CHAPTER 2

Theoretical Framework for Innovation Policy in ASEAN

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2.1 | Introduction

This chapter aims to introduce a theoretical framework for the design of innovation policy in the Association of Southeast Asian Nations (ASEAN). In addition to religious, ethnic, and political diversity, ASEAN Member States (AMS) are diverse in terms of economic status, such as living standards (ranging from low- to high-income countries) and industrial structure (e.g. agriculture, tourism, manufacturing, and finance). Therefore, this chapter pays particular attention to a theoretically desirable approach to innovation policy that takes into consideration the different development phases and industrial characteristics.

The chapter is organised as follows. The first section defines innovation. The second section reviews theories and facts about economic growth to illustrate why innovation policy matters to the government at any development phase. The third section identifies the determining factors in innovation from a theoretical perspective – appropriability, technological opportunities, and knowledge spillovers – and attempts to integrate them into the frameworks of sectoral, national, and regional innovation systems. In the fourth section, policy implications of the effects of knowledge spillovers on innovation are discussed, with a specific focus on the diffusion of innovation. The discussion develops to several frameworks on which innovation policy in ASEAN should be built. These are innovation intermediaries, entrepreneurship, and a whole-of-government approach. The final section concludes the paper.

2.2 | What Is Innovation?

Innovation is defined as new products, processes, and practices created in a society and disseminated within the society. Because of its specific focus on ASEAN, in which many member states are developing countries, this chapter places a greater emphasis on the latter element – diffusion – for the following reasons. First, innovation is not merely a technical process driven solely by scientific advancement; it is also a social process that inevitably hinges on how receptive users are to the new knowledge embodied in technologies and practices and how responsive providers of knowledge are to social needs. Such recognition has important implications for innovation policy, as will be discussed later. Second, the novelty element associated with innovation defined here does not necessarily mean the innovation must be new to the world. A technology that is entry-level in one society can be regarded as an innovation in another society where the technology has yet to be introduced as long as it brings new solutions to exiting problems in the society. Third, the introduction of state-of-the-art technology without taking into account social needs and absorptive capacity is not merely ineffective but also could be detrimental to social welfare. Ample anecdotal evidence demonstrates that the introduction of entry-level technologies could have an immense impact on living standards in developing countries. Typical examples include vaccination against diphtheria, pertussis, and tetanus; the supply of clean water; and improvement in sanitation (World Bank, 2010). The theoretical consequences of the emphasis on the diffusion of innovation will be further discussed in Section 2.5.3 on entrepreneurship.

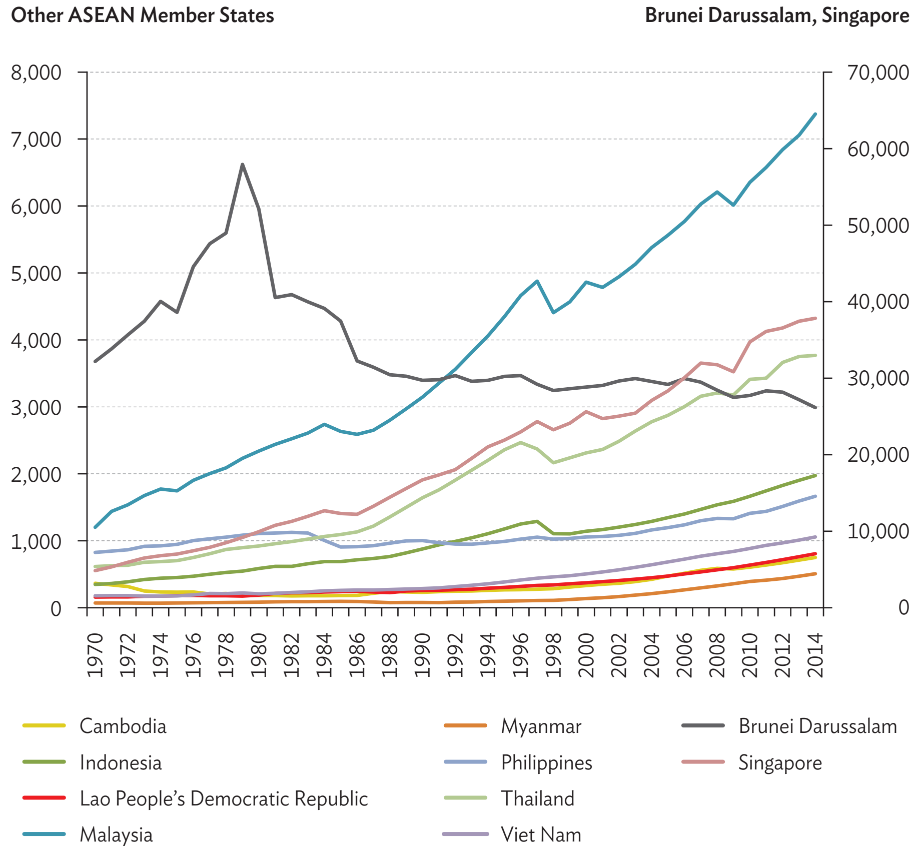
2.3 | Why Innovation?

2.3.1 Welfare improvement

This chapter starts with a discussion of the determinants of welfare, which represents happiness, because improving welfare is the ultimate goal for any government at any development phase. This leads to an understanding that innovation is a critical factor for improving welfare, and that is why innovation policy is of great importance for any government. Assuming wealth can represent welfare, welfare has been evaluated using real gross domestic product (GDP) per capita.[1] Figure 2.1 shows time series variations in the real GDP per capita of AMS. The results show that ASEAN is diverse in terms of the level and growth of living standards, and AMS can be classified into four groups: high-income (Brunei Darussalam and Singapore); middle-income

[1] There has been a rebuttal to the assumption that an increase in income per capita is positively associated with self-reported happiness of a nation (Easterlin, 1974). More fundamentally, empirical studies in the United States show that happiness is one component of (not identical to) utility, and it is possible to give up happiness to increase income, thereby improving utility overall (Benjamin et al., 2011; Glaeser et al., 2016).

Figure 2.1: Living Standards of ASEAN Member States (GDP per capita, US$)



ASEAN = Association of Southeast Asian Nations, GDP = gross domestic product.

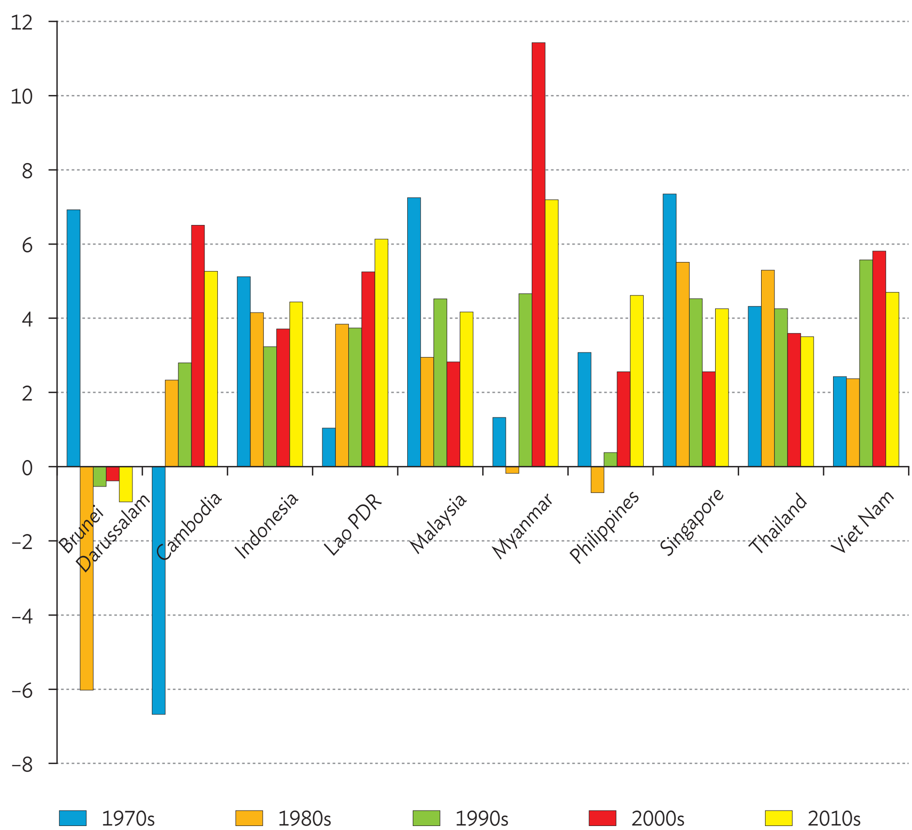
Note: The right-hand axis represents Brunei Darussalam and Singapore, while the left-hand axis represents other ASEAN Member States. GDP per capita is measured in constant 2005 prices.

Source: Author's elaboration based on United Nations, National Accounts Main Aggregates Database.

(Indonesia, Malaysia, the Philippines, and Thailand); and low-income (Cambodia, Lao PDR, Myanmar, and Viet Nam). This suggests the need to understand innovation policy in and for ASEAN according to each country's development phase.

Most AMS have experienced remarkable improvements in living standards since the late 1980s. Figure 2.2 shows the rate of improvement in living standards by decade and country. Most member states recorded an annual improvement in living standards of more than 2% since the 1990s. Transitional economies, such as Cambodia, Lao PDR, Myanmar, and Viet Nam, have demonstrated even better performance than other ASEAN economies since the 1990s, at least partly because they were starting from a lower base. Myanmar recorded an annual improvement of over 11%, which amounts to a 250% improvement in the 2000s. Some countries recorded negative values occasionally (Cambodia in the 1970s, Myanmar and the Philippines in the 1980s) or continuously (Brunei since the 1980s), indicating that people became poorer on average during those periods. The periods of decline appear to be linked to exogenous shocks, such as political turmoil in those countries and major changes in natural resource prices.

