1. Introduction

Rajah Rasiah

1.1 INTRODUCTION

Latecomer economies typically access technology through learning – via a combination of imports and domestic development. The cumulative dimension of technology offers firms the opportunity to learn from already developed technologies. While superior national innovation systems in developed economies support firms at the technology frontier so that the transnationalisation of economic activities by giant corporations is *inter alia* aimed at tapping knowledge appropriated globally,¹ developing economies – especially those emerging at the bottom of the technology ladder – generally attract them only on the basis of large low-wage labour, natural resources and domestic and regional markets. Nevertheless, whatever the reasons for relocation, the participation of foreign firms offers host sites the potential for knowledge spillovers. Some developing economies seek knowledge from abroad through imports, training of personnel overseas, licensing and subcontract deals. Transnational corporations (TNCs) still play a major role involving this channel, albeit indirectly as imitation and arm’s-length transactions figure prominently. Countries such as Japan, South Korea and Taiwan generally absorbed foreign technology through imitation and licensing from TNCs. Others such as Singapore and Ireland have relied extensively on TNCs’ foreign direct investment (FDI) to stimulate learning and innovation. Clearly, both strategies – learning and innovating to compete, using TNCs both directly and indirectly – are embedded in national economic policy. Hence discussions relating to the role of FDI on technology cannot be detached from the conditions prevailing and economic policies pursued at host sites.

The term foreign firm was preferred over TNCs² and multinational corporations (MNCs) here owing to significant participation of firms with no distinct production, marketing or R&D-based foreign parents or subsidiaries in a number of African economies. Both terms – TNCs and MNCs – essentially exclude stand-alone foreign firms. Most stand-alone foreign firms have foreign bank accounts, but so do a number of local firms. Given the relatively

small size of most stand-alone foreign firms, they often compete with local firms on the basis of superior intangible assets involving owner-managers or owner-picked foreign human capital endowed with tacit knowledge or entrepreneurship. Interviews in Kenya and Uganda showed several firms owned by foreigners who had relocated either with entrepreneurial skills to take advantage of small business opportunities but willing to take big political risks or who have come to utilise the tacit knowledge gained working abroad.³ Friendship and kinship relationships constitute a major source of social and political support to compensate risks associated with purely market-driven relationships. Given the technological backwardness and low income levels associated with these countries, both the participation and the relevance of these firms for technological capability building should not be overlooked. While the technological capabilities of these firms can be expected to be inferior to typical TNCs, the smaller size and a lack of inter-country production links reduce problems of power asymmetries with local firms.

While the role of foreign firms in the appropriation of knowledge, learning and innovation is growing in significance, little consensus exists on their impact on local firms. Scattered works – both anecdotal and analytical – detail spillovers of tacit and experiential knowledge embodied in human capital in the creation of local firms (e.g. Allen and Donnithorne, 1957; Rasiah, 1994, 2002a). Foreign-firm-driven technological capability development does not evolve in a vacuum. Domestic institutions through policy instruments and intermediation with markets and firms, and firms and institutions have been critical in stimulating learning and innovation (see Rasiah, 1999; Doner, 2001; Aoki, 2001). Network strength and cohesion has been shown to be critical to raise the fluidity of interactions and systems synergies (see Rasiah, 2002b).

This chapter attempts to examine the literature expounding the role of FDI in the development of exports, productivity and technological capabilities in developing economies with a view to formulating a conceptual and methodological approach to evaluating the empirical evidence from selected economies in Africa, Asia and Latin America. It is organised as follows. Sections 1.2 and 1.3 present the analytic and methodological frameworks to examine the nexus between exports and firm-level and systemic capabilities. Section 1.2 examines the main theories and findings on foreign firms and technology in developing economies. Section 1.3 discusses an alternative framework developed. Section 1.4 discusses the criteria used to select the economies examined in the study. Section 1.5 presents the conclusions.

1.2 PAST APPROACHES

Written works dealing with the nexus between technical change and markets have a long history. Smith (1776) had established the famous dictum that the ‘division of labour is determined by the size of the market’. What is less discussed is Smith’s other concurrent dictum, ‘the size of the market is also determined by the division of labour’, which was lucidly articulated by Young (1928). The scale effects of specialisation based on static comparative advantage and trade was discussed extensively by Ricardo (1830) – which was modelled robustly later by Sraffa (1960) using the standard system. Given the different approaches used by authors working on foreign firms and technology, their arguments are examined using three broad classifications: Marxist, structural and institutional, and neoclassical. This classification is used as a convenient means of discussing the issues and is not intended to define the leaning of the authors concerned.

Marxist

Marx (1965) expounded that competition forces firms to replace old modes of technology with new ones, which Schumpeter (1987) referred to as ‘gales of creative destruction’. Marx (1964, 1965 and 1967), and later Luxemburg (1963) had argued that the creative destructive effects of early integration with capitalism through colonialism in most developing economies, despite the pain it causes, was necessary to initiate and engender the dynamic productive forces that characterise industrial capitalism.⁴ Technical change constitutes the engine of productive forces, in which Marx had argued reach its zenith of capabilities under industrial capitalism and hence argued for capitalist expansion, which became the basis of Kalecki’s (1976: 24) investment model for development. Subsequent Marxist works took two divergent approaches.

The first focused on exchange relations – the circuits of money and commodity – deriving from Lenin’s (1965) claim that capitalism had reached a monopoly stage and hence offered little opportunities for an extension of surplus accumulation in new regions. Baran (1957, 1973) extended this thesis to contend that capitalist integration will set into motion the development of underdevelopment (see also Frank, 1973). Frobels et al. (1980) offered a TNC-specific analysis for the application of this argument: the creation of an international division of labour that is based on the Babbage–Taylorist decomposition of production so that low wage (including levels below reproduction costs) in host sites endowed with large industrial reserve army help extend development in the core and underdevelopment in the periphery. A more sophisticated analysis of this strand was offered by Wallerstein (1974,

1979), who introduced the concept of semi-periphery to allow the progression of some countries to achieve accumulation, but marginalisation would ensure that they remain behind the core economies. TNCs were viewed as a major instrument of capitalism exploiting developing economies to expand accumulation in the developed world. Brazil and Indonesia are some of the countries often quoted to make this point (e.g. Frank, 1973; Muto, 1977). Increased penetration of TNCs are also considered to de-skill workers as low-wage employment is claimed to be the basis of incorporation in developing economies (Frobel et al., 1980). While making the same point, Amin (1976) in addition argued that foreign firms bring inappropriate capital-intensive technology – thereby raising the costs of diffusion and distorting technology development in host sites. These arguments obviously departed from Marx's original explication of industrial capitalism and implied that increased participation of TNCs will sap developing economies of the potential to develop their technological capabilities.

