiwanger JC, Jarmin RS, Miranda J (2010) Who Creates Jobs? Small vs. Large vs. Young NBER Working Paper 16300. NBER, Cambridge MA.
- Hsieh PF, Lee CS, Ho JC (2012) Strategy and process of value creation and appropriation in service clusters. *Technovation* **32**, 430-439.
- Keupp M, Friesike S, von Zedtwitz, M (2012) How Do Foreign Firms Patent in Emerging Economies with Weak Appropriability Regimes? Archetypes and Motives. *Research Policy* **41**, 1422-1439.
- Lanjouw JO, Schankerman M (2004) Protecting Intellectual Property Rights: Are Small Firms Handicapped? *Journal of Law and Economics* **47**, 45-74.
- Lavie D (2006) The Competitive Advantage of Interconnected Firms: An Extension of the Resource-Based View. *Academy of Management Review* **31**, 638-658.
- Lee S, Park G, Yoon B, Park J (2010) Open innovation in SMEs: An intermediated network model. *Research Policy* **39**, 290-300.
- Magacho L, Presa M, Viana M, Carneiro J (2010) University-industry-government linkages – the internationalization case of Pipeway Engenharia. Triple Helix Conference, Madrid, 20-22 October 2010.
- Mani S (2011) Promoting Knowledge-Intensive Entrepreneurship in India. In: Szirmai A, Naudé W, Goedhuys M (eds) *Entrepreneurship, innovation, and economic development*. Oxford University Press.
- Martinez LM (2010) Patent Licensing: Global Perspective and Analysis of Case Studies. *Journal of Intellectual Property Rights* **15**, 440-446.
- Maskus KE (2000) *Intellectual property rights in the global economy*. Institute for International Economics, Washington.
- Naudé W, Goedhuys M (eds) *Entrepreneurship, innovation, and economic development*. Oxford University Press.

