

The Public Sector and Entrepreneurship

Is it better to license a technology to a start up, a spin-out, or an existing company? This is one of the questions facing public sector technology transfer offices (TTOs) around the world. There is no simple answer. The choice can depend on whether an entrepreneurial spirit characterizes the institution that developed the technology. The more entrepreneurial, the more likely the institution will wish to set up a new company. However, if an incubator infrastructure exists, then a spinout becomes more feasible.

This section considers the **benefits and risks of dealing with spinouts** by reviewing experiences, with continual reference to the situations of developing countries. The associated factors of **venture capital, technology transfer intermediaries, and the formation of business incubators** are also discussed. Anyone engaged in dealing with spinouts, venture capital companies, and incubators will want to read the entire section; it covers a range of issues from licensing considerations, to the use of milestones, to compensation, and offers plenty of elucidating analyses about realistic expectations, based on a series of real examples from the United States and the United Kingdom. All of these chapters show in one way or another that while there is certainly an “art” to entrepreneurship, reliable recipes are available.

Brown and Soderstrom¹ present the rationale for, and a comprehensive practical overview of, the creation of university spinout companies.

Based on the successful experiences of **Yale University**, the authors **advocate a hands-on approach**, through which the university actively and directly manages the creation of new companies and invests in the human and physical resources needed for their success. Such an approach may provide a greater chance for success than licensing the university’s technology to a start-up company, which would likely be completely separate from the university. The approach of establishing and licensing to a spinout does, however, introduce a number of significant risks. Brown and Soderstrom identify these risks and demonstrate how each of them can be mitigated in order to increase the potential for success.

The strategy of creating university spinouts, as opposed to simply licensing technologies to existing companies, is particularly likely to appeal to universities in developing countries for several reasons. Licensing is often the “preferred” option for university technology transfer. Simply because it is less complex, it requires an acceptable licensee who is both interested in and capable of developing the technology. In many countries where the biotechnology industry, for example, is in the early stages of development and where there is a smaller chance of finding an acceptable licensee, creating a spinout may hold more promise. To the extent that the goal of commercializing university technologies is to generate economic growth, the creation of new companies can have

Krattiger A, RT Mahoney, L Nelsen, JA Thomson, AB Bennett, K Satyanarayana, GD Graff, C Fernandez and SP Kowalski. 2007. 13: Public Sector and Entrepreneurship. In *Executive Guide to Intellectual Property Management in Health and Agricultural Innovation: A Handbook of Best Practices* (Krattiger A, RT Mahoney, L Nelsen et al.). MIHR (Oxford, UK), PIPRA (Davis, USA), Oswaldo Cruz Foundation (Fiocruz, Rio de Janeiro, Brazil), and bioDevelopments-International Institute (Ithaca, USA). Available online at www.ipHandbook.org.

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a greater impact close to home by generating jobs, attracting additional investment, and facilitating the growth of a biotechnology cluster. Because universities and public sector research institutes are often the giants of R&D within a developing economy, they need to be relied upon as sources for human capital and investment in entrepreneurship, since there may be no other sources.

Despite the promise spinouts may hold, they may not always be appropriate. Garner and Ternouth² address the question of what **realistic expectations** universities and research institutions should have concerning the risks of investing institutional resources in creating and spinning out new technology-based companies and they hold almost opposite beliefs to those of Brown and Soderstrom. The authors conclude that publicly funded institutions should consider how best to achieve their primary missions of delivering social and economic benefits, and they caution policymakers against exerting too much pressure on their region's universities to create new companies, because the process is difficult, consumes limited institutional resources, and is risky. The authors recommend that universities and research institutions should, as a rule, favor licensing-out to existing companies and third-party start-up companies and get involved only in the higher-risk strategy of investing the institution's own time and resources to create a spinout with measured and informed caution.

