J Evol Econ 14: ♣–♣ (2004)
DOI: 10.1007/s00191-004-0184-1

Journal of Evolutionary Economics

Book reviews

Sunil Mani (2002): Government, innovation and technology policy. Edward Elgar, Cheltenham, UK, 379 pp., ISBN 1 84064 970 4

A recent book by Sunil Mani intervenes into ages-old discussions between liberal economists, who believe that the State should draw back from economic regulation, and "governmentalists," who believe that the State should cover all failures of the market. In terms of research and development, these debates have been active since the 1960s, when the first national scientific councils were created. The book supplies very strong arguments suggesting that the government role in economic policy-making should be pro-active.

The book renews the debate on the role of the State in respect of technological development. Following the article by Arrow published in 1962, it is generally believed that were the financing of R&D left solely to private sector, there would soon be underinvestment due to the inability of appropriating the full returns from R&D. This phenomenon has been empirically measured as the 'spillover gap', or the difference between social and private returns from R&D (constituting up to two thirds of overall returns). In an effort to prevent such underinvestment, developed countries such as the US and UK undertake diverse measures of State support of private R&D through fiscal and non-fiscal incentive schemes.

While it is clear why developed countries support technological advancement, for developing countries the policy-making process is more obscure. Many developing countries have in fact ended active support of their national R&D due to an assumption that technology is globalized, and so granting advantages to national firms does not seem effective. The government is not willing to subsidize 'the reinvention of a wheel' when the same technology may be acquired in a global open market. However, despite increasing globalization in markets of goods and capital, the globalization of technologies has been notably less significant. R&D is concentrated in a few large companies, and mostly inside developed countries, while developing countries virtually remain unaffected. The hope for a market of technologies to facilitate technology transfer also has not materialized: the market is shrinking, it is not competitive, and it is gradually being replaced by non-market forms such as foreign direct investment (FDI). Evidence from positive technology spillovers from FDI to local firms is also very limited (only a few countries have

been successful in engineering policies that establish this spillover). Less developed countries need to have their own public innovation policies to strengthen R&D regimes.

Developing countries that were successful in technological development, and which established a potential for new technology creation, are termed Type 1 countries in the author's taxonomy, while Type 2 countries include mere assemblers of imported technologies. This classification was based upon the fact that Type 1 countries were granted patents in the United States, while Type 2 countries were not. The book then seeks to consider cases of successful policy making in Type 1 developing countries (although Mani begins his series of case studies by analyzing developed countries that appear major counterexamples to his position: Japan and South Korea).

The Japanese Innovation System is a particular case of low government intervention into economic activities. Although most data on the JIS in the book are prior to 1990, conclusions are still quite representative. It is suggested that the Japanese economic system is bank-centric, and so industrial companies (large businesses in particular) have preferential access to bank finance. The cost of capital is also low in Japan. Thus, companies did not find it necessary to demand additional incentives from the State to finance R&D activities in their post-war development; rather, this situation was arranged by the State itself. Since 1985, when access to bank funding was reduced, industrial R&D slowed and the government had to introduce a number of schemes to enhance R&D investment. In the 1990s, the government's position became even more proactive, with the government R&D budget doubling and a basic policy for S&T initiated. This case suggests that market failures in industrial R&D do not allow for the absence of government intervention.

This theme is continued in the case study of South Korea, which had an average per capita GNP growth of 10 per cent per annum in recent decades. In just thirty years, it has grown from a poor country into a developed economy, was admitted into the OECD, and declared industrialized by IMF. It is another example of a country that managed to privatize the financing of R&D without experiencing any underinvestment. As the book shows, the government has been rather successful in redirecting efforts in terms of providing fiscal incentives and non-financial support to the private sector. The Korean government has concentrated on joint-projects with the private sector, especially in areas of high technology and by making available high-quality skilled manpower (including the employment of foreign nationals and the institution of reverse brain drain initiatives). The government has been able to achieve this because of its special relationship with the private sector (with businesses structured into chaebols, or large business conglomerates). This type of organization is rather unique to Korea, and it is not clear whether it can be transplanted to other countries.

Singapore is considered another example of a Type 1 country that has shown spectacular economic results throughout the past few decades, due primarily to its low-interventionist State policy and the encouragement of foreign-owned companies. However, it is argued in this book that the government implemented a diverse innovation policy with the ultimate goal of enhancing local technological development through technology-based SMEs. The key to this process was the creation of

a pool of technically-trained personnel who would emerge as techo-entrepreneurs and skilled manpower in other firms. At the same time, while promoting multinational company operations inside the country, the government tried to arrange positive spillovers from these companies. After a critical mass of technically-trained human resources was created, the government placed fiscal incentives (tax incentives and grants) into operation. Singapore is suggested as a role model of a Type 2 country that tried gradually to transform itself into a Type 1 country. It also has the best tendencies among Type 1 countries considered in terms of R&D intensity, the patenting record, and high-tech exports.