Figure 2.2: Improvement in Living Standards in ASEAN Member States (%)

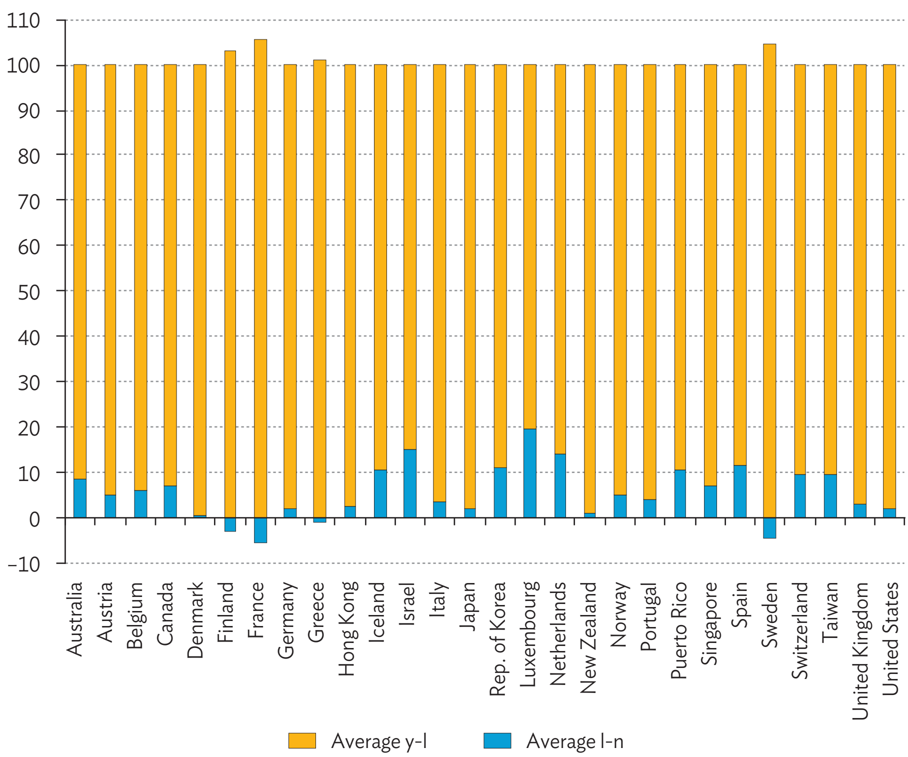


ASEAN = Association of Southeast Asian Nations, Lao PDR = Lao People's Democratic Republic.

Source: Author's elaboration based on United Nations, National Accounts Main Aggregates Database.

How can a nation's living standards be steadily improved? A simple mathematical procedure provides an answer to this question. Real GDP per capita is defined as (Y/N), where Y denotes value-added and N denotes the population. This can be decomposed into labour productivity (Y/L), where L denotes labour and the labour force participation rate (L/N). Because $Y/N = Y/L*L/N$, assuming that a lower case variable represents the growth rate of the variable ($Y'/Y = y$, where the apostrophe denotes differentiation with respect to time), then $Y/N = Y/L*L/N$ can be rewritten using logarithmic derivatives as $y - n = (y - l) + (l - n)$. This means that the improvement in living standards is determined by the growth rates of labour force participation and labour productivity. Figure 2.3 shows the contribution of each factor to y-n using data from 1980 to 2010. The results show that in all countries, the annual average growth of labour productivity was far more important than that of labour force participation for improving living standards. This means that labour productivity growth is the key to understanding the reason for steady welfare improvement.

Figure 2.3: Decomposition of the Improvement in Living Standards (%)



Average l-n = average growth in labour participation rate, average y-l = average labour productivity growth, Rep. of Korea = Republic of Korea.

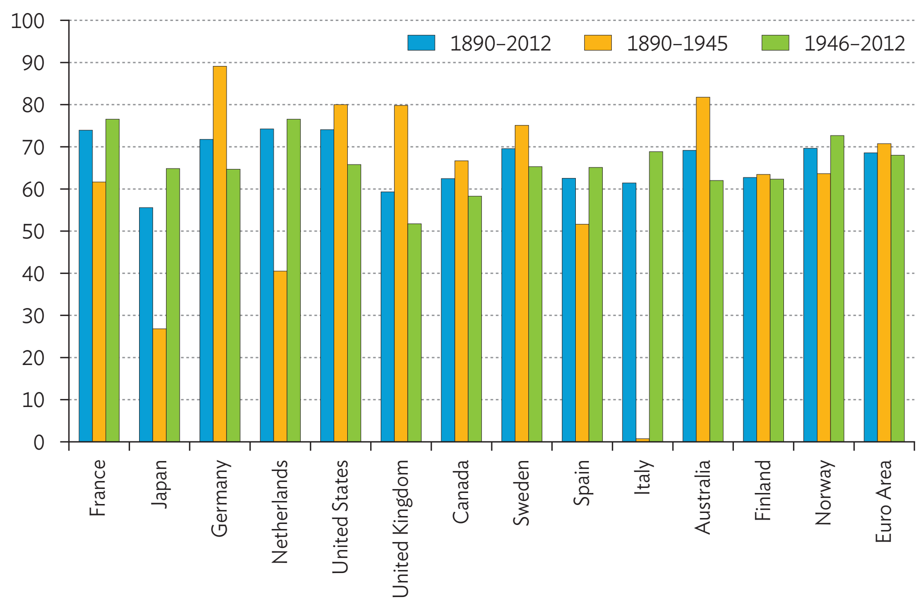
Source: Author's elaboration based on International Monetary Fund, World Economic Outlook.

2.3.2 Determinants of labour productivity growth

Let us use a simple decomposition again to understand the determinants of labour productivity growth by introducing another indicator of productivity: total factor productivity (TFP). Unlike labour productivity, which assumes labour as a sole input, TFP is the ratio of economic output to all production factors used. Given a competitive market for a final product from labour and capital, the level of TFP can be defined as $Y/L^{\alpha}K^{\beta}$, where K denotes the capital stock, α denotes the labour share (proportion of the wage to value-added), and β denotes the capital share ($\alpha + \beta = 1$). The growth rate of TFP is then defined as $y\text{-}\alpha l\text{-}\beta k$, i.e. the Solow residual, which is the output growth that cannot be attributed to input growth weighted by the cost share (Solow, 1957). This means that labour productivity growth, $y\text{-}l$, can be decomposed into TFP growth and capital deepening, which refers to the degree of upgrading of capital intensity (K/L).

Figure 2.4 shows the contribution of TFP growth to $y\text{-}l$ using data from 1890 to 2012 in currently advanced economies. The results show that in all advanced economies, TFP growth accounted for more than half of the growth in labour productivity during

Figure 2.4: Contribution of Total Factor Productivity Growth to Labour Productivity Growth (%)



Source: Author's elaboration based on data from Bergeaud et al. (2016).

the period. It is no coincidence to find that countries that experienced modern economic growth later, such as Italy and Japan, recorded an even greater contribution from TFP growth in the post-World War II era (1946–2012). This suggests that capital deepening was a critical factor in labour productivity growth before World War II in these economies. This was presumably because they were yet to build a sufficient knowledge stock to create innovation, having had capital deepening play a dominant role in labour productivity growth.

Another study based on the same dataset supports such a notion by illustrating that the contribution of TFP growth to labour productivity growth was particularly salient in the high-growth era (the 1950s and 1960s) in Japan (Cette et al., 2009). One may wonder then what determines TFP growth.[2] A number of empirical studies have tackled the decomposition of industry-level TFP ($\sum_i s_{it}\omega_{it}$, where *s* denotes the market share of a firm *i*, and ω denotes firm-level TFP at time *t*), thereby identifying and measuring four key factors: (1) the within effect, i.e. the effect of the change in an individual firm's TFP, ($\sum_{i\in S} s_{it}(\omega_{i2}-\omega_{i1})$, where *S* denotes firms that survive in the market); (2) the between effect, i.e. the effect of the change in market share, ($\sum_{i\in S}(s_{i2}-s_{i1})\omega_i$); (3) the entry effect ($\sum_{i\in E} s_{i2}\omega_{i2}$, where *E* denotes firms that enter the market); and (4) the exit effect ($-\sum_{i\in X} s_{i1}\omega_{i1}$, where *X* denotes firms that exit the market) (Baily et al., 1992; Griliches and Regev, 1995; Foster et al., 2001; Melitz and Polanec, 2015). The policy implications of this decomposition are that the government should promote (or eliminate barriers for) industry research and development (R&D) on which innovations are built; encourage competition in the market, which optimises resource reallocation; and promote entrepreneurship, which accelerates industrial metabolism (exit and entry).