The process of creating a spinout is essentially one of providing the right social/professional environment, legal/financial framework, and resources for something new to grow and succeed and—given the risks—to fail “gracefully” if need be, without causing harm beyond the loss of opportunity and the initial investment. A very important element of creating spinout companies is to channel the enthusiasm and commitment of those who believe in the technology, want to see it succeed, and aspire to a positive outcome (for example, by providing products that improve the wellbeing of under resourced populations). Finally, a key point is to incubate a spinout long enough to enable it to run once it is “out there.”

Pragmatic information about how organizations can transfer their intellectual property (IP)

rights to a spinout company (normally through a licensing agreement) and then **convert the intellectual property into products or services for the public's benefit** can be found in the chapter by Sandelin.³ Based on three decades of experience at **Stanford University**, the chapter identifies some key issues related to negotiating such transfers. These include:

- the general attitude toward spinouts held by a public research organization's senior administration and governing board
- various licensing considerations
- the use of milestones
- the amount and kind of compensation that should be received for licensing a technology

The chapter provides guidance on how to best reach a successful agreement. The definitions of particular terms in a contract, such as infringement responsibilities, sublicensing, and warranties and indemnities, are all carefully considered. In addition, the chapter covers conflict of interest (COI) and conflict of commitment (COC) issues that arise when employees of public research organizations become engaged in spinout companies. The authors provide clear examples to help policymakers and administrators better deal with the issues involved in a licensing agreement.

Governments everywhere are encouraging public research organizations to use their inventories of IP rights to create spinouts. Successful spinouts create new jobs, contribute to economic development, and potentially grow into large multinational corporations. TTOs are key players in this effort, but they should balance the interests and mission of public research organizations with the objectives of the spinout and the needs of society.

One surprising way that public research institutions can more effectively use their intellectual property is by attracting venture capital. Wyse⁴ advances the premise that, **rather than venture capital driving the creation of new companies, it is the creation of new companies that attracts venture capital**. Research institutions and government policies are able to constructively influence the creation of new companies. The chapter seeks

to inform those in public research institutions, and government policymakers, about the role that venture capital can, and does, play in technology-based entrepreneurship, and the types of environments that can encourage entrepreneurship and thereby attract venture capital.

Venture capital is a specific sector of the financial industry that channels investment from institutional and private investors, corporations, pension funds, and government agencies into venture funds that in turn invest in portfolios of equity in new companies. The model essentially **spreads out and shares the technology risks involved in each of the individual companies**. It also seeks—to the extent possible—to reduce the risks involved by specializing in a certain field of technology where the venture fund's management has expert knowledge. Venture capital may also be actively involved in the management of the companies, participating on the board and even providing business services. In return for bearing and managing such risks, venture capitalists expect to achieve sufficiently high internal rates of return, typically between 20 and 40 percent.

The availability of financial capital is not, generally, the limiting factor. In 2005, US\$34 billion was invested in U.S. biotech companies from all sources (Table 1) with nearly US\$4 billion in investment capital coming from venture capital. While venture capital is concentrated geographically to a few locations, individuals and institutions with interests in investing in growth opportunities can be found worldwide—including in developing countries. The fundamentals of success are straightforward: **the formation of new companies creates an environment that increases their probability for success**. Thus, the two essential pieces that need to be provided are:

1. Planting the “seeds” of new companies—encouraging skilled people with new ideas to develop those ideas.
2. Creating an environment favorable for entrepreneurship and success. Universities and research institutes can plant the seeds, while government policies can shape the environment.

A **favorable environment for creating and growing new companies** consists of an encouraging business culture (one that rewards success and treats failure as a learning opportunity), access to intellectual capital (such as that flowing from universities), sufficient financial capital, and reliable physical capital (facilities, laboratories, communications). All of these are enhanced if a region enjoys a low cost of living and a high quality of life.

