International Journal of Institutions and Economies
Vol. 3, No. 2, July 2011, pp. 165-172

The Role of Institutions and Linkages in Learning and Innovation

Rajah Rasiah*
Faculty of Economics and Administration
University of Malaya
Email: rajah@um.edu.my

Abstract: This paper presents the evolutionary meaning, rationale and context of institutions and the linkages that have been necessary to stimulate learning and innovation. Institutions and institutional change are central to driving learning and innovation. The processes of innovation do not end at the point of its creation. Linkages are important in the spread and diffusion of stocks of knowledge, which not only act as building blocks for new stocks of knowledge but also are synergized further through creative duplication and accumulation into new stocks of knowledge. Where linking with multinationals has figured strongly leveraging has had a strong influence on upgrading. Also important has been the role of *meso*-organizations that were subject to stringent institutions.

Keywords: evolutionary, innovation, institutions, learning, leveraging, linkages

JEL classifications: B15, B25, D02, D83

1. Introduction

Despite attempts to define institutions its applicative meaning has remained without consensus. The dominant position on institutions has been articulated by the new institutional economists who argue that the market is the dominant institution in driving economic transactions, and that it should define the parameters and space left behind for other institutions (Coase, 1937; Williamson, 1973; North, 1971). The Nobel Laureate North (1994) defined institutions as the rules of the game, and organizations and their entrepreneurs as the players. However, such a definition raises some ambiguity as to whether they also include organizations and relationships between economic agents and organizations. Since institutions refer to influences that govern human action, either individually or collectively (through a firm, organization or a particular group), and they are considered by many as the *sine qua non* of economic development, evolutionary economists have preferred to keep its meaning to capture whatever that holds and molds the standard behavioral

patterns in societies. Nelson and Sampat (2001) and Nelson (2008a) suggested that 'institutions' should be used to denote the structures and forces that mold and hold in place prevalent behavioural patterns or social technologies. In doing so Nelson and Sampat (2001) distinguish physical technologies from social technologies by defining the formula (recipe) aspect of the activity as physical technology and the way it is structured, coordinated and delivered as social technology. Technological progress is core to evolutionary economists as it is the propellant of economic progress and structural change (see Nelson, 2008a, 2008b).

Evolutionary economists argue that the influence of any one or set of institutions, or the composition or blend of them within a group in socio-economic action explains how economic transactions and change occur (Nelson and Winter, 1982; Nelson, 2008a, 2008b). It is this evolutionary explication, which helps explain the origin and evolution of several industries and technologies over time and in different localities that we assume in the papers in these two special issues.

The rest of this introductory article is organized as follows. Section two explains the relationship between institutions and institutional change and innovation. Section three explains the significance of linkages in driving learning and innovation. Section four finishes with an overview of the evolutionary context of how the articles were selected for issues 3.2 and 3.3 of the *International Journal of Institutions and Economies*.

2. Institutions and Innovations

The importance of institutions and institutional change in the innovation process was articulated lucidly by Nelson and Winter (1982) and Nelson (2008a). The systemic nature of knowledge flows was demonstrated by Marshall (1890), Nelson and Winter (1982: 63), but the importance of specialized *meso*-organizations in attracting the resources to produce knowledge (a public good) was emphasized by Nelson (2008a, 2008b). The flows of knowledge from R&D labs, universities and firms to other economic agents are critical in the spread and snowballing of economic synergies. Scitovsky (1954) and Rosenstein-Rodan (1984) distinguished technical from pecuniary external economies. Rasiah (1995) and Nelson (2008b) went further to discuss the imperfect, yet coordinated and uncoordinated nature of knowledge flows. Institutions play a critical role in the production and appropriation of economic synergies from the processes that generate learning and innovation. The specificity of industries, initial structural conditions and the timing of catch up have also attracted different institutional roles (Rasiah, 1988, 1996, 2002; Hobday, 1995; Malerba, 1992; Malerba *et al*., 2001; Nelson, 1993). Knowledge flows from interaction between workers and from

the movement of human capital, to drive systemic synergies. Mature firms in open integrated clusters gain new ideas to support continuous organizational change as old employees are replaced to make way for fresh ones, while new firms benefit from the released entrepreneurial and technical human capital to start new firms (Best, 2001; Rasiah, 1994). Rasiah (1994, 2002) and Saxenian (1994) documented the development and movement of human capital, which supported new firm creation in Penang and the Silicon Valley respectively.