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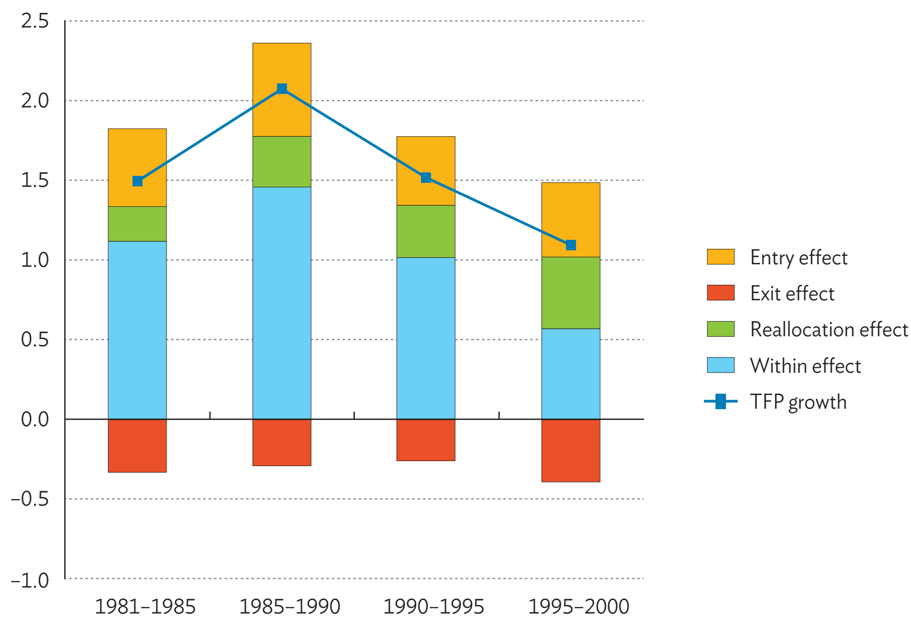
2 Endogenous growth theory provides an alternative way of understanding the determinants of TFP growth. It assumes an aggregate production function, $Y = AL^{\alpha}K^{\beta}$, where *A* denotes the technology level. Then labour productivity growth is decomposed into technological progress, $a(=A'/A)$, and capital deepening. Unlike neoclassical theories, which see *A'* as exogenous (manna from heaven), Romer (1986) argues that knowledge stock created endogenously results in knowledge spillovers, which implies the absence of diminishing marginal returns to capital adopted by neoclassical theories at the social level (note that they work at the firm level). The endogenous growth model assumes that $A' = pLA^{\lambda}$ where *p* denotes the probability of discovering a new idea leveraging public knowledge, *LA* denotes research and development (R&D) staff, *LB* denotes production workers ($L = LA + LB$), and λ denotes the constant degree of R&D overlapping (the smaller λ is, the more efficient is R&D). Furthermore, it is assumed that $p = p'A^{\Phi}$, where Φ denotes knowledge spillovers (the greater Φ is, the more ideas come from public knowledge), and *p'* and Φ ($0<\Phi<1$) are exogenous and constant. This means that $a = p'A^{\Phi-1}LA^{\lambda} = (p'LA^{\lambda})/(A^{1-\Phi})$. In a steady state, *a* is constant, which means that the growth rate of LA^{λ} is equal to that of $A^{1-\Phi}$. Therefore, $\lambda(LA'/LA)=(1-\Phi)(A'/A)$. Given that the population growth (*n*) is constant, this can be rewritten as $a = n\lambda/(1-\Phi)$. This implies that the higher the population growth is, the larger the knowledge spillovers are, and the less redundant R&D investment is, the higher TFP growth is.

Figure 2.5 shows the decomposition of TFP growth using data for Japan's manufacturing sector. The results show that the secular stagnation in Japan since the 1990s stemmed from a decrease in the within effect, reflecting decreasing innovation by incumbent firms (those already in the market), a negative exit effect,[3] and a low entry effect. This implies that government interventions were needed to increase innovation, foster a pro-market environment for firms to procure and reallocate resources efficiently, and facilitate entrepreneurial activities to increase the entry rate. In sum, from a theoretical perspective, innovation is the most influential factor in the improvement in welfare that any government should aim for. This is why innovation policy is immensely important for governments regardless of the development phase or economic environment.

Figure 2.5: Decomposition of Total Factor Productivity Growth in Japan's Manufacturing Sector (annual growth rate, %)



TFP = total factor productivity.
Source: Fukao (2012).

[3] Fukao (2012) argues that the negative exit effect stems from the evacuation of productive establishments (hollowing out of industry) rather than the presence of zombie firms (Caballero, Hoshi, and Kashyap, 2006), which are virtually bankrupt but allowed to survive because of commercial banks' concerns over these firms being 'too big to fail'.

2.4 What Drives Innovation?

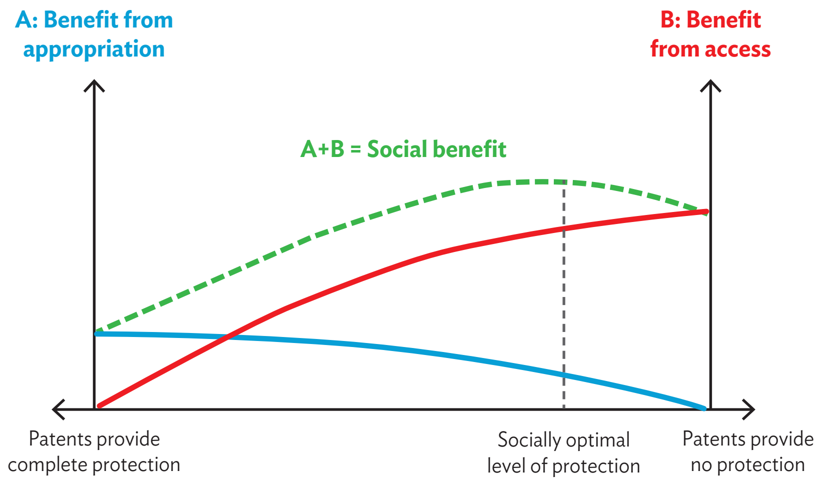
2.4.1 Determinants of innovation

A natural question that follows is, how can the government promote innovation? To answer the question, it is necessary to understand two opposite factors shaping innovative activities: the appropriation of knowledge, which enables current innovators to secure profits from the creation of new knowledge, and access to knowledge, which allows potential innovators to learn from prior knowledge and identify the novelty of their ideas. The former has to do with a demand-side factor of innovation, which is appropriability, while the latter has to do with a supply-side factor of innovation, which is technological opportunity.

Figure 2.6 demonstrates the benefit curves of each factor and the optimal point at which the social benefit (the sum of the two) is maximised. Benefit from the appropriation of knowledge attains its maximum value when patents provide complete protection.[4] This extreme can be seen in the pharmaceutical industry, where patents are the most effective means to appropriate innovative returns. Previous surveys of R&D managers in the private sector in Europe, Japan, and the United States show that there are three ways for firms to appropriate innovative returns according to industrial characteristics: legal methods, such as utility and design patents; know-how; and first-mover advantage (Levin et al., 1984; Arundel et al., 1995; Goto and Nagata, 1997; Cohen et al., 2000; Nagaoka and Walsh, 2009). Focusing on legal methods, the benefit from the appropriation of knowledge becomes zero when patents provide no protection. On the other hand, the benefit from access to knowledge marks its maximum value when patents provide no protection. It becomes zero when all prior knowledge is privatised through patenting. This extreme is the case where the tragedy of the anti-commons, where the privatisation of upstream knowledge (e.g. research tools, such as mice) through academic patenting deters downstream innovations, becomes a reality (Heller and Eisenberg, 1998; Eisenberg, 2001; Walsh et al., 2003). The social benefit curve is depicted as the sum of the two.

4 It is notable that patents act as a means not only of appropriation but also of knowledge diffusion. Patents not only allow applicants to exclude others from using the patented technology but also publicly disclose information about the technology within a specific period of time from application. The latter element acts as an important source of knowledge for followers.

Figure 2.6: Appropriation of and Access to Knowledge as Determinants of Innovation



Source: Author's elaboration based on Tanaka (2005).

In general, strong patent protection is conducive to economic growth in developed countries (Lerner, 2002) as developed country firms tend to have accumulated knowledge that can leak out and benefit others. Patent protection that is too strongly enforced in developing countries will make it difficult for these countries to tap into global knowledge and will hamper their economic growth (Maskus, 2000; Boldrin and Levine, 2008; Dutta and Sharma, 2008). It should be noted that factors other than the development phase, such as technologies, regions, and periods, may influence the optimal balance between the two that maximises social benefit. Therefore, arbitrary regulations and initiatives for innovation that do not take into account such factors may be not only ineffective but also detrimental to social welfare.

Another factor associated with both the demand and supply side of innovation is knowledge spillovers.[5] In the case of investment in physical assets, it is impossible for others to earn revenue from the capital invested by someone else. In the case of R&D

[5] There are two types of spillovers: knowledge (or pure) spillovers and rent (or pecuniary) spillovers. Unlike knowledge spillovers, rent spillovers take place through market transactions. If suppliers embody their R&D efforts into intermediate goods and the market for them is competitive, then users can procure better inputs at lower prices. A typical example of this can be seen in discrete process industries, such as the automotive industry, where the production process can be divided into many processes and undertaken by various suppliers, including small and medium-sized enterprises (SMEs).

investment, however, knowledge as an outcome of R&D investment may be diffused in a society through various channels, making it difficult for innovators to fully appropriate the returns to their R&D investment. This implies a gap between the private and social rates of return to R&D, which refers to the difference between the marginal products of a firm's own R&D and others' R&D. Economists have measured this gap and found that the social rate of return to R&D is significantly higher than the private rate of return in various regions, industries, and periods (Mansfield et al., 1977; Bernstein and Nadiri, 1988; Goto and Suzuki, 1989). This implies low incentives for the private sector to perform R&D for fear of knowledge leakage, leading to underinvestment where the private sector invests in R&D at a lower level than that which is socially optimal. Such underinvestment justifies innovation policies, such as patent systems, R&D subsidies, and R&D tax credits, which will be discussed later. Thus, knowledge spillovers are a deterrent to private R&D.