While governments cannot legislate entrepreneurship, they can encourage it by providing a favorable environment. Once enough companies exist, they will themselves further transform the environment, attracting or creating the skills and capital that can **develop into a technology cluster**. Ultimately, the practice of investing venture capital is a skill that can be imported to a region or country, where it can be mastered by local investors. Wyse clearly implies that the next stage in the growth of the venture capital industry will involve spreading into new regions across the globe.

He also encourages the public sector to provide more funding for translational research, that is, research that moves a technology or product further up the value chain and closer to market, thus reducing both the investment needed for commercialization and the risk (Figure 1). The point of the figure by Wyse is that knowledge-based biotech industries in agriculture require a greater emphasis on translational research, compared to the pharma industry, to be able to attract the venture capital and corporate investment necessary to commercialize new products and technologies

It is also important to know what other forces discourage or encourage the commercialization of inventions. Cook⁵ focuses on **the barriers created by cultural differences between academic institutions and business**. He contends that these barriers can be overcome by motivated technology transfer intermediaries. Inventors are usually creative, self-motivated, flexible individuals, but this does not mean that they naturally pursue the commercial potential of their discoveries. Whether or not an inventor ever shows his or her invention to the outside world actually depends on two variables:

1. whether he/she wants to disclose it

TABLE 1: SOURCES OF CAPITAL IN THE BIOTECH INDUSTRY

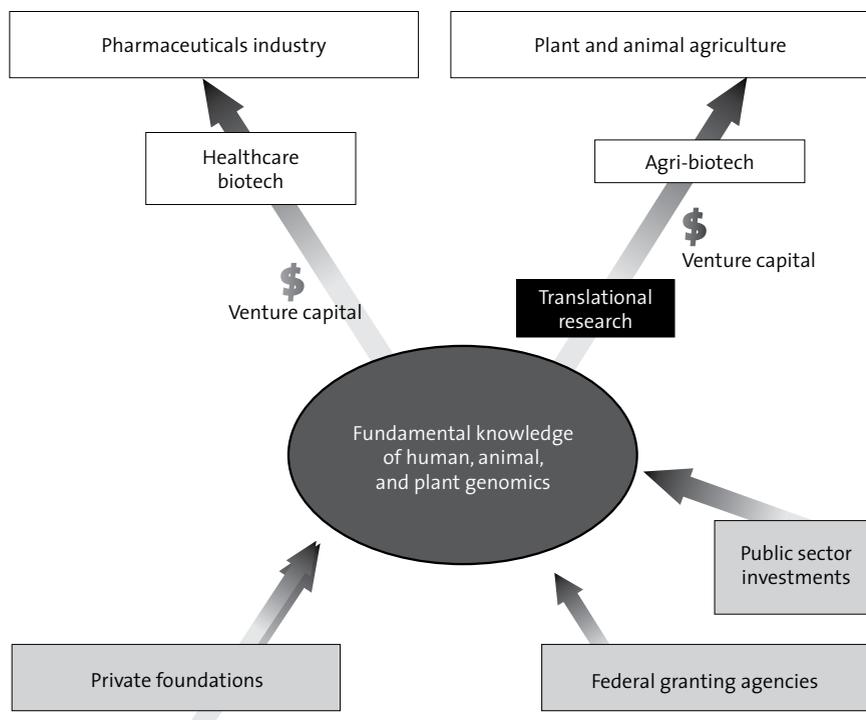
SOURCES OF CAPITAL	TOTAL INVESTMENTS (US\$, MILLIONS)	
	2005	2006 (1 st Q TO 3 rd Q)
Public		
IPO ^a	819	567
Follow-ons ^b	4,194	3,032
PIPES ^c	2,376	1,817
Debt	5,565	12,241
Private (venture capital)	3,518	3,186
Other	1,114	303
TOTAL CAPITAL	17,586	21,146
Partnering	17,268 (50%)	12,463 (37%)
TOTAL	34,854	33,609

- a. IPO – initial public offering: a private company files to have a portion of its shares sold to the public on a regulated stock exchange, such as NASDAQ.
- b. Follow-ons – When public companies sell additional shares on the stock exchange to raise additional cash.
- c. PIPES – Private investments in public entities: the sale of public shares to private financial institutions that may take public shares off the public market as a way for companies to raise cash.