Closer to Marx's and Luxemburg's original works, Warren (1973, 1980) led the argument on how competition between firms has transformed the global environment for the extension of accumulation to developing economies. Although Murray (1973) had contended that state power had declined to pressure foreign firms to engender, *inter alia*, technology transfer, Warren appeared convinced that competition between firms had risen far more and was opening opportunities for developing economies to learn and develop. The relocation of production sites in developing economies and the market access foreign firms enjoy offered the conduit for quickening learning and upgrading. Governments of developing countries were encouraged to launch policies to extract maximum gains from the operations of foreign firms. The successful development of Singapore and Ireland using foreign firms as the spearhead of learning and innovation through invitation and leveraging lends support to Warren.

Structural and Institutional

Like the Marxists, structural economists have produced mixed arguments and findings on the topic of foreign firms and technology diffusion in developing economies. Hirschman (1958, 1977) argued pervasively that export-oriented foreign firms tend initially to create severe imbalances in host economies but provide the catalyst for supply responses leading to the development of backward linkages.⁵ The role of government to attract foreign firms and subsequent stimulation of backward linkages are viewed as critical for learning and eventually innovations to take place in developing economies. Akamatsu (1962) had argued, *inter alia*, that foreign investment was one of the instruments that would generate inter-country regional growth synergies.

Lall and Streeten (1977) discuss circumstances when such spillovers from the operations of foreign firms can occur, but raise doubts about their viability on the grounds of power asymmetries and the inherent problems posed by non-autonomous and corrupt host governments representing developing economies. Dunning (1958, 224–5) had examined American investment in British manufacturing using case studies to show technology transfer from American to local suppliers, customers and competitors. Allen and Donnithorne (1957) and Rasiah (1988, 1995: chs 6 and 7) offer empirical evidence of the development and movement of skilled human capital and entrepreneurial capabilities from foreign firms to start or support local firms in developing economies. Rasiah (2003b, 2003c) provided statistical evidence to demonstrate the importance of foreign ownership in the development of export (directly) and technological capabilities (indirectly) in the electronics industry in Indonesia, Malaysia, the Philippines and Thailand.

Singer (1950) contended otherwise, arguing that foreign investment is economically part of the investing country; with its monopoly over technology, it may weaken the recipient by diverting investment and resources away from local industry that might have otherwise developed. This is part of the ‘crowding-out’ thesis, which seriously affects developing economies. Newfarmer (1985: 185–6), Newfarmer and Mueller (1975), Agarwal (1976), and Lim and Pang (1979) provide anecdotal and statistical evidence to suggest that foreign firms produce few linkages in developing economies. Capannelli (1999) produced empirical evidence to show that Japanese consumer electronics firms in Malaysia generally retain all the key input supplies involving higher value added activities, leaving sourcing of only low value added inputs to local firms. In addition, Capannelli (1999: 208) also observed that the production technology used by Japanese subsidiaries in Malaysia involved in maintenance, inventory control, testing and inspection was inferior to that used in parent firms in Japan, but product technology involving some standardised products was superior. Lall (1978) and Moxon (1975) also questioned the relevance of TNC technology for diffusion in developing economies. The evidence amassed on this issue is still inconclusive owing to the problems associated with defining what is relevant, especially when economies integrated in the world economy have developed on the basis of catching up in industries where learning in path-dependent technologies dominates global exports. Learning in some industries has involved the pursuit of upgrading either through FDI or licensing and imitation. Some economies, e.g. Singapore and Malaysia, targeted technology-creating information technology to stimulate growth in fast-expanding industries. Upgrading in technology-using industries, e.g. garments and leather, offered the springboard to nurture learning and the foreign exchange to support higher-value-added industries. Korea, Taiwan and Singapore enjoyed completely different structures when active promotion of industrial

policy started in the 1960s (see Amsden, 1989; Wade, 1990; Lall, 2001). It is difficult to extract experiential and tacit knowledge on the basis of specific experiences, as cross-diffusion of skills from one department to another in the same firm and from one industry to another constitutes the very essence of dynamism in industrial districts (see Saxenian, 1994; Best, 2001; Rasiah, 1994, 2002b). In addition, problems of infrastructure and absorptive capacity have required foreign firms sometimes to introduce technologies that reflect little the influence of relative factor endowments. For example, Emmanuel (1989) argued that foreign firms are often forced to adopt capital-intensive technologies owing to infrastructure and labour control problems in Africa.

While disputes exist on the diffusion of skills and process technologies, the controversy involving foreign firms' role in engendering R&D activities in developing economies is even stronger. Vernon (1966, 1971) had argued using the product cycle argument that TNCs would relocate only standardised low-value stages of production at host sites. In addition to the need for strong institutional support and higher incomes to provide market demand, Vernon argued that governments in home countries also offered greater proprietary protection of such activities than host economies. Increased mobility of R&D scientists and engineers from developing economies such as India and China to major industrial clusters – e.g. Silicone Valley, Route 128, Ireland and Germany – has perpetuated the concentration of R&D activities at parent sites (see Rasiah, 2004). Some developing economies have managed to reverse some of these tendencies: e.g. Singapore attracts scientists and engineers from abroad and continues to build its institutional support facilities to stimulate R&D operations by TNCs. Nevertheless, the influence of agglomeration economies for R&D activities to be retained at parent sites has remained pervasive. Lall (1979, 1980), Mansfield et al. (1979), Creamer (1976), Ronstadt (1977), Behrman and Fischer (1980), Dunning (1994a, 1994b), Cantwell (1995) and Rasiah (1996) offered statistical evidence showing little R&D activities in TNC subsidiaries in developing economies. Cantwell (1995) and OECD (1998) make the same observation involving TNCs' R&D activities in developed economies. Mathews (1996)⁶ and Dunning (1997)⁷ introduced different variants of the stage-based notion of FDI articulated by Akamatsu (1962) and Vernon (1966) involving technological activities as countries develop. Much of the foreign R&D operations of TNCs tend to be focused on developmental aspects – including the adaptation of machinery and equipment. Using a framework to distinguish different types of activities involving R&D, Amsden et al. (2001) show that TNCs' involvement in R&D operations in developing economies is generally confined to simple activities, though Singapore was reported to have effected a transition in FDI from production-based to applied R&D activities through government policy. Sunkel (1989), Furtado (1973) and Cardoso (1977) have argued that

TNCs stimulate manufacturing in Latin American economies, but the nature of their operations tends to confine technological capabilities to low value-added activities.