There is, however, another important property of knowledge spillovers that relates to the concept of absorptive capacity (Cohen and Levinthal, 1990). This concept builds on the recognition that knowledge spillovers are not manna (a gift) from heaven; rather, they are contingent on the absorptive capacity created through a firm's own R&D efforts. Most of the latecomers in innovation start with imitation, which requires abilities to identify the appropriate sources of knowledge and to understand the contents. This, in turn, requires a certain level of knowledge stock accumulated through continuous own R&D efforts, and the level rises as followers catch up with the technological frontier. In other words, without absorptive capacity, it is impossible to search, select, comprehend, and exploit external sources of knowledge for internal innovative activities. This implies that when knowledge spillovers are large, the incentives for private R&D will be higher because of the greater necessity for firms to build absorptive capacity to learn efficiently from external sources of knowledge.

2.4.2 Systems of innovation

Before discussing the policy implications of theories of innovation, this subsection illustrates a systematic way to understand the relationship among the determinants of innovation (i.e. technological opportunities, appropriation conditions, and knowledge spillovers), leveraging key streams of research on systems of innovation.

The concept of sectoral innovation systems highlights that industrial innovations exhibit distinct sectoral patterns in the following ways (Nelson and Winter, 1982; Pavitt, 1984; Malerba, 2002).

First, regarding technological opportunities, firms innovate not only by exploiting internal resources but also by tapping into external sources of knowledge, such as feedback from customers, better inputs from suppliers, the reverse engineering of competitors' products, and academic research by universities and public research institutes. It has been recognised that different industries rely on different external sources of knowledge. Specifically, the impacts of academic research on industrial innovations are greatest in pharmaceuticals, where advancement in life sciences directly boosts drug discovery (Hicks et al., 2001; Huang and Murray, 2009; Furman and Stern, 2011). Several empirical studies of science-based sectors, such as the pharmaceutical industry, show that interactions with universities improve the R&D productivity of incumbents and promote new firm creation to leverage academic inventions (Deeds and Hill, 1996; Powell et al., 1996; Zucker et al., 1998; Baum et al., 2000; Rothaermel and Deeds, 2004).

Second, regarding appropriability, innovation surveys conducted in various countries show that the effectiveness of patents as a means to appropriate the returns to R&D investment varies significantly across industries, which leads to great variations in patent propensity at the industry level (Levin et al., 1984; Arundel et al., 1995; Goto and Nagata, 1997; Cohen et al., 2000; Nagaoka and Walsh, 2009). Patents are most effective in biotechnology. Biotechnology-related innovations tend to be standalone as opposed to systemic in that a final product can be clearly defined by specific information in patent documents (e.g. chemical equations), which makes it very difficult for followers to invent around, and makes patents particularly effective as appropriation mechanisms for innovators. In other technological fields, lead times and the first-mover advantage are more important than legal protection.

Third, regarding spillover channels, previous studies classify economic activities into three industrial knowledge bases: analytical (science); synthetic (technology); and symbolic (culture), and argue that different industrial knowledge bases require different modes of transfer in a systematic manner (Asheim and Gertler, 2005; Asheim et al., 2007; Martin and Moodysson, 2011). The key components of this framework are the degree to which tacit knowledge is involved and the significance of personal interactions in knowledge transfer. Specifically, the three broad categories are defined as follows.

First, innovations in science-based sectors, such as biotechnology, tend to build on 'analytical knowledge', which is knowledge generated through attempts to explore and explain the universal principles of nature (Asheim and Gertler, 2005).

The production of analytical knowledge refers to encapsulating natural sciences and mathematics, where the key inputs are reviews of scientific articles and the application of scientific principles. Knowledge outputs can be communicated in a universal language, such as mathematical or chemical equations, which are the least tacit and the most likely to be embodied in codified channels (e.g. scientific articles and patents). Therefore, knowledge outputs in analytical knowledge-based industries tend to be disseminated through channels that are less geographically constrained, such as licensing.

Second, innovations in mechanical engineering tend to build on 'synthetic knowledge', which is knowledge generated through attempts to design something that works as a solution to a practical and more applied problem. Knowledge is created through a heuristic (learning-by-doing) approach rather than a deductive process, which makes know-how and craft-based skills, both of which contain more tacit knowledge, more important for innovations of this type. Efficient transfer of tacit knowledge requires personal communications among scientists and engineers, which tend to be more active in industrial clusters (Storper and Venables, 2004). Therefore, knowledge outputs in synthetic knowledge-based industries tend to be disseminated through personal interactions, such as technical consultations, which benefit from geographical proximity.

Third, the production of 'symbolic knowledge' refers to the creation of cultural meanings embodied in shapes, images, words, sounds, experiences, and cultural artefacts. Symbolic knowledge is the most tacit of the three because the means of production is based on learning-by-doing and observing other creators, such as artists, musicians, industrial designers, and architects. These characteristics strongly affect the spatial configuration of talent because the nature of the valuable knowledge in such occupations particularly favours spatial concentration, which facilitates frequent personal interactions. This implies that talents located in a cluster would be able to receive greater spillovers of locally embedded knowledge from other talents through personal interactions, making them more productive (Gertler, 2003).

The concept of industrial knowledge bases is closely associated with the significance of geographical distance in knowledge transfer according to the degree of tacitness of knowledge being transferred and the significance of personal interactions in knowledge transfer.[6] In essence, physical distance does not matter for the transfer

[6] Another important perspective is the cognitive distance, which will be discussed in the section of innovation intermediaries.

of analytical knowledge, while the transfer of symbolic knowledge tends to be geographically constrained. This notion invokes two important frameworks for understanding the determinants of innovation: national innovation systems and regional innovation systems. The former highlights the creation of knowledge in a nation built on interactions among firms, universities, and public research institutes, rather than relying on independent efforts by each of them (Lundvall et al., 1992; Nelson et al., 1993; Braczyk et al., 1998). This is in contrast to a linear model of innovation, where innovation is supposed to be mechanically derived from scientific advancement. A typical example of such interactions is university–industry collaborations, such as joint research, consultation of firms by university scientists, licensing of academic patents, and academic spin-offs. Figure 2.7, which summarises a national innovation system, illustrates key channels of university–industry knowledge transfer. Efficient university technology transfer is more significant in science-based sectors, where breakthrough innovations tend to build on the advancement of academic research (Nelson and Winter, 1982; Pavitt, 1984). Furthermore, science linkages in patents (i.e. the number or proportion of inventors' backward citations to non-patent literature, such as academic articles) increase over time, not only in science-based sectors but also in the whole economy (Narin et al., 1997). This implies that academic institutions that create high-impact scientific knowledge (academic articles cited very frequently by subsequent studies) are becoming more significant for the growth of knowledge-based economies.[7]

Rooted in the concept of national innovation systems, the key to understanding regional innovation systems is the localised flow of knowledge. As far as public channels, such as academic articles, are concerned, the geographic range of university spillovers is not deemed to be localised. However, a number of empirical studies show that university spillovers are geographically constrained (Jaffe, 1989; Mansfield,

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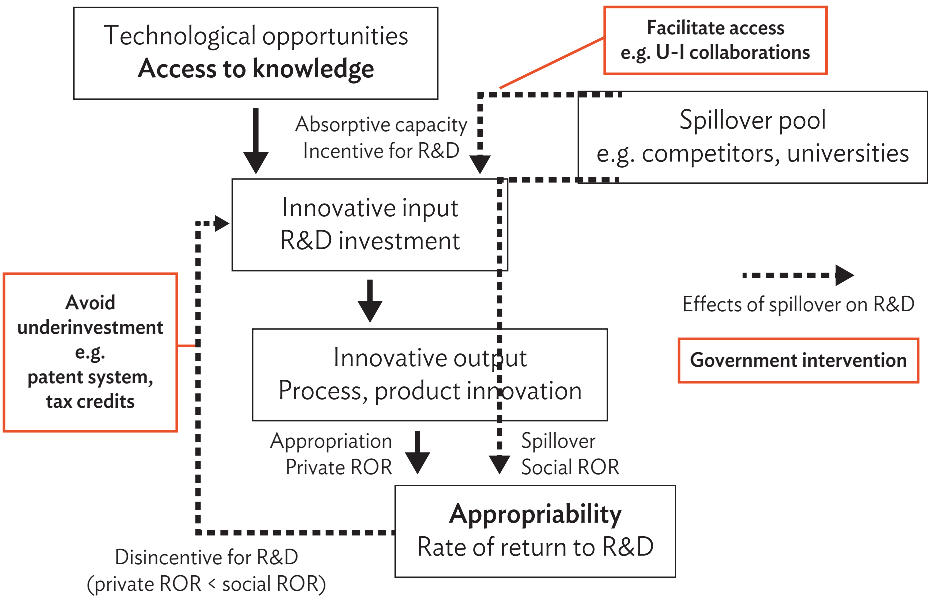
[7] It should be noted that efficient university technology transfer calls for a flexible labour market for scientists. If scientists at national universities are not allowed to consult for private firms, formal university–industry collaborations would be limited, as used be the case in Japan before the incorporation of national universities in 2004 (Collins and Wakoh, 2000; Kneller, 2007; Fukugawa, 2017). It also calls for an efficient capital market so that academic spin-offs based on intangible assets, such as valuable academic patents, can grow faster by leveraging initial public offerings (Fukugawa, 2012). The growth of new technology-based firms also depends heavily not only on entry regulations but also on the protection of incumbents, which has to do with the efficiency of the goods market. These notions strongly suggest that innovation policy encompasses a broader range of policies, such as competition, finance, investment, and labour, than science and technology policy with which innovation policy is frequently identified.