Source: Wyse⁶

FIGURE 1: COMMERCIALIZING KNOWLEDGE-BASED BIOTECH INDUSTRIES IN AGRICULTURE AND PHARMACEUTICALS

Agriculture requires much translational research.



Source: Wyse⁷

2. whether the environment in which the inventor operates encourages or discourages disclosure

Much can be done to improve the environment surrounding an inventor. If an environment promotes creativity and is receptive to invention disclosure, it will not matter as much if an inventor has less self-confidence or is less of a risk taker. The manager of an institution's technology transfer effort should make every attempt to create an environment that fosters disclosure.

On the other hand, new companies operate in a very different environment. They generally have no established market position, are trying to convince potential investors that the company will succeed, and are usually understaffed and under-resourced. Such companies are most in need of effective leadership and of professional technology transfer intermediaries with the ability to translate a pioneering invention into a successful product. Such intermediaries should:

- understand the value systems that drive the inventor and the market
- be fluent in the vocabulary in both situations, so they are able to translate while retaining all linguistic nuances
- appreciate the various types of risks and how to mitigate them
- be credible to inventors as well as investors

These same qualities are valuable for those who are working to establish partnerships between the public and private sectors of developed and developing countries. Identifying, motivating, and retaining individuals with the capability to be intermediaries should be an important element of any effort to commercialize intellectual property.

The basic message of the chapter (along with the other chapters in this section of the *Handbook*) state that the role of the university is to channel its limited public resources into activities that create new opportunities that can be taken up by the market, but not to intentionally supplant or engage directly in the market. This means leaving venture creation to the market whenever possible. Indeed, most universities do not have sufficient professional resources or experience to manage spinout companies.

This and other chapters explore when and how universities can work with the market to channel investments into high-risk, high-return opportunities. This suggests a further question: when and how might universities work with other nonprofit and philanthropic funding sources to create spinout product development partnerships (PDPs) around high-risk, high-social-return opportunities? This is a question will be explored in the future by leading universities that have begun to master the process of spinning-out successful for-profit companies.

A more methodical approach has been gaining popularity over the last 15 years: **the creation of business incubators as tools for stimulating local economic development**. The concept of an incubator is simple and appealing: it provides a facility and services (for example, business planning and legal, accounting, and marketing support) to catalyze small business growth. Incubators have proven very effective. Incubated companies have a dramatically higher rate of survival than the average spinout. Additionally, companies that “graduate” from incubators provided an average of 85 full-time jobs per incubator. Used to promote the growth of entrepreneurial ventures of every imaginable type, small business incubation is now entrenched in both urban and rural areas throughout the United States.

Zablocki⁸ discusses in detail the **six steps for setting up and operating successful incubators**:

1. Conducting a *feasibility study*. For a proposed incubator, such a study can achieve a number of important objectives and, if properly done, can provide a solid basis for judging the economic and political viability of the proposed project.
2. Identifying and *securing stakeholders*. While each incubator's circumstances are unique, anticipated stakeholders would likely include local and state governments and a variety of public and private sector organizations (universities, major corporations) interested in fostering new-business development in the region. Stakeholders might also include economic-development organizations that could fund the rehabilitation of a facility or the operation of the

incubator program. The support of these stakeholders is critical to initiating an incubator program.