However, contrary to Marshall (1890) knowledge appropriation is not costless, as argued by Lall (1992). The historical sequence to the development of technological capabilities through industrial policy started in Britain when Henry the VII imposed taxes on exports of wool in 1485 (see Reinert, 2007). A series of follow up industrial policies helped the United States, Germany, Sweden, Japan, Korea and Taiwan achieve technological superiority in increasing returns to industries. Coase (1937, 1992) and North (1994) discussed the significance of institutions in production allocation and capitalist development, but come short of identifying markets as the superior institution in the process. Freeman (1989) had demonstrated using the experience of Japan that international flows of stocks of knowledge from developed to developing economies take a sequential movement from imports to adaptation, assimilation and innovation – all of which are costly stages that countries typically go through in moving up the technology ladder. While the Marshallian systemic doctrine of knowledge flows remains critical in the generation and diffusion of technological spillovers, institutions other than markets – regulations by governments, trust relationships supported by particular socio-cultural and economic groups and in-house command in intermediary organizations (e.g. R&D labs) – have been no less important in technological catch up.

Performance instruments have also acted as strong institutions to support technological catch up in some countries. The strong government in South Korea ensured that performance standards drove technological catch up by Samsung in electronics, Hyundai in shipbuilding and automobiles, and the Pohang Steel Company (POSCO) in steel (see Amsden, 1989; Kim, 1997). The government in South Korea also insulated through expensive loans from abroad to shield the successful *chaebols* from the destabilization caused by a rise in oil prices by four times in 1973-1975. The Industrial Technical Research Institute created by the Taiwan government in 1973 was instrumental in driving technological catch up *inter alia* in information hardware, machinery and plastics (see Amsden, 1985; Fransman, 1985). The government financed the acquisition of Radio Company of America (RCA) in 1979 (Rasiah and Lin, 2005) and the founding of the joint-venture company of Taiwan Semiconductor Manufacturing Corporation (TSMC) with Philips in 1987, which by the end of 2000 had become the world's leading

contract manufacturer of fabricated wafers. Using its contract manufacturing framework in 2007, TSMC also announced plans to fabricate microprocessors by August 2008 (Rasiah *et al*., 2011).

Governments can create or strengthen the institutions to promote agglomeration effects. Governments can also screen particular clusters and identify bottlenecks, gaps and weaknesses to ease, fill and ameliorate these problems. Such problems can take the form of critical basic infrastructure, high tech infrastructure, or supplier firms. Given the problems of information asymmetries between government and firms, intermediary organizations such as chambers of commerce, training institutions and R&D labs often help resolve collective action problems. Interdependent relationships that are driven by the discipline of the market, participation of government when public goods are involved and complementation through trust-loyalty to extract social commitment from the humans directing all of them is vital for the development of competitive clusters. Stakeholder coordination (e.g. through industry, government, consumer and labour coordination councils) often help root and expand social capital.

A lack of firm-level drive, human capital and high tech institutions necessary to stimulate innovation and competitiveness have often undermined the capacity of clusters to enjoy sustainable differentiation and division of labour, which are also the prime reasons for the stagnation that has characterized industrial estates in many developing economies. Attempts to initiate catch up strategies should start with the mapping of firms, institutions, their policy frameworks and integration with markets (global and local), and to identify the existing and potential drivers of industrial dynamism in particular regions or locations.

3. Linking, Leveraging and Learning

One of the key pillars of the diffusion and spread of knowledge is the argument on path dependence (Freeman, 1988). Linkage is the first step in the sequence of learning and innovation. Rather than reinventing the wheel most major innovations have benefited from past stocks of knowledge that form the starting and driving force of innovations. This is a major advantage latecomers enjoy (Gershenkron, 1962).

Both formal and informal channels are critical in linking and learning. Formal channels include imports of machinery and equipment, education and training of personnel, books and manuals, in-firm internships, licensing and acquisition of particular scientific knowledge bases and technologies. Informal channels include interactions between people, viewing of demonstrations on video and via products through using or viewing. Some interactions are stimulated through formal arrangements while others are achieved through

informal links between producers and users. The significance of user-producer interactions was best articulated by Lundvall (1992).