- Neuhäusler P (2012) The use of patents and informal appropriation mechanisms: differences between sectors and among companies. *Technovation* **32**, 681-693.
- Nystrom, K (2008) The institutions of economic freedom and entrepreneurship: evidence from panel data. *Public Choice* **136**, 269-282.
- OECD (2010) *Innovative SMEs and Entrepreneurship for Job Creation and Growth: 'Bologna + 10' High-Level Meeting on Lessons from the Global Crisis and the Way forward to Job Creation and Growth*. OECD Publishing, Paris.
- OECD (2011) *Intellectual Assets and Innovation: The SME Dimension, OECD Studies on SMEs and Entrepreneurship*. OECD Publishing, Paris.
- Ohler F, Radauer A, Streicher J (2007) Benchmarking National and Regional Support Services for SMEs in the Field of Intellectual and Industrial Property. Austrian Institute for SME Research, Vienna.
- Page J & Söderbom M (2012) Is Small Beautiful? Small Enterprise, Aid and Employment in Africa. UNU-WIDER Research Paper. World Institute for Development Economics Research, Helsinki.
- Park K, Lee K (2006) Linking technological regimes and technological catch-up: analysis of Korea and Taiwan using the US patent data. *Industrial and Corporate Change* **15**, 715-753.
- Pederzoli C, Thomä G, Torricelli C (2013) Modelling Credit Risk for Innovative SMEs: the Role of Innovation Measures. *Journal of Financial Services Research* **44**, 111-129.
- Rassenfosse GD (2012) How SMEs exploit their intellectual property assets: evidence from survey data. *Small Business Economics* **39**, 437-452.
- Revilla AJ & Fernandez Z (2012) The relation between firm size and R&D productivity in different technological regimes. *Technovation* **32**, 609-623.
- Rogers M (2004) Networks, Firm Size and Innovation. *Small Business Economics* **22**, 141-153.
- SBA Office of Advocacy (2012) *Annual Report of the Office of Economic Research: FY 2012*. Washington, 2012.
- Stam E & Stel AV (2011) Types of Entrepreneurship and Economic Growth. In: Szirmai A, Naudé W, Goedhuys M (eds) *Entrepreneurship, innovation, and economic development*. Oxford University Press.
- Szirmai A, Naudé W, Goedhuys M (2011) *Entrepreneurship, innovation, and economic development*. Oxford University Press.
- Szirmai A, Naudé W, Goedhuys M (2011) Entrepreneurship, Innovation, and Economic Development: An Overview. In: Szirmai A, Naudé W, Goedhuys M (eds) *Entrepreneurship, innovation, and economic development*. Oxford University Press.
- Teal F (2010) Higher Education and Economic Development in Africa: A Review of Channels and Interactions. Working Paper Series 2010-25, Centre for the Study of African Economies, University of Oxford.
- Teece DJ (1986) Profiting from technological innovation: implications for integration, collaboration, licensing and public policy. *Research Policy* **15**, 285-305.
- Tether B (2002) Who co-operates for innovation, and why. An empirical analysis. *Research Policy* **31**, 947-967.
- Thomä J & Bizer K (2013) To protect or not to protect? Modes of appropriability in the small enterprise sector. *Research Policy* **42**, 35-49.
- Tomlinson PR & Fai FM (2013) The nature of SME co-operation and innovation: a multi-scalar and multi-dimensional analysis. *International Journal of Production Economics* **141**, 316-326.
- Tracy SL (2011) Accelerating Job Creation in America: The Promise of High-Impact Companies. SBA Office of Advocacy, Washington.
- Voeten JV, Haan JD, Groot GD (2011) Is that Innovation? Assessing examples of revitalized economic dynamics among clusters of small producers in Northern Vietnam. In: Szirmai A, Naudé W, Goedhuys M (eds) *Entrepreneurship, innovation, and economic development*. Oxford University Press.
- Williams D (2013) Building a Support Infrastructure for Technology-Based Businesses: What Can Emerging Economies Learn from the Western Experience? In: Oakey R, Groen A, Cook G, Sijde PVD (ed) *New Technology-Based Firms in the New Millennium (New Technology-Based Firms in the New Millennium 10)*. Emerald, Bingley.
- Williamson PJ, De Meyer (2012) A Ecosystem Advantage: How to Successfully Harness the Power of Partners. *California Management Review* **55**, 24-46.
- WIPO (2013) Conceptual Study on Innovation, Intellectual Property and the Informal Economy. WIPO, Geneva.
- Yoffie DB, Kwak M (2006) With Friends like These. The Art of Managing Complementors. *Harvard Business Review* **84**, 89-98.
- Zeng SX, Xie XM, Tam CM (2010) Relationship between cooperation networks and innovation performance of SMEs. *Technovation* **30**, 181-194.

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ICC is the world business organization, a representative body that speaks with authority on behalf of enterprises from all sectors in every part of the world.

The fundamental mission of ICC is to promote open international trade and investment and help business meet the challenges and opportunities of globalization. Its conviction that trade is a powerful force for peace and prosperity dates from the organization's origins early in the 20th century. The small group of far-sighted business leaders who founded ICC called themselves "the merchants of peace".

ICC has three main activities: rule setting, dispute resolution, and policy advocacy. Because its member companies and associations are themselves engaged in international business, ICC has unrivalled authority in making rules that govern the conduct of business across borders. Although these rules are voluntary, they are observed in countless thousands of transactions every day and have become part of the fabric of international trade.

ICC also provides essential services, foremost among them the ICC International Court of Arbitration, the world's leading arbitral institution. Another service is the World Chambers Federation, ICC's worldwide network of chambers of commerce, fostering interaction and exchange of chamber best practice. ICC also offers specialized training and seminars and is an industry-leading publisher of practical and educational reference tools for international business, banking and arbitration.

Business leaders and experts drawn from the ICC membership establish the business stance on broad issues of trade and investment policy as well as on relevant technical subjects. These include anti-corruption, banking, the digital economy, marketing ethics, environment and energy, competition policy and intellectual property, among others.

ICC works closely with the United Nations, the World Trade Organization and intergovernmental forums including the G20.

ICC was founded in 1919. Today its global network comprises over 6 million companies, chambers of commerce and business associations in more than 130 countries. National committees work with ICC members in their countries to address their concerns and convey to their governments the business views formulated by ICC.



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