3. Identifying a *market niche*. This requires much attention to detail. Successful businesses carefully attend to the work of defining the market position of their products and services relative to their competitors, as well as to modifying their market position in response to changing customer preferences.
4. The *formation process*. The basic structure of an incubator facility is determined by owner attributes and regional demographics (it could be private, local-government led, or university led or it could be a nonprofit company).
5. *Services*. As the incubator concept has evolved, the range of services offered by incubators has greatly expanded. Early incubators provided access to a photocopier and a conference room, clerical support, and perhaps switchboard services. Today, incubators themselves provide, or provide access to, a broad spectrum of office support, business consulting, and professional services. Business consulting services may include business-plan preparation, financial planning, advertising and marketing, strategic planning, technical and commercial communications, relocation planning, capital development (equity and debt services), business taxes, employee relations, R&D, and government procurement.
6. *Strategic Planning*. Strategic planning compels incubator management to confront tough issues. How will the incubator continue to operate if revenue projections from rental income are not achieved? How will major facility repairs (for example, a ruptured boiler) be paid for? Addressing these worst-case scenarios through strategic planning can provide both a clear course of action if things go as planned and, if they do not, the necessary contingency plans to navigate what may be a difficult beginning.

Economic development programs for small businesses proliferated in the 1980s. These programs have been referred to as **incubators without**

walls. Well-managed incubators often distinguish themselves by serving as a focal point for access to the broad spectrum of available business services. Incubator managers thus provide the point of contact for entry into various programs. Many efforts to assist small business are, by contrast, programmatic in nature and limited by the scope of their intent. A well-positioned incubator, on the other hand, will help its tenants to access the range of existing programs and, in addition, provide access to informal networks for business and financial advice and assistance. For example, a retired executive may agree to help out a struggling firm, or a business angel may appear, discretely looking for new investment opportunities.

Successful incubator programs are marked by foresight, focus, and leadership. Successful incubator programs also know how to identify, organize, and maximize talent and resources, making the most of community support and entrepreneurial networks. A core group committed to starting a business incubator must recognize that its efforts cannot be pursued in a vacuum. As Zablocki puts it: “*The dream of a few must become the dream of many.*” ■

All chapters refer to: *Intellectual Property Management in Health and Agricultural Innovation: A Handbook of Best Practices*. 2007. A Krattiger, RT Mahoney, L Nelsen, JA Thomson, AB Bennett, K Satyanarayana, GD Graff, C Fernandez, and SP Kowalski (eds.). MIHR: Oxford, U.K., and PIPRA: Davis, U.S.A. Available online at www.ipHandbook.org. The online version contains for each chapter a detailed Editor's Summary, Implications, and Best Practices.

- 1 Chapter 13.1 by A Brown and J Soderstrom titled Creating and Developing Spinouts: Experiences from Yale University and Beyond, p. 1253.
- 2 Chapter 13.5 by C Garner and P Ternouth titled New Companies to Commercialize IP: Should You Spinout or Start-up? p. 1295.
- 3 Chapter 13.2 by JC Sandelin titled Dealing with Spinout Companies, p. 1271.
- 4 Chapter 13.3 by R Wyse titled What the Public Sector Should Know about Venture Capital, p. 1281.
- 5 Chapter 13.4 by T Cook titled The Role of Technology Transfer Intermediaries in Commercializing Intellectual Property through Spinouts and Start-ups, p. 1289.
- 6 See *supra* note 4.
- 7 *Ibid.*
- 8 Chapter 13.6 by Edward M. Zablocki titled Formation of a Business Incubator, p. 1305.