Several critical channels of linking across borders to knowledge bases can be discerned. Trade, investment, human flows and media links are some of the channels by which cross border knowledge flows have been identified. However, while linking has offered the potential for latecomers to connect and subsequently upgrade in particular technologies or co-evolve different technologies, not all have actually reached the technology frontier. Multinationals became a major initiator of knowledge flows in both the foreign direct investment (FDI) dependent countries of Malaysia and Singapore, and those less dependent on FDI such as Korea and Taiwan. Human capital movements within multinationals, relocation of particular segments of the value chain at host-sites and the interactions between them in different *meso*-organizations supporting technological change, help explain why technological spillover occurs when these relationships are anchored and coordinated dynamically and not in locations when much of agglomeration is confined to just co-location.

The East Asian rapid industrialization experiences of Japan, Korea, Taiwan and Singapore demonstrate the critical role of leveraging by governments to quicken and deepen the flow of knowledge from generating firms of frontier countries to recipient firms of latecomer countries. The early logic of a standard framework evolved by government to use leveraging as a strategy to systematically stimulate technology transfer was articulated by Johnson (1982). Johnson argued that *ikusei* (incubation) was the route to spawning local technological catch up through linking with foreign multinationals to acquire strategic technology. The use of *ex ante* vetting, monitoring and *ex post* appraisal to evolve leveraging capabilities in Japan's Ministry of International Trade and Industry (MITI) was well articulated by Johnson (1982). These government regulatory instruments acted as key institutions that drove learning and innovation in Japanese firms. Amsden (1989) and Fransman (1985) presented similar interventions as instruments that drove technological catch up in Korea and Taiwan respectively.

4. Evolutionary Experiences

The central role of institutions and institutional change in driving innovations is recognized by evolutionary economists (see Nelson, 2008a, 2008b). Hence, issues 3.2 and 3.3 of the *International Journal of Institutions and Economies* are devoted to bringing together evolutionary accounts of innovation and learning experiences (including on technological catch up and its failure) focusing on their manifestation in institutions, particularly in the functioning of *meso*-organizations to drive linking and learning. The

successful progression of learning and innovation is argued in the two issues as having strong support from positive institutional change while the lack of such success, as resulting from a reversal of institutional change or failure of institutions.

Typical of evolutionary approaches, each paper uses methodologies that are best suited to the experiences examined, the data available and the issue being studied. Papers in these issues show higher adherence to evolutionary approaches when the data collected for analysis is *ex post* of the inductive framing of questions. Where papers use data and instruments usually associated with neoclassical analysis, they at least attempt to use evolutionary concepts to examine technical change and technology spillover.

Note

* Papers appearing in volume 3, issues 2 and 3 of the *International Journal of Institutions and Economies* were contributed by participants of the 8th International Globelics conference that was organized by University of Malaya and held on 1-3 November 2010 in Malaysia. Globelics is the acronym for Global Network for Economics of Learning, Innovation and Competence Building Systems. Comments from Richard Nelson are gratefully acknowledged but the errors that remain are mine.

References

Amsden, A. (1985) "The State and Taiwan's Economic Development", in Evans, P., Rueschemeyer, D. and Skocpol, T. (eds), *Bringing the State Back In*, Cambridge: Cambridge University Press, pp. 78-106.

Amsden, A. (1989) *South Korea and Late Industrialization*, New York: Oxford University Press.

Best, M. (2001) *The New Competitive Advantage*, Oxford: Oxford University Press.

Coase, R. (1937) "The Nature of the Firm", *Economica*, 4(16): 386-405.

Coase, R. (1992) "The Institutional Structure of Production", *American Economic Review*, 82(4): 713-19.

Fransman, M. (1985) "International Competitiveness, Technical Change and the State: The Machine Tool Industries in Taiwan and Japan", *World Development*, 14(12): 1375-1396.

Freeman, C. (1988) "Japan: A New National Innovation System?", in Dosi, G., Freeman, C., Nelson, R.R., Silverberg, G. and Soete, L. (eds), *Technology and Economy Theory*, London: Pinter, pp. 330-349.

Freeman, C. (1989) "New Technology and Catching Up", *European Journal of Development Research*, 1(1): 85-99.

Gershenkron, A. (1962) *Backwardness in Historical Perspective*, Harvard: Belknap Press.