Neoclassical

The effects of trade under neoclassical models – drawing from Ricardo (1830) and Marshall (1927) – led to the formulation of the Heckscher–Ohlin model where it was demonstrated that the static benefits of perfect competition and trade under conditions of factor (labour and capital) immobility would rise as specialisation based on relative factor endowments would maximise inter-country welfare. Bhagwati (1979: 96–8) relaxed the capital immobility condition to show how capital exports from a capital-surplus labour-scarce economy to capital-scarce labour-surplus economy can benefit both countries as the flows leads to equalisation of interest rates and wages. Technical change is not addressed directly and dynamically in this model. Subsequent works involving technical change have evolved truncatedly. The most influential technique showing technical change (assumed to be exogenous) that evolved from such analyses owes its existence to Solow's (1956) estimation of total factor productivity using the production function approach.⁸

Reuber et al. (1973) provided empirical evidence using simple discrete statistics to show that foreign firms operating in developing economies use 73 per cent of their process technology and 83 per cent of their quality control systems without any change. However, this study did not examine if the technological dimensions changed over time, and did not control for industrial specificities. This study and Hughes and You (1969: 193–4) explained that the most important reason for adaptations was to fit small-scale operations in developing economies. Rasiah (1988, 1994, 1995) offered empirical evidence from case studies in the semiconductor TNCs in Malaysia to show frontier process technology is critical especially in competitive industries characterised by rapid technological obsolescence – caused by shortening product cycles and efficiency-improving machinery and equipment change. Rasiah's (2003b) statistical analysis involving a larger sample of electronics firms – both foreign and local – from Indonesia, Malaysia, the Philippines and Thailand corroborated this finding.

Different postulations of technology, trade and FDI using general equilibrium models have also been advanced. Kojima (1975) developed a model to show that FDI in export-substituting rather than in import-competing industries in home countries will reduce trade with consequent negative implications for technology development. However, the static model used offered little explication of how technology development will be stunted as a result. A more sophisticated general equilibrium model was advanced by Krugman

(1979) showing how technology transfer will lower resource utilisation costs in developing economies and hence will stimulate FDI inflows. An empirical examination of this model will be useful, though it should be confined to specific industries where FDI flows are driven by resource endowments (including labour) and located alongside institutional and systemic developments at host sites. The development of the information hardware industry in Singapore and Taiwan relied extensively on technology transferred from TNCs, but the conditions and consequences were different. FDI inflows were sustained with greater technology transfer (which was also facilitated strongly by domestic institutional development in Singapore). The transfer of tacit and experiential knowledge embodied in human capital relocating from consumer electronics firms in Taiwan in the 1970s helped stimulate the initial growth of local firms in the industry. Using arm's-length licensing transactions, subcontract orders and Taiwanese human capital hired from TNCs in Taiwan and from the United States, and strong government support to promote R&D operations,⁹ local firms subsequently expanded sharply to engage extensively in original equipment manufacturing (OEM), original design manufacturing (ODM) and original brand manufacturing (OBM) operations (see Lin and Rasiah, 2003).

Neoclassical statistical estimations of technology flows involving foreign firms to developing economies focus largely on production function estimations of spillovers. Caves (1974a, 1974b) presented arguably the first systematic production function estimation of spillovers, which led to a plethora of works extending the framework (e.g. Blomström and Persson, 1983; Blomström and Wolffe, 1994). Urata (2001) examined the nexus between investment and exports in Asia. Sjöholm (1999) and Blomström and Sjöholm (1999) showed that foreign firms in Indonesia enjoyed higher productivity than local firms, and also generated positive spillovers. Haddad and Harrison (1993) and Aitken et al. (1999), *inter alia*, took this approach to a new dimension by refining the methodology to address locational, industry-type, scale and demonstration effect variables. These works helped to improve the original instruments that Caves had used to extend the understanding of spillovers. However, there has been growing debate over whether the relationships traced through such methodologies can be equated with actual spillovers. Given that technological external economies are often difficult to picture exhaustively,¹⁰ it is not wrong to contend that spillovers cannot be measured completely.

It can be seen that all three approaches offer considerable insights on foreign firms and technology in developing economies. While some approaches are inherently static, the main features of contention go beyond mere techniques. Removing static articulations, foreign firms' operations have correlated positively with technology development in some locations, industries and

time periods but not in others. Some case studies offered rich analysis of dynamic relationships between firms and technology – *vis-à-vis* export intensity, firm-level capabilities (e.g. human resource, process and product technology), linkages and systemic influences. Large surveys have offered more representative measurement of discrete influences, though at the expense of excluding some dynamic relationships.

1.3 ALTERNATIVE APPROACH

Although the disjuncture between theory and empirical evidence and attempts to bridge the gap remains elusive, important insights on foreign firms, technology, exports and productivity have evolved over time. Many of these developments appear to have come from contributions in evolutionary economics. First is the local, national and regional innovation system within which foreign firms are embedded, which includes the significance of absorptive capacity. Second is the technology trajectory of host sites and regions – i.e. the technological position of foreign firms and local firms. While higher technological gaps offer greater room for learning and absorption, government instruments defined to stimulate capability building may fail if local firms have not reached the threshold levels necessary to participate in higher-value-added activities. For example, incentives to promote R&D would enjoy few takers if firms merely perform simple low-value-added activities. Third is the public goods characteristics of institutional development and systemic links that help resolve collective action problems. Knowledge flows and appropriation are clearly public goods, which are effectively diffused across firms and institutions in smoothly coordinated networks or clusters. Table 1.1 presents a taxonomy of capabilities and performance with influences from the environment firms embed, structure that define their operations and their own conduct. This framework is articulated alongside a model shown in Figure 1.1 for understanding foreign firms in the context of their operations in individual economies by their position in the development ladder and the role and impact of government policies on their conduct and impact (see Figure 1.1).

The approach adopted in this book takes the implicit argument from Smith (1776) and Young (1928) that market size and capabilities stimulate each other. Smith made the observation – which was lucidly articulated later by Young – that causation involving the division of labour and the size of the market runs both ways. Put simply, the scale and ‘gales of creative destruction’ effects of external markets and competition respectively influence capability building, while improvements in the latter help sustain exports. This argument is also consistent with Hirschman’s (1958) dynamic analysis

Table 1.1 Taxonomy of capabilities and performance

Environment systemic	Structure	Conduct	Firm-level capabilities	Performance
Basic infrastructure, labour supply, socio-political and economic environment, high-tech support and network cohesion	Organisational structure of firms – vertically or horizontally integrated, domestic-oriented or internationalised, ownership and firm size	Human resource development and process and product technologies, and financial strategies	Human resource, process technology, R&D, product technology, product technology R&D, financial capability	Export, value added, labour productivity, return on investment

Note: The NIS viewed from the lenses of firms – adapted with contributions from IO, IP and BS.