Figure 2.7: Effects of Knowledge Spillovers on Innovation and Their Policy Implications



< = less than, R&D = research and development, ROR = rate of return, U-I = university–industry.

Source: Author.

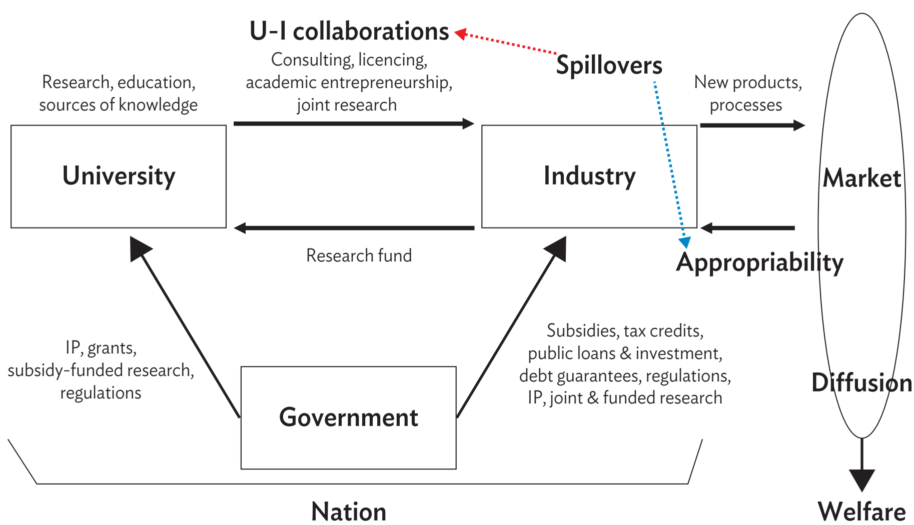
1995; Anselin et al., 1997; Autant-Bernard, 2001; Gittelman, 2007; Ponds et al., 2010; Fukugawa, 2013). In other words, university knowledge spills over into private R&D in a region through some channels, but firms in remote regions do not receive the benefits. The key reason behind this is that university research tends to engage in technologies at the embryonic stage, and such knowledge tends to contain more tacit knowledge. This makes it necessary for the firms tapping into academic research for their innovative activities to have face-to-face communications for efficient transfer (Mansfield, 1995; Jensen and Thursby, 2001). This implies that the region is the key unit of analysis in knowledge creation and dissemination because, other things being equal, active face-to-face communication and transfer of tacit knowledge are more likely to occur when there is geographical proximity. This has an important implication for innovation policy in that clusters play a key role in the promotion of innovation, which will be further discussed in the context of entrepreneurship.

2.5 | How to Encourage Innovation?

2.5.1 Theoretical implications for innovation policy

Figure 2.8 summarises two types of government interventions suggested from theories on knowledge spillovers. On the one hand, knowledge spillovers reduce appropriability at the firm level, leading eventually to underinvestment in R&D at the social level. A typical example of a policy instrument for this type of market failure is a patent system, which aims to secure inventors to exclude others from using the patented technology, thereby augmenting appropriation conditions. Other incentives to encourage firms to initiate R&D projects include the outsourcing of government research, preferable interest rates, tax credit, grants, and debt guarantees.

Figure 2.8: National Innovation Systems



IP = intellectual property, U-I = university–industry.

Source: Author.

Table 2.1 summarises the advantages and disadvantages of these policy instruments. Table 2.2 illustrates the type of policy intervention the government should adopt according to social and private rates of return to R&D. It is notable that underinvestment refers not to the level of the social rate of return to R&D but to the gap between the social and private rates of return to R&D. 'Input additionality' (private R&D that would have not been performed without public support) is considered to be negligible in technological fields where both the private and social rates of return are high relative to the opportunity costs (Category B) because the private sector would have invested in R&D in the absence of government support. The impact of underinvestment is the most serious in technological fields where the social rate of return to R&D is high while the private rate of return is low (Category A).

Table 2.1: Government Interventions to Support Private Research and Development

Type	Advantage	Disadvantage
Tax concession	— Non-discriminatory, open to all — Arm's length instrument, activities chosen by industry — Maintenance of firms' confidentiality — Speedy processing (where approval is 'automatic')	— Of no benefit to unprofitable or start-up firms — Subsidises 'existing' activity that would have occurred anyway (unless based on incremental performance, which is hard to police)
Repayable loan	— Can be targeted widely or focused — Priorities or scope (type, timing, size) set by government — Specific proposals can be made by firms	— Requirements (e.g. collateral) work against small and medium-sized enterprises and start-ups — Procedures are long and cumbersome
Grant	— Benefits focused activities, sectors, clusters, and some types of firms — Allows for prioritisation and, therefore, is appropriate for innovative projects — No need to write it off	— May be subject to criticism for being unfair — Government must have the ability to select recipients
Equity participation	— Benefits focused activities — Firms get investment money up front, reducing risks and uncertainty and increasing creditability	— May be subject to criticism for being unfair — Government must have the ability to select recipients — Must write-off bad projects

Source: Intarakumnerd (2013, p. 9).

Table 2.2: Rates of Return to Research and Development and Appropriate Government Interventions

		Private Rate of Return to R&D	
		Low	High
Social Rate of Return to R&D	High	A: Large additionality	B: Small additionality
	Low	C: Adverse selection	D: Taxation improves welfare

R&D = research and development.

Note: A high rate of return means that R&D investment is preferable in relation to the opportunity cost of other investments (e.g. interest rate).

Source: Author's elaboration based on Nagaoka et al. (2011).

This is the scenario that best justifies government intervention. A typical example of a technology that falls into Category A is a general-purpose technology that yields tremendous rent spillovers to users in various sectors.[8] General-purpose technologies include the steam engine, electricity, transistors, scientific instruments, and the Internet. Patents have been used to appropriate innovative returns to R&D investment in these technologies. Furthermore, large-scale government-led research consortia have provided incentives for private R&D in high-tech industries, which has often been associated with public procurement, chiefly from the military sector.

On the other hand, spillovers provide motivation for firms' own R&D because firms need to build richer absorptive capacity to learn from external sources of knowledge (suppliers, customers, competitors, academic institutions, and overseas) more efficiently. Firms can learn through various channels and from various sources, including customer feedback, quality improvements in inputs, technical analysis of competitors' products, licensing of overseas patents, and scientific advancement. The types of spillover channels and pools differ across development phases. University technology transfer is more important in advanced economies, while access to global knowledge, such as having technology transfer from multinational enterprises' foreign direct investment and adapting it to social needs, is more important for less-developed economies. This aspect of knowledge spillovers justifies another policy intervention: securing the wider access of the private sector to external sources of knowledge, thereby augmenting technological opportunities.

2.5.2 Innovation intermediaries

For the government to enhance access to knowledge, it is important to understand the roles played by 'innovation intermediaries'. Innovation intermediaries are individuals or organisations, be they private or public, that connect the constituencies of national, sectoral, and regional innovation systems, which otherwise would have been fragmented, thereby augmenting knowledge spillovers and, thus, innovation (Stankiewicz, 1995; Howells, 2006). According to detailed definitions of innovation intermediaries, as a consultant, they provide clients with solutions to technological

8 It is notable that the diffusion of general-purpose technology depends on users' recognition about not only the technological but also organisational implications of the new technology. For instance, when electricity was first popularised, plant managers left all the machines in the same places and just replaced the pipes used for steam engines with electric wires. It took more than 20 years for plant managers to recognise that the strength of electricity lay not only in the technical feature as a new power source but also in the organisational feature that an assembly line could be entirely redesigned so that plant managers could have workers work more efficiently (Duhigg, 2016).

problems in R&D. As a broker, they foster market transactions among clients. As a mediator, they foster non-market-based, mutually beneficial collaborations among clients. As a resource provider, they secure clients in collaborations with access to financial, technological, and physical resources to achieve a collaborative outcome (Howard Partners, 2007).

Typical examples of private innovation intermediaries are trade associations that disseminate information on business opportunities, management practices, and technological standards so that participating firms can introduce best practices in the industry and perform better. In many developed countries, various public innovation intermediaries have been developed as part of regional innovation policy. Examples include public research institutes, technology transfer organisations, and liaison offices and incubators in universities and science parks. They develop and deploy human resources that act as gatekeepers[9] bridging different realms (Westhead and Batstone, 1999; Collins and Wakoh, 2000; Fritsch and Lukas, 2001; Santoro and Chakrabarti, 2002; Balconi et al., 2004; Fukugawa, 2006a; Woolgar, 2007; Cassi et al., 2008; Molina-Morales and Martinez-Fernandez, 2010). Another strand of research stresses the importance of the division of labour between public and private intermediaries (Intarakumnerd and Chaoroenporn, 2013). They argue that public intermediaries, such as national research institutes, should play an active role in producing public goods that are necessary for the general technological upgrading of firms in the sector, while private intermediaries, such as trade associations, should play active roles in creating public goods that can be used among private actors. Furthermore, public intermediaries tend to be important as consultants and resource providers, while private intermediaries tend to be important as brokers, creating competitive advantage according to the needs of users.