Malaysia, although significantly bigger than Singapore, has a lot in common with the latter in terms of its development path: it has within a short period of time transformed from a primary goods exporter into a high technology exporter, and its enterprise sector is dominated by foreign companies. The country itself, however, has a much more explicit State policy of technology promotion. Even so, it has been less successful in achieving this target due to, as Mani argues, a shortage of technically-skilled manpower. Although the government itself tries to encourage education and training, and its level of education spending is comparable to that of Japan and the US, the enrollment in S&T related subjects in tertiary education is quite low. Also, Malaysia has been notably less successful than Singapore in arranging spillovers from FDI, mainly because it lacks strong technology-based SMEs.

South Africa and India are two economies of the Type 1 type that have been subscribing to policies of import substitution and self-reliance in technological development. Since the early 1990s, both economies have dismantled this policy and have opened up their economies, and in two chapters of his book, Mani tries to evaluate the results of this political shift.

South Africa is the most developed country on the African continent, with average per capita income more similar to Malaysia than to its neighbors. Although, as a consequence of the end of apartheid, the economy did not grow at all during 1990s, it did make certain achievements in the area of S&T. South Africa is one of the few countries in the developing world explicitly to use the national innovation system approach. The government established sophisticated innovation policies after considerable consultation with stakeholders, and these policies were backed by a detailed technology foresight study through which a set of twelve priority areas was defined. A series of research grants was established, targeting these areas of priority. Not enough time has passed to allow an adequate evaluation of the efficiency of this program. However, it has been noted that none of the instruments managed to address the severe shortage of skilled manpower both in manufacturing and in research. As a result, both research intensity and the demand for innovation are quite low in South Africa. It thus has substantial parallels with Malaysia in the need to establish human resource development policies.

India has one of the largest pools of technically-trained personnel, an international recognition in several areas of high technology, and an elaborate network of government research institutes. At the same time, it has depended on foreign sources of technology, and its exports of manufactured products have been relatively low, due to major weaknesses of its national innovation systems. The availability of

human resources was one of the lowest among Type 1 countries; it was pointed out that the Indian education system has certain failures, and is accompanied by a vast brain drain. Indian technological infrastructure, although widespread, has a limited interaction with the industrial sector and is dependent heavily on government grants; it is thus in need of further restructuring. India also has a number of fiscal incentives, but their size is quite low (when compared with other countries considered in the book). The government traditionally used tax incentives to stimulate R&D. However, the study reveals that they were not particularly important in deciding whether to accomplish R&D activities. Despite this fact, the Indian government was successful in promoting venture capital schemes (although, again, multiple regulation limited the development of this sector). The book recommends that India should develop more specific, context-relevant policies.

Brazil is the largest and the most developed country of Latin America. It also has been successful in certain areas of high technology, undertaking virtually a half of all R&D done in Latin America. Much as did India, it underwent industrial liberalization during early 1990s. Consequently, government investments into R&D, and the number of agencies working in the sphere, dropped significantly. However, contrary to expectations, R&D investments by business increased, as did the number of patents issued to Brazilian inventors, and exports of high-tech content. Interventions of the Brazilian state into the technology market were different from those in the Indian case, including restrictions on import of foreign technology, various schemes of technology development finance, and the creation of an adequate supply of highly-trained scientific personnel. While fiscal measures were relatively successful (in late 1990s, loans and grants were replaced by tax incentives and a growing venture capital industry), one of the major problems is a low density of researchers and engineers. This, as the book speculates, may be due to the unavailability of the right kind of personnel, and a low preference for R&D by Brazilian enterprises.

Israel, the last of country cases considered in the book, has been regarded as a successful model of the implementation of research grants supporting R&D. Israel is one of the most technologically developed countries in the world, due to its pool of very talented and highly educated personnel (acquired primarily through the migration of qualified engineers and scientists from Western Europe and the former Soviet Union). It is a country with the highest per capita number of researchers and engineers in the world. The study reveals that it was the availability of technically-trained manpower that made a research grant scheme a success, and so developing countries lacking this crucial resource are unlikely to be able to copy Israeli's experience. Also, the management of research grants has been very efficient, achieved through centralization of grant distribution; grants did not target specific sectors, but were rather 'horizontal', which was another positive point. Finally, countries should use research grants and venture capital as two complementary source of R&D finance; the venture capital industry is on the increase in Israel, and it gradually takes over the research grant scheme. Replication of Israeli's experience depends on a country's own capability to produce innovation, so only Type 1 countries are likely able to replicate it.