Source: Adapted from Rasiah (2003b).

Source: Compiled by the author.

Figure 1.1 Towards a model of foreign firms, technological capabilities and NIS

calling for export orientation as the basis for promoting backward linkages. Although this chapter does not deal with backward linkages extensively as measurement is confined to firm-level capabilities, it captures a significant part of its potential. Technological capabilities rise with the location of firms on the technology ladder (see Dosi, 1982; Pavitt, 1984). High-tech infrastructure is essential to stimulate firms' participation in product and process technology development (e.g. R&D support).

A number of critical variables influence the development of technological capabilities, exports and labour productivity, the last two being indicators of competitiveness. The nature of foreign enterprise – defined by home-country origin, the industry, type (vertical, horizontal, conglomerate or stand-alone) with scale and scope ramifications – often strongly influence the conduct, technological capability and economic performance of individual firms. Chandler (1961, 1977) and Dunning (1997) articulated a similar, but with distinct business, perspective to the origin and growth of MNCs that is important in understanding the role of foreign firms in developing economies. The eclectic

framework of Dunning (1997) sought to explain the economic rationale behind MNCs' efforts to internationalise operations addressing the advantages of ownership, location and internalisation (OLI), which helped the investigation of technological impact through understanding the motives of relocation. Hence any effort to understand the technological impact of foreign firms on host sites requires at least some knowledge of the motives and characteristics of the foreign firms involved. Natural resources (e.g. Angola, Chile and Liberia), large reserves of literate labour (e.g. China, the Philippines and Bangladesh), domestic markets (e.g. Brazil, China and Mexico), special trading spheres (e.g. Mexico under the North Atlantic Free Trade Area and Cambodia under the ASEAN Free Trade Area), the strength of the local and national innovation systems, including government policy instruments (e.g. Singapore, Israel, Taiwan and Korea), have been important in attracting foreign firms – especially when accompanied by political stability and bureaucratic efficiency (see Dunning and Narula, 2000; Rasiah, 2002a).

Apart from olipolistic advantages driving the expansion of firms to transnationals (see Hymer, 1960, 1972), the growth in the number of cross-border subsidiaries is also driven by efforts to internalise intangible assets – embodied and disembodied knowledge – and to appropriate the relative benefits offered by host sites. The social dimension used in the business school in the activities of MNCs was advanced by Dunning (2003: 1–21), who introduced the concept of relational assets, which are intangible assets that are either internalised directly or indirectly through alliances. Relational assets are human-intensive – though they may be embedded or articulated by individuals or organisations (ibid.: 4). Subsumed in this concept are the elements of economic transactions influenced by social relationships, which are referred to as social capital. Relational assets are internalised or appropriated directly or indirectly through participation in business networks – a two-way process of fostering intra-network and inter-firm relational capital (ibid.: 9). These relationships also help enrich human capital, but the diffusion of codified and tacit and experiential knowledge from foreign firms to the local economy is likely to be strong only when the systemic conditions – institutions, density of firms and systemic links (including elements of trust) – are strong.

Since a firm's performance is influenced by its own endowments and conduct, and the nature and degree of coordination with other economic agents, it can be examined according to the taxonomy shown in Table 1.1. Industrial organisation typically states that firms' performance is determined by the structure (or environment, including other economic agents in factor and final markets) in which the firm is located and its conduct (see Bain, 1968; Scherer, 1973, 1980; Greer, 1992). Four related and overlapping literatures – national innovation system (NIS), industrial policy (IP), industrial organisation and the

Business School (BS) – discuss the policy and institutional environment necessary to stimulate learning, innovation and firm-level performance. BS exponents such as Prahalad and Doz (1987), Bartlett and Ghoshal (1989), Birkinshaw et al. (1998), Cantwell and Mudambi (2001) and Andersson et al. (2002) discussed local integration, embeddedness and differentiated subsidiaries on the basis of competence-creating and competence-exploiting conduct of multinational firms. The earliest IP argument in economic literature can be traced to Smith (1776), Hamilton (1791), Mill (1848) and List (1885).¹¹ NIS examines knowledge production, flows and diffusion involving learning and innovation, which provides a systemic dimension to firms' conduct and performance (Freeman, 1989; Lundvall, 1992; Nelson, 1993; Nelson and Winter, 1982a, 1982b; Dosi, 1982; Pavitt, 1984). IP typically prescribes the trade and technology policy environment to nurture infant firms to competitive status (see Lewis, 1955; Myrdal, 1957; Kaldor, 1957). The institutional embeddedness of learning, innovation and knowledge flows can be viewed better by integrating the value chains approach (Gerrefi, 1994, 2003) and NIS. BS offers a broader exposition of the environment – socio-political and cultural, conduct of affiliates, and the importance of social capital to explain the operations of firms (see Dunning, 1997). The taxonomy used here assumes causation to run both ways.

Institutional and systemic influences can be examined using the proxies of basic infrastructure and high-tech infrastructure and network cohesion. The first and last are particularly important for firms to keep costs and defects low and meet tight delivery times. High-tech infrastructure becomes essential for firms to participate in higher-value-added activities. The NIS and IP literature actively supports government intervention to overcome market failures associated with firms' participation in R&D activities in particular, and the range of related activities such as human resource training beyond schooling, and process technology acquisition and development. Hence the NIS and IP literature advocates interventions for building the high-tech infrastructure necessary to stimulate innovations in firms.