The significance of innovation intermediaries is closely associated with 'cognitive distance' in knowledge transfer. The provider and user of knowledge become more cognitively distant when they exhibit greater difference in knowledge bases, codes of behaviour, and cultural backgrounds. For instance, the issue of cognitive distance is salient in the case of university–industry collaborations where universities pursue open science, while industry prefers proprietary technology. Furthermore, innovation

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9 Cohen and Levinthal (1990) describe a gatekeeper as a person who possesses the 'knowledge of who knows what, who can help with what problem, or who can exploit new information' (Cohen and Levinthal, 1990, p. 133). Previous sociological and business studies refer to such an interface using different terms. See Lewin (1949) and Allen and Cohen (1969) for knowledge gatekeepers, Burt (2003) for network entrepreneurs, Harada (2003) for knowledge transformers, and Aldrich and Herker (1977), Adams (1980), and Tushman and Scanlan (1981) for boundary spanners.

intermediaries are particularly important for small and medium-sized enterprises (SMEs), which tend to suffer from market failure and systemic failure. SMEs tend not to retain sufficient business records, tangible assets, or reputation in the business community, all of which are required to secure financial resources from the financial market. SMEs also are vulnerable to weak appropriation of innovative returns in the product market as they retain insufficient complementary assets (production facilities, distribution channels, and customer service networks), which negatively affect R&D investment, and thus hamper the long-term growth of firms.

Innovation intermediaries can also address the systemic failure that makes it difficult for SMEs with insufficient social capital to identify external sources of knowledge, develop ties to potential partners, and exploit links for innovative activities.[10]
With regard to the role intermediaries play in SME innovation, Fukugawa (forthcoming) examines the division of labour among innovation intermediaries for SMEs by comparing policy-led groups, such as cooperative associations, and voluntarily formed groups, such as cross-industry interaction groups (Fukugawa, 2006b), both of which are SME inter-firm organisations developed only in Japan. The estimation results of an endogenous switching regression model that enables counterfactual analysis show that cooperative associations improved participants' TFP through cost sharing, such as joint logistics, while voluntary groups improved participants' TFP through knowledge sharing, such as joint R&D. Furthermore, innovative SMEs exploited different intermediaries so that the benefit from each intermediary would be complementary to TFP growth. These results suggest that the division of labour between innovation intermediaries is critical for the innovative activities of SMEs, which tend to lack social capital and absorptive capacity and, thus, have the greatest need for intermediaries in their innovative activities.

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[10] Public institutes for testing and research, called *Kosetsushi*, constitute an important component of regional innovation policies in Japan. *Kosetsushi* were initially established in the late 19th century in agriculture, textiles, and brewing (e.g. sake and soy sauce), and then gradually developed in manufacturing. They play three key roles in regional innovation systems. First, they diffuse technological knowledge mainly for local SMEs through various routes, such as testing, use of analytical equipment, technical consultation, joint research, and seminars for the introduction of new technologies and standards. Second, they conduct their own research, patent inventions, and license patents mainly to local SMEs. Third, they act as a catalyst for local SMEs to develop innovative networks to external sources of knowledge (Fukugawa, 2016; Fukugawa and Goto, 2016). At least partially inspired by Japan's experiences, some developed countries have established technology diffusion programmes for SMEs as a part of their regional innovation policies. Examples include the Industrial Research Assistance Programs in Canada, the Steinbeis Foundation in Germany, the Regional Board for Economic Development in Italy, the Technology Innovation Centre in the United Kingdom, and the Netherlands Organisation for Applied Scientific Research (Shapira et al., 2011). Previous studies provide econometric evidence that such programmes have had a positive impact on their clients' labour productivity growth (Jarmin [1999] examined the impact of manufacturing extension) and innovations (Ponds et al. [2010] examined the Netherlands Organisation for Applied Scientific Research; Fukugawa [2017] examined *Kosetsushi*).

2.5.3 Entrepreneurship

As previously mentioned, this chapter emphasises diffusion as a critical element of innovation. This recognition leads to another important perspective in the design of innovation policy: entrepreneurship. Inventors are those who create something new by exploiting technological opportunities resulting often from scientific advancement, while entrepreneurs are those who are alert to business opportunities and able to turn inventions into innovation through successful commercialisation. Entrepreneurship is therefore central to the diffusion of innovation (Say, 1803;[11] Schumpeter, 1942). Figure 2.9 shows a typology of entrepreneurial activities. Entrepreneurship in the first place refers to the discovery of business opportunities (Kirzner, 1973;[12] Shane, 2003). Entrepreneurs find business opportunities not only from scientific advancement, but also from internal information, such as unexpected success or failure in the market and customers' feedback, and exogenous shocks, such as changes in demographic structure, the perception of people, regulations, and market structure. The exploitation of business opportunities often takes a form of new organisation creation (Gartner, 1988), which is closely associated with risk taking (Cantillon, 1755;[13] Knight, 1921[14]) and new entry (Lumpkin and Dess, 1996).[15]

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11 'The application of knowledge to the creation of a product for human consumption is the entrepreneur's occupation' (Say, 1803, p. 330).

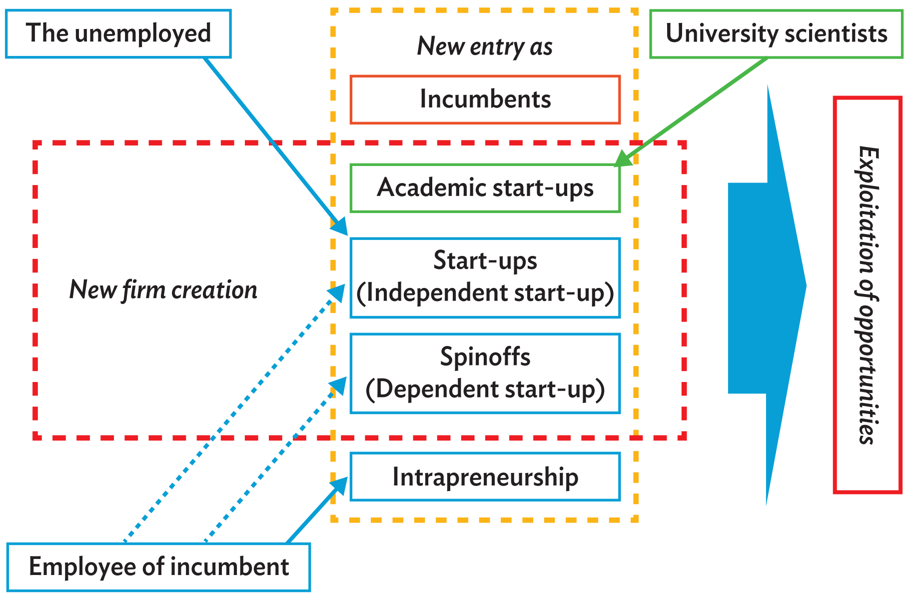
12 'The entrepreneurial element in the economic behavior of market participants consists … in their alertness to previously unnoticed changes in circumstances which may make it possible to get far more in exchange for whatever they have to offer than was hitherto possible' (Kirzner, 1973, pp. 15–16).

13 '[Inhabitants of a state] can be divided into two classes, undertakers and hired people; and that all the undertakers are as it were on unfixed wages and the others on wage fixed' (Cantillon, 1755, Higgs' translation, p. 55).

14 'Entrepreneurs also guarantee to those who furnish productive services a fixed remuneration' (Knight, 1921, p. 271).

15 It is notable that entrepreneurial activities are not confined to new firm creation. Indeed, incumbents play an important role in the exploitation of business opportunities through 'intrapreneurship', which means an entrepreneurial attempt made by an employee without starting a new firm (Burgelman, 1983; MacMillan, 1986). There are ample examples of major innovations created through intrapreneurship, including SR-71 by Lockheed Martin, the Post-It by 3M, Elixir by Gore, the VHS by JVC, autofocus by Konica, the digital camera by Casio, the plasma display panel by Fujitsu, and the PlayStation by Sony. They are the R&D outcomes from skunk works or yami-ken (research in secret) where employees explore unconventional ideas (i.e. non-core tasks) before having their research sanctioned by senior management. According to Parker (2011), intrapreneurship accounted for a significant proportion (22%) of entrepreneurial activities by American adults from 2005 to 2006. Hellmann (2007) argues that intrapreneurship becomes important when a company is firmly committed to an internal development policy, a key intellectual property right is owned by the company, and the environment for external development is not favourable for employees (e.g. the incumbents are efficient in appropriation in the existing market, financing for external venturing is difficult, and intellectual property rights protection is ineffective).

Figure 2.9: Entrepreneurship as a Channel for the Diffusion of Innovation



Note: A dotted line indicates employees leaving the patent firm.
Source: Author.

The promotion of entrepreneurial activities is affected by a number of factors: demography and education as a source of potential entrepreneurs, the degree of competitiveness of the market as a port of entry for entrepreneurial firms, and the protection of intellectual property rights as a means for entrepreneurial firms to appropriate innovative returns. This means that incorporating entrepreneurship into innovation policy inevitably expands the boundaries of the policy as it encompasses diversified policy fields, which will be discussed later. More specifically, entrepreneurship has important implications for innovation policy in knowledge-based economies. Previous studies on the knowledge spillover theory of entrepreneurship (Acs et al., 2013; Ghio et al., 2015) argue that an increase in knowledge stock inevitably creates the need for high-tech entrepreneurship because, in knowledge-based economies, more inventions will be left undeveloped by large R&D-intensive firms and research universities. Increasing the knowledge stock requires entrepreneurship for the following reasons. Large high-tech firms with a greater stock of knowledge tend to have a larger portion of undeveloped ideas because of 'asymmetries of valuation' on inventions (companies tend to underestimate the economic value of employee inventions that are unrelated to their core task), which create a 'knowledge filter' (Acs et al. 2004) impeding the exploitation of potentially valuable ideas.