It is concluded that both advanced countries and successful developing countries have adopted sharply focused innovation policies to achieve technological development, and these policies remain relevant even in a phase of globalization. Developing countries should broaden their list of non-fiscal policy measures, and fine-tune their policies to establish a stable supply of technically-trained manpower: qualified scientists and skilled engineers. All eight cases analyzed in the book emphasize that human resource development should be an integral component of a nation's innovation policy, and the government thus has an important role in improving market performance in technological areas.

The book supplies evidence that, to succeed in building a technology-rich economy, carefully designed State policies are critical. It is important to note that Mani's conclusions were based on research in eight countries with different economic, institutional, and cultural set-ups, and that he attempted to identify similarities and to consider differences between the cases.

Yet, this very interesting book also has several shortcomings.

First, the issues of globalization have been dealt with one way: the implication of globalization for the direct transfer of technologies. Still, it is only through globalization that countries such as Singapore could find their position in the international value-chain, e.g. in the electronics industry. Globalization is of importance for technological development, primarily in terms of global labor division. How these global tendencies are entangled with R&D policies is a separate issue that may require addressing as well. Another important aspect of globalization is the formation of regional economic unions, such unions being part of the globalization process on the region level, which may facilitate the transfer of technologies within themselves. For example, the upcoming accession of the Central European countries to the European Union has increased the willingness of firms to transfer high technologies, and to move technology-rich manufacturing activities, into these countries. Mani mentions the turnover of technologies inside EU and NAFTA, but the case of South Asian trade and economic unions would also have been interesting. The role of regional unions (and possibly global unions such as the WTO) for the acquisition of technologies may require further consideration, and may impact conclusions drawn by the author.

Second, the State is considered only as a provider of finance and a facilitator of economic activities (this has been a scope of fiscal and non-fiscal measures). Another interesting aspect that was mentioned just briefly is the effects of State participation in the ownership of innovating enterprises and technologies. In Korea and Japan (especially the former), provision of this finance is frequently dependent upon the government's (or top-officials') participation as a shareholder in the industrial groups; this is the case in which State ownership may have a positive impact. The counter example is when State-provided finance for research places conditions on the company such as the sharing of intellectual property rights, or even the full transfer of ownership to the State; often, this may lead to a rejection of State assistance, and to consequent underinvestment of research. The implication of state ownership is another important aspect of innovation policy, which may require further attention.

The main drawback of the book, however, is that no experience of economies in transition has been considered. This may be a little more than a mere omission of a few examples, since these country cases may alter certain conclusions reached by the author. The countries of Central & Eastern Europe, including those of the former Soviet Union, have all undergone dramatic changes in past fifteen years. They were richly endowed with human capital and R&D facilities, and they all have faced considerable difficulties employing this potential.

The classification of Type 1/Type 2 countries leaves "economies in transition" unattended. By their level of educated population, the ratio of R&D to GDP, and even patents granted to their citizens in the US, they can be placed among Type 1 countries, and yet, utilization of R&D in such countries can be strikingly low, sometimes closer to that of the Type 2 countries. There is a little more here than mere classification interest, because the author insists that Type 2 countries should apply policies other than those of Type 1 countries.

Next, it is argued that economies in transition used to have a more overwhelming State presence in economic affairs, and thus liberalization reforms were induced. Consequently, a decline of the scientific sector occurred, and R&D in technology-rich industries virtually ceased (exactly as theory would predict). In countries such as Russia, the R&D sector emerged in a market economy unprepared and unable to generate funds for itself, since scientific developments can rarely be immediately turned into Schumpetrian innovations, whether through the introduction of a new product or of a new manufacturing technology. For such countries, policies inspiring commercialization of R&D are necessary, and the book elaborates little on the possible scope of such policies.

Finally, and most importantly, is that the dynamics observed in transition economies violates, to a certain point, the suggestions of the book. All economies in transition had abundant technically-trained personnel, and good researching facilities. Many of these economies also introduced various fiscal supporting measures, as well as appropriate legislation for intellectual property. Despite all these efforts, and a rich endowment with human capital, the progress made on building technology-rich Western-type economies has been much lower than expected. It may be hypothesized that "something else", which may be called a country's "institutional capital", is needed to support the advance of knowledge-based economies. Technology policy has to be context-based, and there is no universal recipe that serves all countries. Its main focus should be a balance between resources and market forces inside the country and in its global economic environment; and this balance may only be achieved through an institutional infrastructure which is primarily the government's responsibility. Apparently, Mani implies this, but his conclusions would be more explicit were he also considering economies in transition.

Pavel O. Luksha, PO Box 157, 249020 Obninsk-9, Russia
(e-mail: luksha@severstalgroup.com)