The importance of clusters in creating competitive advantages was noted by Porter (1990, 1998). In addition, Putman (1993) and Enwright (2000) discussed important benefits of spatial clustering of related activities. Guerrieri and Pietrobelli (2003) articulated three specific forms of clusters contending that post-Marshallian clusters will be less locally driven and vertically disintegrated with increasing integration into global production networks. The Marshallian cluster – symptomatic of Emilia Romagna – is characterised by strong inter-firm links and cooperation between numerous small firms of similar size. The mother-firm-driven cluster is defined by the role of one or more of large firms that drive the expansion and participation of firms in the value chain located geographically. Although this development was arguably made famous by the Japanese firms – especially Toyota and subsequently

other firms such as Nissan – Markusen (1996) also identified similar developments involving Boeing (in Seattle), Ford, Chrysler and General Motors (the last four in the Detroit cluster). The large hub firms also enjoy strong connections with firms located outside the geographically defined clusters. However, cooperation between competitors in such clusters is generally low. Guerrieri and Pietrobelli (2003: 4) identified a similar cluster around Fiat in Piedmont in Italy. Markusen (1996) defined a third type of cluster, which is driven by subsidiaries of MNCs in offshore locations. The latter may be the most important type of cluster that relates to technological spillover issues involving foreign firms in developing economies. Initial conditions at incorporation, the nature of host-institutional responses and the composition of firms and industries have produced significantly different cluster synergies in the developing economies. Rasiah (2002b) observed the influence of these features within just one country, i.e. Malaysia. Ernst (2003) attempted to examine the differential impact of foreign firms' global production networks in East Asia.

Best (2001) offered a dynamic explication of the concept of clusters when introducing his business model, i.e. the productivity triad. Arguing that dynamic clusters generate techno-diversity, thereby stimulating differentiation and division of labour, which in turn ensures growth and expansion of regions. While a cluster may have considerable density of firms and the requisite institutions, it may not enjoy strong connecting bonds between them. The role of systemic instruments in driving cluster cohesion has been important in the development of dynamic industrial districts. Inter-firm pecuniary relations through sales and purchases is only one channel of inter-firm interactions (Rasiah, 1995). Knowledge flows – rubbing-off effects from the interaction of workers and the movement of tacit and experiential skills embodied in human capital – raise systems synergies (Marshall, 1890; Polanyi, 1997; Penrose, 1959; Dunning, 2003). Open dynamic clusters encourage inter-firm movement of tacit and experiential knowledge embodied in human capital, which, *inter alia*, distinguishes dynamic from truncated clusters (see Best 2001; Rasiah, 2002b). New firms benefited from gaining managerial and technical personnel from older firms in the Silicon Valley irrespective of national ownership. American and Japanese firms hired technical and managerial personnel from old firms in Silicon Valley. Mature firms gain new ideas and processes to ensure continuous organisational change as some old employees are replaced to make way for fresh ones with new ideas, while new firms benefit from the entrepreneurial and technical – tacit and experiential – knowledge to start new firms (Rasiah, 2002b). Saxenian (1994, 1999) offered an impressive documentation of inter-firm movement of human capital, which helped support new firm creation capabilities in Silicon Valley. Rasiah (1994) traced, using detailed case studies, the creation of new local firms through the

movement of personnel from foreign electronics firms to local firms in Penang. Despite the relative insignificance of FDI, Mathews (1997), and Guerrieri and Pietrobelli (2003) documented evidence of Taiwanese electronics firms started by former local employees of foreign multinationals. Rasiah (1999), Doner (2000) and Aoki (2001) had argued for the important role of intermediary organisations in strengthening network cohesion – including coordinating demand–supply relations between government, firms and institutions.

The role of government is only received positively by neoclassical frameworks generally when involving the provision of basic infrastructure (e.g. primary schooling, health and sanitation, road and telecommunications and basic utilities). IP and NIS exponents are quick to emphasise the public goods characteristics of high-tech infrastructure such as R&D, training and information communication technology (ICT) and hence argue that government support is necessary to stimulate learning and innovation. Institutions associated with human resource development and R&D often face collective action problems. Private agents are unlikely to participate in market-driven activities when the risks involved are not matched by returns. Moreover, private agents will never be able to appropriate fully gains from new innovations (Mansfield, 1985). Schumpeter (1934), Abramovitz (1956), Kaldor (1957) and Arrow (1962) had argued that interventions in markets are necessary to stimulate participation in welfare-enhancing public goods activities.¹² Training and R&D institutions involve considerable acquisition and diffusion of knowledge, which is a public good in that its consumption by one does not exclude that by others, which was lucidly captured using historical examples involving the development of new technologies in the United States by Wessner (2003). Hence knowledge-appropriating institutions such as universities, R&D labs and technical schools come under the category of public goods. It is well recognised that strong government support initiated technological progress in the Western economies and Japan (see Gerschenkron, 1962; Kaldor, 1967; Johnson, 1982).

Given the public good characteristics of training and R&D, it can be argued that government participation is essential to stimulate firms to engage extensively in human resource training and R&D activities. Government support can take the form of financial incentives or subsidies, launching of training and R&D organisations, and special programmes to build firm–university and firm–public training and R&D relationships. However, as advanced by Dosi (1984) and Pavitt (1984), firms at the bottom of the technology ladder hardly participate in R&D activities. Most developing economies – e.g. Bangladesh, Indonesia, Tanzania – are entrenched at the foot of the technology ladder in manufacturing. Only a few developing economies have developed sufficiently the high-tech institutions – e.g. Korea, Taiwan and

Singapore – to support firms' participation in R&D activities. Hence this book takes the view that product R&D capability will be low in most developing economies. Also, given the eclectic nature of government intervention in these countries, apart from laying the groundwork to attract FDI, government support is unlikely to be strongly correlated with even human resource and process technology capabilities. Nevertheless, network cohesion – often through concentration of basic infrastructure support in export-processing zones – is essential to facilitate firms' efforts to internalise much of the related transactions and coordinate their operations competitively.

The measurement of institutional and systemic influences on exports, productivity and technological capabilities is extremely difficult. Given that firms are likely to relate cohesion to the inherent properties of institutions and other firms rather than separately, it is more appropriate to just introduce one institutional and systemic variable – integrate the overlapping features with systems, cluster or network strength. This would help reduce if not eliminate the problem of double counting and the use of highly related variables. Given that this book seeks to go beyond the market–government dichotomy, network strength arises as a novel means of demonstrating institutional and systemic influences on firms to capture market–government interactions.