Asymmetries of valuation on inventions become greater when a company commits to a development policy that focuses exclusively on the core domain, which is most certain to make profits, and as a result, non-core inventions are never developed internally (Hellmann, 2007). Universities also tend to have a greater portion of undeveloped knowledge when regulations prevent academic inventions from being efficiently transferred to the private sector, such as through academic entrepreneurship.

The knowledge spillover theory of entrepreneurship regards entrepreneurship as an important conduit for such undeveloped inventions. This theory essentially argues that knowledge stock created endogenously results in knowledge spillovers, which allow entrepreneurs to identify, create, and exploit opportunities. In other words, this theory endogenises entrepreneurial opportunities by linking innovation (the accumulation of knowledge stock) to entrepreneurship (new firm creation), while previous studies tend to view entrepreneurship as an exogenous factor like a genetic trait.

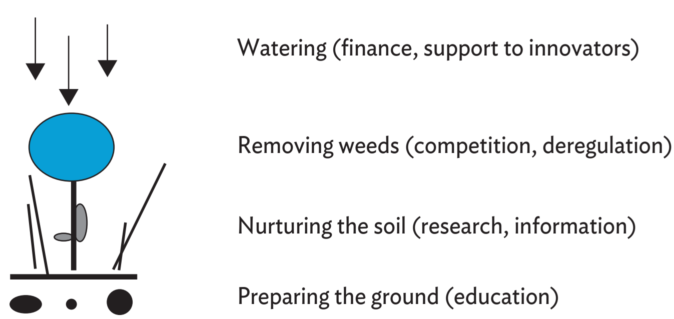
In addition to focusing on endogeneity of entrepreneurship, the knowledge spillover theory of entrepreneurship is distinctive from previous theories in its focus on clusters. The theory argues that in exploiting opportunities, entrepreneurs are faced with localised competition, and localised entrepreneurial activities have a self-reinforcing nature, leading to entrepreneurial clusters. Knowledge about new opportunities and resource requirements tends to be tacit (Rocha and Sternberg, 2005). As tacit knowledge tends to be disseminated through personal interactions, which benefit from geographical proximity, entrepreneurial activities tend to be localised. Geographic concentration expands the knowledge pool, such as entrepreneurs' previous successes and failures (Acs and Virgill, 2010), from which potential entrepreneurs can learn, thereby facilitating the demonstration effect (Audretsch et al., 2006). Furthermore, entrepreneurial clusters encourage the development of knowledge-intensive business services and professional services firms, such as legal services, accounting services, and venture capital, which in turn encourages new firms to locate nearby (Nystrom, 2007). These positive feedbacks lead to the persistence of entrepreneurial clusters. Entrepreneurship in a region is suppressed in cases where localised competition among entrepreneurs is fierce (e.g. because of excessive entry), incumbents appropriate innovative returns so efficiently that they make the rate of return to entrepreneurship very low, and government interventions and regulations hamper entrepreneurial activities (Acs et al., 2009). This highlights the importance of taking entrepreneurial clusters into account when designing innovation policy.

2.5.4 Whole-of-government approach

As previously emphasised, innovation is a social process that inevitably hinges on how receptive users are to new knowledge embodied in technologies and practices and how responsive providers of knowledge are to social needs. Furthermore, discussion on the promotion of entrepreneurial activities reveals that a wide range of policy fields are relevant to innovation policy. These features of innovation policy call for a whole-of-government approach. Such an approach is important, particularly in developing countries, because social structures incubating innovations tend to be immature and unfavourable in those countries.

The World Bank (2010) uses a gardening metaphor to explain the whole-of-government approach to innovation policy. Figure 2.10 illustrates four key ways in which gardeners help plants grow. First, 'preparing the ground' refers to policies concerning education, training, and migration to create a source of potential innovators. Second, 'nurturing soil' refers to policies for making the nation's research base strong in terms of quality and making it responsive to social needs. Third, 'removing weeds' refers to eliminating unnecessary regulations on innovation, entrepreneurship, entry, and competition, thereby securing private companies the freedom to do business. Fourth, 'watering plants' refers to the provision of pecuniary or non-pecuniary incentives for potential innovators. This metaphor implies that although the fourth recommendation (finance and support to innovators, e.g. R&D subsidies and tax credits) is what is normally recognised as innovation policy, simply watering the plants would be inefficient unless it is complemented by efforts represented by the first, second, and third recommendations.

Figure 2.10: Explaining the Whole-of-government Approach Using a Gardening Metaphor



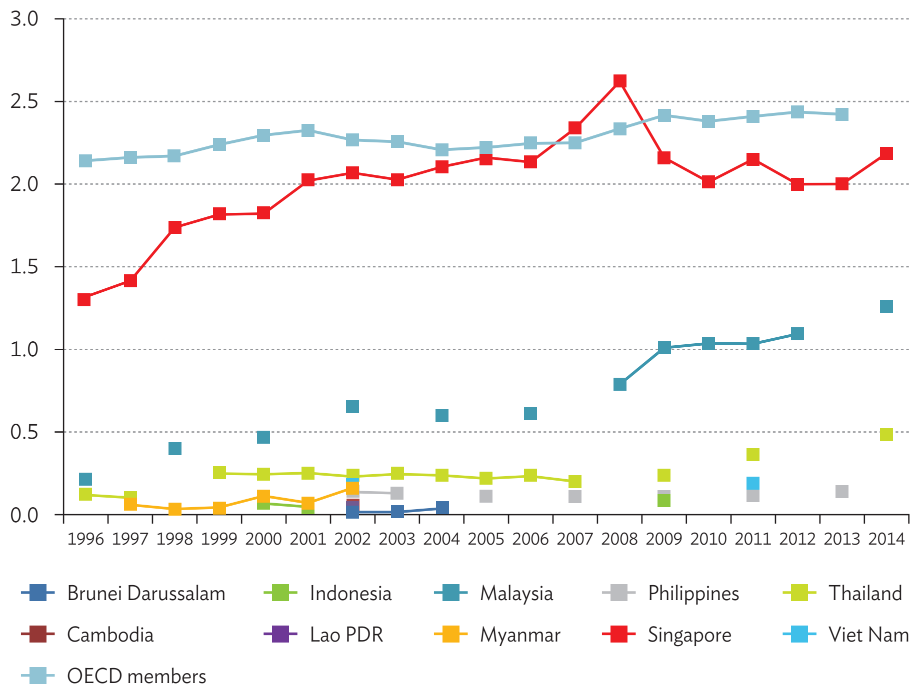
Source: World Bank (2010, p. 60).

The whole-of-government approach has wide implications for innovation policy in and for ASEAN. The most important implication is the significance of different types of education according to a country's development phase. A number of studies show that the social rate of return to investment in education (the macroeconomic growth effect of education) is greatest for primary education, which is most salient in developing countries, while the private rate of return (the wage effect of education) is greatest for tertiary education (Psacharopoulos, 1994; Psacharopoulos and Patrinos, 2004; Canton, 2007; Psacharopoulos, 2009). This suggests that developing country governments should support primary education in the first place as it helps eliminate illiteracy and reduce transaction costs, accruing huge social benefits. Although its social benefit is the lowest, supporting higher education helps reduce the cost of private R&D through enlarging the domestic labour supply of scientists and engineers.

Implementing the third recommendation is economically the most efficient step but politically the most difficult one. Although it requires little economic cost for the government to adopt 'removing the weeds' type policy measures, it is very difficult to do because the most serious obstacles to competition and innovation normally include bureaucracy and vested interests (e.g. unions, guilds, and lobbies). Bureaucracy is inevitable as the government grows in size, and it tends to create more regulations and interventions to increase authority, which hampers innovation. Incumbents with vested interests tend to put pressure on the government through donations so that they are better able to appropriate returns from the product market and exclude new entrants, which hampers entrepreneurship.

Another implication of this approach is that developing countries should make public research responsive to social needs in order to promote private R&D as the private sector tends to be technologically immature and is unlikely to have the accumulated, sufficient absorptive capacity to exploit external sources of knowledge. R&D intensity (R&D as a share of GDP) exceeds 3% in developed counties but is less than 1% in developing countries. As Figure 2.11 indicates, this tendency is true for AMS. Private R&D constitutes over 60% of the total in developed countries but less than 30% in developing countries (World Bank, 2010). The supply-side factors in less active private R&D in developing countries are the higher opportunity costs, such as of foreign direct investment; imported technology; having many small firms, fewer scientists and engineers, and fewer college students in science, technology, engineering, and mathematics; and the high cost or scarcity of capital. The demand-side factors are a less competitive, more segmented, and barrier-rich domestic market. The institutional factors are an unstable macroeconomic environment, complex bureaucracy,

Figure 2.11: Research and Development Intensity in ASEAN Member States (%)