Hobday, M. (1995) *Innovation in East Asia*, Cheltenham: Edward Elgar.

Johnson, C. (1982) *MITI and the Japanese Miracle*, Stanford: Stanford University Press.

Kim, L. (1997) *From Imitation to Innovation*, Cambridge: Harvard Business School Press.

Lall, S. (1992) "Technological Capabilities and Industrialisation", *World Development*, 20(2): 165-86.

Lundvall, B.A. (ed.) (1992) *National Systems of Innovation – Towards a Theory of Innovation and Interactive Learning*, London and New York: Pinter Publishers.

Malerba, F. (1992) "Learning by Firms and Incremental Technical Change", *Economic Journal*, 102(413): 845-59.

Malerba, F., Nelson, R., Orsenigo, L. and Winter, S. (2001) "Competition and Industrial Policies in a 'History-Friendly' Model of the Evolution of the Computer Industry", *International Journal of Industrial Organization*, 19(5): 635-664.

Marshall, A. (1890) *Principles of Economics*, London: Macmillan.

Nelson, R. (ed.) (1993) *National Innovation Systems: A Comparative Analysis*, New York: Oxford University Press.

Nelson, R. (2008a) "What Enables Rapid Economic Progress: What are the Needed Institutions?" *Research Policy*, 37(1): 1-11.

Nelson, R. (2008b) "Economic Development from the Perspective of Evolutionary Theory", *Oxford Development Studies*, 36(1): 9-21.

Nelson, R. and Sampat, B. (2001) "Making Sense of Institutions as a Factor Shaping Economic Performance", *Journal of Economic Behavior and Organization*, 44(3): 31-54.

Nelson, R. and Winter, S. (1982) *An Evolutionary Theory of Economic Change*, Cambridge: Harvard University Press.

North, D. (1971) "Institutional Change and Economic Growth", *The Journal of Economic History*, 31(1): 118-25.

North, D. (1994) "Economic Performance through Time", *American Economic Review*, 84(3): 359-68.

Rasiah, R. (1988) "The Semiconductor Industry in Penang: Implications for the New International Division of Labor Theories", *Journal of Contemporary Asia*, 18(1): 24-46.

Rasiah, R. (1994) "Flexible Production Systems and Local Machine Tool Subcontracting: Electronics Component Transnationals in Malaysia", *Cambridge Journal of Economics*, 18(3): 279-298.

Rasiah, R. (1995) *Foreign Capital and Industrialization in Malaysia*, Basingstoke: Macmillan.

Rasiah, R. (1996) "Institutions and Innovations: Moving Towards the Technology Frontier in the Electronics Industry in Malaysia", *Journal of Industry Studies*, 3(2): 79-102.

Rasiah, R. (2002) "Government-Business Coordination and Small Enterprise Performance in the Machine Tools Sector in Malaysia", *Small Business Economics*, 18(1-3): 177-195.

Rasiah, R., Kong, X.X., Lin, Y. and Song, J. (2011) "Variations in the Catch-up Patterns in the Semiconductor Industry in China, Korea, Malaysia and Taiwan",

in Malerba, F. and Nelson R. (eds), *Systems of Innovation: Explaining Differences in the Catch Up Patterns in Six Industries*, under review.

Rasiah, R. and Lin, Y. (2005) "Learning and Innovation: The Role of Market, Government and Trust in the Information Hardware Industry in Taiwan", *International Journal of Technology and Globalization*, 1(3/4): 400-432.

Reinert, E. (2007) *How Rich Countries Got Rich and Why Poor Countries Stay Poor*, London: Constable.

Rosenstein-Rodan, P.N. (1984) "Natura Facit Saltum: Analysis of the Disequilibrium Growth Process", in Meier, G.M. and Seers, D. (eds), *Pioneers in Development*, New York: Oxford University Press, pp. 205-221.

Saxenian, A.L. (1994) *Regional Advantage: Culture and Competition in Silicon Valley and Route 128*, Cambridge: Harvard University Press.

Scitovsky, T. (1954) "Two Concepts of External Economies", *Journal of Political Economy*, 62(2): 143-51.

Williamson, O. (1973) "Markets and Hierarchies: Some Elementary Considerations", *American Economic Review*, 63(2): 316-25.