Labour market conditions often influence export competitiveness, productivity and technological capabilities, including the relocation of labour-intensive low-value-added activities. Hence the framework of analysis used examines wages and union affiliation. Given the problems associated with the reliability of firm-level data on labour market conditions and the conditioning domestic environment on the limited room enjoyed, trade unions are not necessarily effective instruments for ensuring strong labour conditions. Nevertheless, union incidence does reflect a certain minimum floor for labour welfare in the selected economies. Sabel (1989), Piore and Sabel (1984), Sengenberger and Zeitlin (1991), Sengenberger and Pyke (1991) and Wilkinson and You (1995) offered lucid accounts of the high road to industrialisation where good labour conditions were instrumental in stimulating long-term competitiveness and the converse involving the low road to industrialisation. Ghose (2003) produced statistical evidence involving a study commissioned by the International Labour Organization (ILO) showing positive effects on labour market conditions from outward export orientation. The difference can also be presented as flexible casualisation involving poor labour conditions (see Deyo, 1987) and flexible specialisation involving good labour market conditions (Piore and Sabel, 1984). It is for these reasons wage was preferred over unions as the labour market variable in the statistical regressions. However, given the low incidence of union affiliation in some industries globally (e.g. electronics), and high reserves of surplus labour in several developing economies – including supply of labour with at least secondary school education –

wages may show a mixed relationship with exports and technological capability. Given the high levels of literacy and technical knowledge required of electronics workers – especially in semiconductor assembly – exports are likely to show positive correlation with wages. The same may not hold for technological capability variables since firms may be required to have similar levels of capabilities in related stages and types of production to compete in industries where technology evolves quickly – e.g. electronics. For example, the Philippines offers low wages and yet enjoys a high share of literacy among secondary students among developing economies (see Rasiah, 2002b: Table 2, 2003b). Nonetheless, export market pressures in leather and garments and high-skilled and knowledge-intensive labour in auto parts may produce a positive relationship between exports, technological capabilities and wage. R&D capability may provide an exception as the main focus on process R&D in these countries could have influenced greater involvement of workers in creative decision making.

There is a standing debate on the importance of size on firms' export competitiveness, productivity and technological capabilities. Typical industrial organisation arguments posit that firms achieve competitiveness with a certain minimum efficiency scale (MES), which varies with industries (see Scherer, 1973, 1991; Pratten, 1971). Industries engaged in the manufacture of steel, automobiles and tankers are considered to enjoy scale economies and hence require higher MSE unit production numbers to achieve low unit costs. Where scale is not important – e.g. small-batch machine tools and plastic components – scope rather than scale is considered important (Piore and Sabel, 1984; Rasiah, 1995). Audretsch and Zoltan (1991) and Audretsch (2002) offered pervasive analysis of US data to dispel arguments related to the significance of large size in efficiency and innovative activities. The increasing decomposition and dispersal of production involving information technology industries has made small size very efficient. Given the controversy over the role of size in economic performance and the claims of industrial organisation exponents over MES differences across industries, size is considered to offer a neutral relationship with productivity and export competitiveness.

Industrial specificity has a strong bearing on exports, productivity and technological capabilities. Gerrefi (2002, 2003) offered a useful framework to map industrial influences through producer–buyer-driven value chains. Garments tend to be characterised by buyer-driven chains, while automobiles tend to be defined by producer-driven chains. In addition to the control features involving the main drivers in the value chains, industries also enjoy several other characteristics that often change with time. Increased liberalisation and the removal of the multi-fibre agreement by the end of 2004 have already triggered the closure or relocation of garment firms involving a

number of developing economies. Auto parts is closely related to machinery and engineering industries, electronics assembly and test has transformed from being labour-intensive to knowledge-intensive particularly since the 1980s (see Rasiah, 1988; Hobday, 1995; Ernst, 2000a, 2000b, 2000c; Kraemer and Dedrick, 2003) and garments have become strong technology users. The nature of liberalisation seems to be increasingly reducing the number of specialised suppliers involving auto parts in host economies where such capabilities in the past evolved through import-substitution policies with emphasis on local capability development (Veloso and Kumar, 2003). South Africa, Brazil, Mexico, the Philippines and Taiwan are examples (Ofreneo, 2003; Barnes and Lorentzen, 2003; Quadros, 2003). Pharmaceuticals remains R&D-intensive – relying on pockets of R&D capabilities and raw materials in host economies – and its production technology is highly process-driven. Food processing varies with products – from high-volume, resource-dependent fruit packing by foreign firms (e.g. Del Monte and Chiquita) to small-scale bakeries. Even in fruit packing and wholesaling tensions have broken out between the packaging and distributing firms and supermarkets dealing with final sales (see Dolan and Humphrey, 2000). Mytelka (1999) and Mytelka and Farinelli (2000) offered greater focus on the elements and relationships that differentiate and define innovation networks, arguing persuasively that the so-called sunset or traditional industries such as garment and wine producing have become knowledge-intensive. Hence the empirical chapters in the book will either examine the relationships between exports, productivity and technological capability by ownership within industries, or use industry dummies as control variables in statistical analysis.

In light of the problems associated with measuring spillovers, two alternative but related methodologies are advanced here. The first draws from past works and is the most simple and straightforward, albeit it does not help statistical estimations given the costs of amassing large data sets. The case studies, while proving costly if representative samples are pursued, are rich and help unravel dynamic relationships that do not often appear in large surveys. Although such an approach is often considered not representative of wider populations, its efficacy on the chosen firms cannot be rivalled. Case studies of course range from the simple examples – but with broader coverage – used by Allen and Donnithorne (1957) and Dunning (1958), to the detailed ones used by Rasiah (1994), Best (2001), Ernst et al. (1998). Although all the chapters used case studies at least as the starting point in understanding industry dynamics in the related countries, only Chapter 8 uses this methodology exclusively as its mode of data collection and analysis.

The second methodology uses the technology capability framework, which relies on indexes and statistical methods; its antecedents can be traced to Lall (1992), Lall and Wignaraja (1995), Bell and Pavitt (1995), Westphal et al.

(1990), Ernst et al. (1998), Wignaraja (2002), Figuiredo (2002), Ariffin and Bell (1999); Ariffin and Figuiredo (2003). However, unlike these rich and dynamic frameworks, the methodology used here had to be adapted and simplified to run cross-industry regressions. Common proxies without an overlap between variables had to be computed for the statistical analysis. Hence the statistical methodology used in the empirical chapters required some departure from the rich explorations undertaken in the framework. The adapted framework has its limitations, as some capabilities may have been acquired above the socially optimal opportunity costs. The normalising formula used does not attach particular weights to a given set of proxies and hence may introduce biases. In addition, the cluster, systems or network strength variable requires subjective assessments by companies. Nevertheless, since the measurements use estimations of data drawn wholly from firms, these biases are outside the control of analysts and hence can be subsumed under the usual problem associated with data collection in general. Importantly, the approach allows to some extent the estimation of latent spillovers, the extent of realisation of which will depend, *inter alia*, on the absorptive capacity of the domestic environment.