FOR GOVERNMENT POLICYMAKERS

- ✓ Much of **the success of a spinout or start-up will depend on the entrepreneurial spirit** at the institution. The more entrepreneurial, the more likely it will be that someone wants to set up a new company.
- ✓ Governments should **encourage public research organizations to use their inventories of IP rights to create spinouts** because they create new jobs, contribute to economic development, and potentially grow into multinational companies. But governments should recognize that setting up a new business is a **high-risk activity** and should allow new companies to fail gracefully.
- ✓ Rather than venture capital driving the creation of new companies, it is usually the creation of new companies that attracts venture capital.
- ✓ The formation of new companies creates an environment that increases the probability of success for other companies. Thus, the public sector should (1) plant the seed, encouraging skilled people with new ideas to develop those ideas and (2) create an environment that favors entrepreneurship and success. **Universities and research institutes can plant the seeds, while government policies can shape the environment.**
- ✓ While a government cannot *legislate* entrepreneurship, it can *encourage* entrepreneurship by providing a **favorable environment for creating and growing new companies**. This would be an environment with (1) an encouraging business culture that rewards success and treats failure as a learning opportunity, (2) access to intellectual capital (such as that flowing from universities), (3) access to sufficient financial capital, and (4) reliable physical capital (facilities, laboratories, communications).
- ✓ Public sector institutions may be the largest economic entities present in a developing country. Hence, they can contribute much by **taking the lead in developing and fostering the establishment of spinout companies** that are seeded with technologies generated in the public sector and protected and managed as IP assets.
- ✓ To successfully commercialize intellectual property, a country ought to have a **stable economic and institutional environment, available investment capital, commercializable intellectual property, a commercial environment that can develop intellectual property, and competent technology transfer intermediaries**.
- ✓ Technology transfer of any sort is likely to succeed only if there is **sustained commitment** at the most senior levels of both government and research institutions.
- ✓ Governments can encourage regional economic development by fostering and financing business incubators. Ideally, they ought to be located in strategically selected regions and **build on potential synergies of existing institutions**. Small business incubators in particular have proven to be effective economic development tools.

Given that IP management is heavily context specific, these Key Implications and Best Practices are intended as starting points to be adapted to specific needs and circumstances.



FOR SENIOR MANAGEMENT

(UNIVERSITY PRESIDENT, R&D MANAGER, ETC.)

- ✓ Experts are divided as to what approach should be taken by public institutions with regard to creating companies. Some advocate a **“hands-on” approach** in which the institution actively and directly manages the creation of companies and invests in the resources needed for their success. Others argue that the university should **channel its resources into activities that may result in marketable technologies**, but not engage directly in marketing activities.
- ✓ **The creation of business incubators as a tool for stimulating local economic development** should not be underestimated. Incubated companies have a dramatically higher rate of survival than the average spinouts.
- ✓ **Spinouts often create enhanced opportunities for its faculty.** If spinouts remain in the region, faculty inventors can remain active as consultants. Also, a university’s success with spinouts can attract new talent.
- ✓ Much of the **success of a spinout or start-up will depend on the entrepreneurial spirit** at the institution. The more entrepreneurial, the more likely it will be that someone wants to set up a new company.
- ✓ The formation of new companies creates an environment that increases the probability of success for other companies. Thus, the public sector should (1) plant the seed, encouraging skilled people with new ideas to develop those ideas and (2) create an environment that favors entrepreneurship and success. **Universities and research institutes can plant the seeds, while government policies can shape the environment.**
- ✓ When engaging in entrepreneurial activities, **risks to the university** include potential impact on tax-exempt status, liabilities for the actions of the company, conflicts of interest and/or commitment, and conflicts with the university’s mission.
- ✓ To be an **effective entrepreneurial university**, representatives of senior administration should routinely review company-founding and business-maintenance activities.
- ✓ Clear policies are needed for **disposing of equity in spinout companies**, both for the sake of the university’s integrity—to prevent conflicts of interest—and for the sake of the company—to prevent the university’s divestment from sending a damaging signal to the market about the value of the company or its technology.
- ✓ To demonstrate the importance of technology transfer, the **TTO should generally report directly to upper-level administration.**
- ✓ In order to **attract venture capital in agriculture**, public sector institutions need to take steps to reduce the risk of investing in agricultural projects.
- ✓ Rather than venture capital driving the creation of new companies, **it is usually the creation of new companies that attracts venture capital.**

Given that IP management is heavily context specific, these Key Implications and Best Practices are intended as starting points to be adapted to specific needs and circumstances.