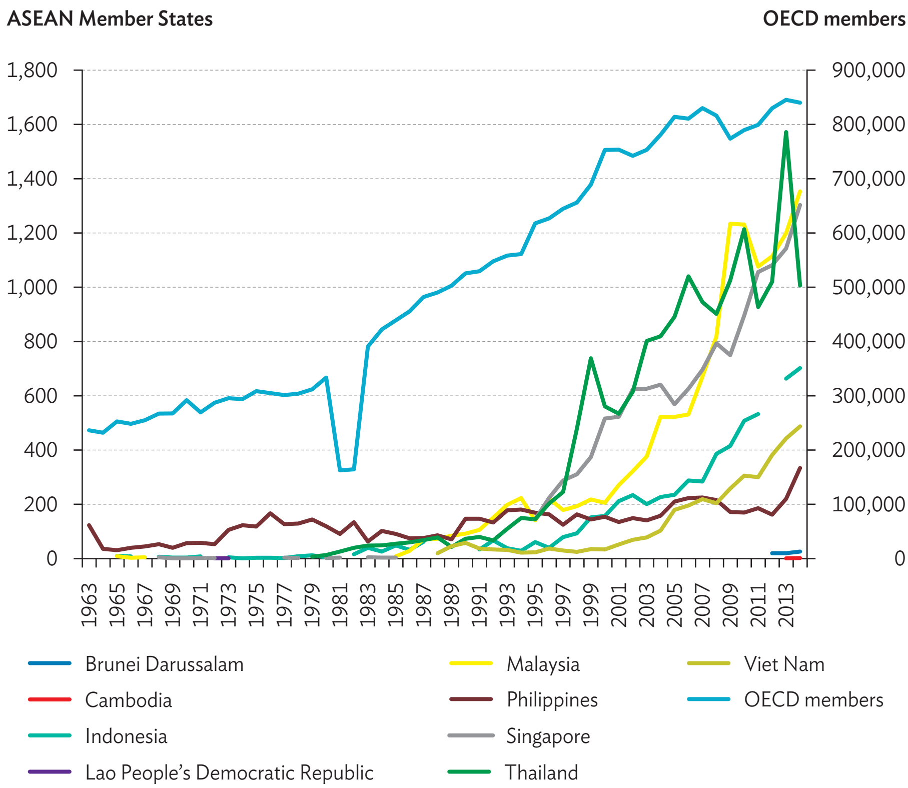
ASEAN = Association of Southeast Asian Nations, Lao PDR = Lao People's Democratic Republic, OECD = Organisation for Economic Co-operation and Development.

Source: World Bank, World Development Indicators.

weak intellectual property rights, high transaction costs, and political instability. Under such circumstances, it is important for developing country governments to make public research responsive to social needs, as such research is often conducted in an 'ivory tower', isolated from the local technological environment.

Another important fact is that foreign firms, especially multinational enterprises, are key private R&D performers in developing countries. A comparison between Figures 2.12 and 2.13 suggests that multinational enterprises making foreign direct investment perform a significant proportion of R&D in developing countries. This underlines the significance of coordinating trade policy (e.g. the creation of a pro-business environment for foreign firms) and innovation policy (e.g. the promotion of technology transfer from parent firms to local firms). Regarding advanced economies, this approach suggests that they should arrange policy measures to support basic research through the promotion of university technology transfer (e.g. the Bayh–Dole Act, or the Patent and

Figure 2.12: Patent Applications by Residents in ASEAN Member States (number of applications)



ASEAN = Association of Southeast Asian Nations, OECD = Organisation for Economic Co-operation and Development.

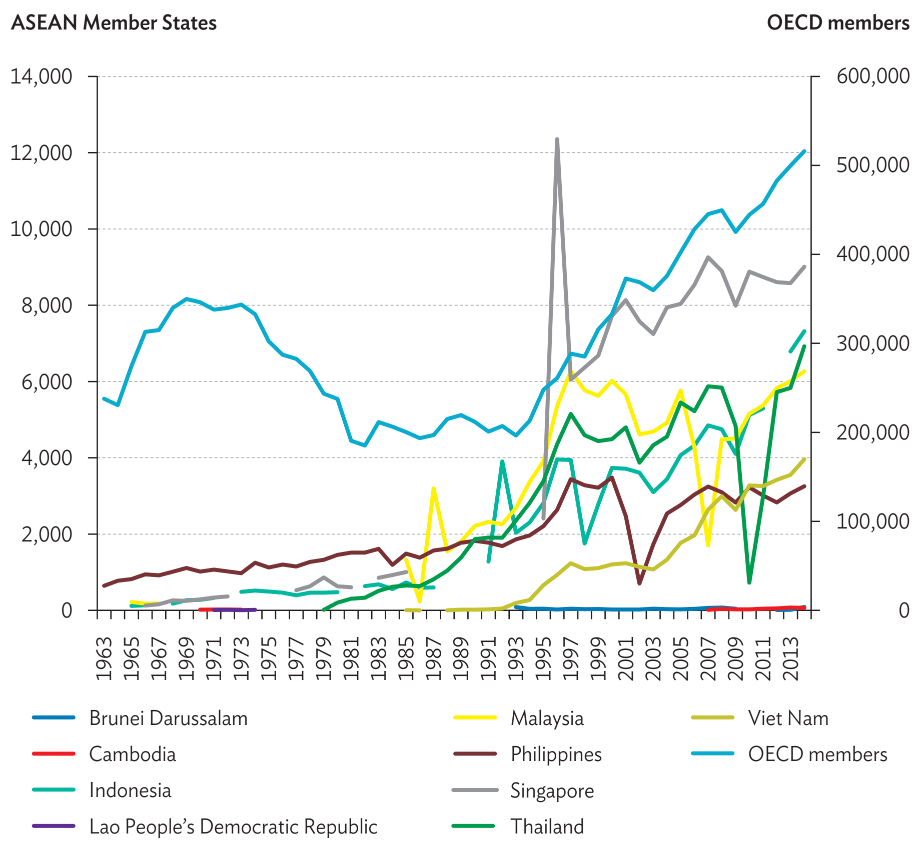
Source: World Bank, World Development Indicators.

Trademark Law Amendments Act), technology transfer organisations, science parks, and business incubators. In light of the discussion so far, Table 2.3 summarises the factors affecting innovation policy according to the industrial characteristics.

2.6 | Conclusion

This chapter defined innovation as the creation and dissemination or diffusion of knowledge. Throughout the chapter, we emphasised the latter element, taking account of the great diversity among AMS. The chapter demonstrated why innovation policy matters for any government under various development phases and economic

Figure 2.13: Patent Applications by Non-residents in ASEAN Member States (number of applications)



ASEAN = Association of Southeast Asian Nations, OECD = Organisation for Economic Co-operation and Development.

Source: World Bank, World Development Indicators.

environments. In short, innovation is a significant, though not unique, source of welfare improvement, and thus the promotion of innovation is a critical policy target for any government at any development phase. Innovation is determined through supply-side factors, such as technological opportunities, and demand-side factors, such as appropriation conditions. Governments can influence both factors by devising policy instruments that secure the private sector's ability to appropriate returns to innovative investments and by providing potential innovators with wider access to public knowledge. In the context of innovation policy in and for ASEAN, it is notable that the optimal design of the policy should vary according to the development phases and sectors. For less-developed AMS, the dissemination of knowledge

Table 2.3: Innovation Policy from the Perspective of Industrial Knowledge Bases

Industrial Knowledge Base	Analytical Knowledge	Synthetic Knowledge	Symbolic Knowledge
Sample industries	Pharmaceuticals, circuit design	Machine tools, automotive	Web design, architecture
Technological opportunities	Scientific advancement	Shop-floor heuristic problem solving	
Appropriability	Patents, UPOV	Know-how	Trademarks, design patents
Knowledge spillovers	Licensing, academic spin-offs	Technical consultation, learning by doing	Learning by observing
Geographical distance to spillover pool	Matters least	Matters more	Matters most
Cognitive distance to spillover pool	Large in university–industry collaborations	Large in university–industry collaborations	
Innovation intermediaries	Science parks, university liaison offices	Trade associations, local public technology transfer organisations	
Entrepreneurship	Academic spin-offs	Intrapreneurship, spin-offs	Spin-offs
Complementary policies	Education, IPR, competition	Education, trade, competition	Education

IPR = intellectual property rights, UPOV = International Union for the Protection of New Varieties of Plants.

Source: Author.

is more important than the creation of knowledge because tapping into existing technologies can have an immense impact on the living standards in such countries. For economically advanced AMS, policies aiming at demand-side factors are more important as they provide the private sector with stronger incentives to perform R&D. For sectors based on analytical knowledge, stronger protection of intellectual property rights would enhance licensing suitable for the transfer of analytical knowledge, while intermediaries, such as technology transfer organisations, would promote licensing and, thus, innovation. Furthermore, promoting university–industry collaborations, such as academic spin-offs, would foster innovations that can leverage the outcomes of academic research, especially in the life sciences.

Another theoretical implication of the fact that dissemination matters for innovation is that entrepreneurship needs to be incorporated in innovation policy. For more economically advanced AMS, the knowledge spillover theory of entrepreneurship provides an important insight for innovation policy. It highlights that knowledge accumulation in developed countries inevitably creates a large number of undeveloped ideas that are held by large firms and research universities. Entrepreneurial activities by employees at incumbents and university scientists bolster innovation through the creation of new organisations to commercialise undeveloped ideas.

The incorporation of entrepreneurship into innovation policy calls for another important perspective: clusters. Like innovative activities, entrepreneurial activities tend to become geographically concentrated because knowledge about new business opportunities and resource requirements tends to be tacit. This feature of entrepreneurial activities points to the importance of policy instruments that support entrepreneurial clusters, such as business incubators and science parks. Furthermore, the promotion of entrepreneurial activities involves diverse policy issues, such as macroeconomic stability; education and training; competition in the markets for goods, labour, and capital; and international trade. This suggests that coordination among related policies is critical in designing and implementing innovation policy. Such features of innovation policy call for a whole-of-government approach, which is important for less-developed AMS due to the institutional obstacles to innovation that characterise such economies.

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