Using the two methodologies introduced above, the empirical chapters in the book seek to test the hypothesis that FDI originating from superior NIS are generally endowed with higher export and technological capabilities than local firms, and hence offer developing economies strong latent capacity to stimulate technology transfer. Because participation in product R&D activities requires superior domestic institutions R&D support infrastructure, foreign firms typically retain such activities at home sites, and hence might demonstrate inferior product R&D capabilities than local firms. Nevertheless, foreign firms are expected to utilise host-site personnel to participate strongly in process R&D activities, and some levels of product diversification and proliferation activities where at least a minimal amount of R&D infrastructure exists – e.g. Brazil, South Africa and Malaysia. The case study approach allows an assessment of technology transfer and spillovers in Costa Rica, which is not possible in the statistical analysis using the survey data.

1.4 THE SETTING

Selection of economies was made on the basis of high FDI participation in manufacturing and varying levels of network, cluster or systems strength (NIS) to support learning and innovation in firms. While the former was easy to observe, the latter was not possible beyond the measurement of institutional proxies at the outset of the study. Hence the proxies of basic and high-tech infrastructure became the initial basis for locating the economies

Table 1.2 Economic and institutional position of economics selected for study, 1999

	Continent	Per capita income (US\$)	BI	HI	FDI in manufacturing
Brazil	L. America	7037	0.375	0.101	Moderate
Costa Rica	L. America	8860	0.391	NA	High
Indonesia	Asia	2857	0.117	NA	Moderate
Kenya	Africa	1022	0.003	NA	High
Malaysia	Asia	8209	0.342	0.041	High
South Africa	Africa	8908	0.309	0.230	High
Uganda	Africa	1167	0.003	0.003	High

Notes: BI and HI refer to basic and high-tech infrastructure indexes computed using proxies (see Rasiah, 2003c for the proxies and the formula used to compute BI and HI). BI and HI vary between 0 and 1 with Italy and Japan holding the highest score of 1 in 1999; NA – not available.

Source: Computed from World Bank (2002).

on the institutional technology ladder (see Table 1.2). The adoption of the first criterion is obvious and extensively discussed in past literature. The second criterion of selection took cognisance of the contributions of evolutionary and institutional economics. The strength and embeddedness of local and national innovation systems have an important influence on the conduct of both foreign and local firms, and hence will have a bearing on exports, productivity and technological capability development. Interviews by the authors involving industry associations, three firms from each industry, officials from relevant government institutions – basic, high-tech (including R&D) institutions – was used to define the questions to capture network strength (connections and coordination between firms and institutions) (see also Table 1.3).

Given the focus on examining technological capabilities across a set of developing economies against varying degrees of strength of national innovation systems with specific focus on individual clusters, the countries were selected on the basis of strong participation of FDI (especially in manufacturing), the strength of high-tech infrastructure and per capita income levels. Malaysia, Brazil, South Africa and Costa Rica were selected on the basis of reasonable national innovation support strength (see Table 1.3) and fairly high FDI levels in GFCF (gross fixed capital formation – see Table 1.4). Indonesia, Kenya and Uganda were selected on the basis of missing institutions and poor systems strength. Peru was considered in this category but had

Table 1.3 Taxonomy of national (and local) innovation strength of selected economies, 2003

Missing and weak institutions	Weak institutions	Fairly strong institutions but relatively weak links with firms	Selected strong institutions
Uganda and Kenya	Indonesia	Kelang Valley (Malaysia)	Penang (Malaysia) and São Paulo (Brazil), Costa Rica and South Africa
Import of products, equipment and machinery, learning by doing and using	Adaptation and modification of existing technology	Production-related R&D operations. Local firms benefiting from government instruments to undertake R&D	Proliferation, diversification and re-engineering of process and product technology. Isolated applied research and development
Very few firms undertake any kind of R&D	Low levels of R&D participation	Truncated presence of R&D operations in some firms	Rising importance of production-related and re-engineering R&D

Source: Compiled by author (2003).

Table 1.4 Share of net FDI in GFCF, 1990–2000 (%)

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Uganda	0.0	0.2	0.7	11.2	15.0	12.8	12.5	17.3	20.7	21.1	19.6
South Africa	NA	NA	NA	NA	1.8	4.5	3.4	16.1	2.7	7.9	5.1
Malaysia	16.4	22.8	24.4	19.5	14.7	10.9	12.0	12.0	11.2	8.9	7.2
Kenya	3.4	1.2	0.6	0.2	0.3	2.0	0.8	1.2	0.6	0.9	8.4
Costa Rica	10.4	13.9	13.0	12.3	14.1	15.8	22.6	17.6	21.3	25.0	15.1
Brazil	1.1	1.4	2.8	1.4	2.5	3.1	7.0	11.3	19.1	26.5	26.9
Indonesia	3.1	3.7	4.2	4.3	3.8	6.7	8.9	6.8	-2.2	-15.9	-16.6

Source: Compiled from World Bank (2002).

to be dropped owing to logistics problems. Singapore was excluded only because of logistics problems.¹³ Among the countries involved, Indonesia and Kenya enjoyed low levels of overall FDI in GFCF in 1999, but their share in manufacturing fixed capital formation was high. FDI accounted for 63 per cent of ownership of manufacturing fixed assets in Kenya in 1999 (Gachino and Rasiah, 2003) and 20 per cent of manufactured exports in Indonesia in 2000.

FDI levels in the period 1990–2000 fluctuated strongly among the sampled economies (see Table 1.4). Uganda had extremely low levels of FDI until 1993 owing to severe macroeconomic failure that gripped the country (see Kasekende, 2000a, 2000b). Institutional failure and political uncertainty in Kenya and improved government–business coordination along with the liberalisation of FDI inflows attracted strong FDI inflows since 1993. In Kenya, after a barren period between 1991 and 1999 when FDI levels fell sharply and stagnated FDI levels rose considerably in 2000 following the introduction of the American-led African Growth Opportunity Act (AGOA) that stimulated FDI inflows into export-processing zones. FDI levels in GFCF rose to a peak in 1997 in South Africa before falling to 5.1 per cent in 2000. Nevertheless, FDI remained a key contributor to manufacturing value added and exports in 2000.

The selection of manufacturing subsectors from the countries was based on the importance of FDI and the contribution of the subsector to manufacturing value added in the economies selected (see Tables 1.5 and 1.6). As with social theory on systems, each industry enjoys its own unique properties to such an extent that it is difficult for policy makers to select one over the other purely on the merits of the internal dynamics of particular industries. Nevertheless, some industries enjoy synergising or clustering properties that help industrial expansion faster than others – e.g. complements such as engineering and electronics and enablers such as information communication technology and new materials. Some industries enjoy natural insulation owing to distance and host sites' natural resource support and cultural dimensions – e.g. agricultural processing and food and beverages. Some industries experienced a decentralisation of production as transnational corporations sought to internationalise operations to take advantage of the low-wage literate labour – e.g. electronics and garments (Frobel et al., 1980). Some industries emerged in particular countries largely as a consequence of deliberate government efforts to promote them – e.g. cars, steel and ships in Korea (see Amsden, 1989). Large domestic markets were important in attracting FDI automobile and parts assemblies into Brazil, Mexico and South Africa.