FOR SCIENTISTS

- ✓ Not all university inventors are **entrepreneurs** nor are they interested in being company founders, and not all spinout company founders from a university are the technology's inventors.
- ✓ While inventors are treated equally under university patenting and licensing policies, **involvement as a company founder entails a greater degree of risk and commitment** to move an invention to commercialization. You may be valuable as an active partner of a spinout company to prevent the repetition of unsuccessful experiments (blind alleys) and to add needed creativity with respect to problem solving as development and commercialization proceeds.
- ✓ **Participation in a spinout** can be a particularly rewarding experience, financially as well as personally, as it involves the practical application of your ideas.
- ✓ **Venture capital investors** combine a broad view of the market with solid technical expertise. You will need to be prepared to convince investors not so much of the technical merits of your research, but of how your ideas lead to economic returns.
- ✓ Rather than venture capital driving the creation of new companies, **it is usually the creation of new companies that attracts venture capital.**
- ✓ Venture capital investors can be great allies, but will impose, for good reasons, distinct conditions on the project. **Be open, patient, and willing to work with investors.**
- ✓ Much of **the success of a spinout or start-up will depend on the entrepreneurial spirit** at the institution. The more entrepreneurial, the more likely it will be that someone wants to set up a new company.
- ✓ There are many factors that determine the feasibility and success of a spinout company. The technology's intrinsic value and **your commitment to your invention** are only part of the picture. If you can find an existing partner with market penetration, the chances of success increase. If you are still convinced, even after failing several times to find a willing licensee for your technology, then it may be time to consider creating a company. As these matters arise, seek the guidance of your institution's technology transfer office.



FOR TECHNOLOGY TRANSFER OFFICERS

- ✓ **Spinouts carry a number of risks**, but with certain factors in place they can represent the best opportunity for developing early-stage technology. This is particularly true because the inventor, and other university participants, will have a vested interest in, and commitment to, the success of that technology.
- ✓ **Potential investors** in a spinout will ask two major IP questions. Could previously existing intellectual property block the technology? Could your intellectual property dominate the market and prevent entry by others? Other key questions involve the characteristics of the market opportunity and the financial bottom line of revenue and expense projections over the life of the technology.
- ✓ **Solid, long-term support from your institution** will be required to: (1) operate the technology transfer office efficiently, so that it can evaluate invention disclosures, obtain IP protection when appropriate, coordinate the search for people or companies that will develop the invention into products and services, and negotiate and prepare the necessary legal agreements (for example, license agreements for IP rights); (2) cover the costs of obtaining IP rights; and (3) provide funding to convert good ideas into working prototypes. (A good idea not put into use is wasted.)
- ✓ Your job is complex and challenging because you have to **balance the needs and expectations of many parties** with divergent interests: Remain responsive to such needs and interests; keep people informed of progress and developments; effectively utilize available resources.
- ✓ When licensing to or creating new ventures, several key attributes are essential for **attracting venture capital investment**: a strong management team, a viable technology, a strong IP position, a large potential market, and location in an environment favorable for entrepreneurship.
- ✓ New ventures in developing countries have much to gain by **attracting and building on international investor networks**. They have the potential to open new markets and bring in new alliances.
- ✓ Much of **the success of a spinout or start-up will depend on the entrepreneurial spirit** at the institution. The more entrepreneurial, the more likely it will be that someone wants to set up a new company.
- ✓ It is necessary to strike a balance between reliance on **licensing-out to existing companies** and investing time and resources in **creating new companies**.
- ✓ Rather than venture capital driving the creation of new companies, **it is usually the creation of new companies that attracts venture capital**.
- ✓ When creating spinout companies, always remain focused on your **institution's primary mission**, such that the spinout will be consistent with, and even serve, that public sector mission.

Given that IP management is heavily context specific, these Key Implications and Best Practices are intended as starting points to be adapted to specific needs and circumstances.