Table 1.7 shows the industries chosen in the seven countries selected. The dynamics of each of the industries in each country was screened through a profound study of the process flow charts, organisation of machinery and

Table 1.5 Share of manufacturing value added in GDP, 1990–2000 (%)

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Uganda	5.7	5.8	6.2	6.0	6.5	6.8	7.9	8.6	8.9	8.7	9.1
South Africa	23.6	22.9	21.8	21.1	20.9	21.2	20.2	19.9	19.3	18.8	18.8
Malaysia	24.2	25.6	25.8	25.9	26.6	26.4	27.8	28.4	27.4	29.3	32.8
Kenya	11.8	12.2	11.1	10.0	10.7	9.9	10.6	10.2	11.1	12.3	13.1
Costa Rica	21.9	22.8	23.3	22.2	21.7	21.8	22.1	22.4	23.0	28.8	24.4
Brazil	NA	25.3	24.7	25.0	23.7	23.6	22.7	22.8	22.3	23.1	24.0
Indonesia	18.3	14.2	19.1	22.3	23.3	24.1	25.6	26.8	25.0	25.9	26.0

Source: Compiled from World Bank (2002).

Table 1.6 Share of manufactured exports in total exports, 1990–2000 (%)

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Uganda	NA	NA	NA	NA	2.4	4.4	13.0	17.4	5.0	3.4	6.0
South Africa	21.9	24.8	36.4	38.7	39.2	43.5	55.3	57.8	53.7	55.0	54.3
Malaysia	53.8	60.6	64.4	69.7	73.6	74.7	75.7	76.6	78.8	80.4	80.4
Kenya	29.2	20.5	36.4	28.3	28.8	27.6	26.4	25.3	23.6	22.2	20.8
Costa Rica	26.8	24.0	25.2	26.9	26.8	25.1	25.4	42.9	52.9	68.0	65.6
Brazil	51.9	54.9	57.0	58.9	55.1	53.5	53.8	53.7	54.7	54.1	58.5
Indonesia	35.5	40.8	47.5	53.1	51.8	50.6	51.4	42.3	45.0	54.4	57.1

Source: Compiled from World Bank (2002).

Table 1.7 Industries selected for study by country, 2001

Country	Sector 1	Sector 2	Sector 3	Sector 4	Sector 5
Uganda	Food and beverages	Machinery and engineering	Textiles and garments	Plastics	Others
South Africa	Auto parts	Electronics	Pharmaceuticals	Food and beverages	Textiles and garments
Malaysia	Auto parts	Electronics	Textiles and garments		
Kenya	Food and beverages	Machinery and engineering	Textiles and garments		
Costa Rica	Electronics	Suppliers			
Brazil	Auto parts	Electronics	Pharmaceuticals	Textiles and garments	
Indonesia	Auto parts	Electronics	Textiles and garments		

Source: Rasiah (2004).

equipment, technical division of labour across the process layout, organisational structure of the firms, and nature of product and market integration, if any, in the global value chain. Case studies involving three firms in each industry in each of the countries constituted the basis for the definition of proxies related to human resource, process and product technology in these industries. Simplifications were unavoidable given the contrast in production and product technology involving the industries – especially food and beverages, auto parts and machinery and engineering. The limited amount of responses from Costa Rica led to the eventual selection of only Intel (electronics) and its suppliers. The focus on only one firm and its suppliers in Costa Rica enabled a more detailed examination of technological capability building involving foreign firms.

1.5 SUMMARY

This book examines exports, productivity and technological capabilities by comparing foreign and local firms. Since inflows of foreign investment directed at technology development are essentially born out of national economic development policy frameworks, efforts to evaluate the role of foreign firms in technology development cannot overlook economic policies. The theoretical basis underlying the analytic framework adopted goes beyond the government versus markets discourse – taking cognisance of the view that the interaction of both is vital for driving change in local and national systems to stimulate learning and innovation in firms. Given the problems associated with measuring spillovers involving large data sets, the empirical chapters attempt to examine the potential rather than the actual spillovers that are likely to occur. It is neither possible nor proper to subject foreign firms to actual spillover assessments since the embedding institutional and systemic structures set limits on their appropriation by local economic agents. Hence the empirical chapters will either map detailed case studies to establish dynamic relationships and the potential technological synergies foreign firms offer in relation to local firms, or estimate and compare technological capabilities developed in foreign and local firms. Chapters 2–7 go further to estimate statistically the determinants of export, productivity and technological capabilities.

The selection of economies was based on both relatively high levels of participation of FDI in manufacturing and differences in basic and high-tech infrastructure. The strength of network cohesion was subsequently added in the location of the clusters on the national innovation ladder (see Table 1.3). While the first is obvious, the latter offers a range of examples to test the proposition that the extent of development of technological capabilities in

foreign and local firms in developing economies depends considerably on the strength of the local and national innovation system they embed (absorptive capacity).

Using the two methodologies introduced above, the empirical chapters in the book examine the hypothesis that FDI originating from superior NIS are generally endowed with higher export and technological capabilities than local firms, and hence offer developing economies strong latent capacity to stimulate technological capability building. Because participation in product R&D activities requires superior domestic institutions and R&D support infrastructure, foreign firms typically retain such activities at home sites, and hence might demonstrate inferior product R&D capabilities to local firms. Nevertheless, foreign firms are expected to utilise host-site personnel to participate strongly in process R&D activities, and some levels of product diversification and proliferation activities where at least a minimal amount of R&D infrastructure exists – e.g. Brazil, South Africa, Malaysia and Costa Rica.

The rest of the book is organised as follows. Chapters 2, 3 and 4 use empirical evidence and statistical analysis to examine the importance of foreign ownership on labour productivity, export intensity and technological capability in Kenya, South Africa and Uganda respectively. In addition, the chapter on South Africa analyses local sourcing intensities between foreign and local firms. Chapter 5 evaluates differences in technological capabilities between foreign and local firms in Indonesia. Chapter 6 discusses productivity and technological, export and local sourcing intensities between foreign and local firms in Malaysia. Chapter 7 examines the statistical differences and relationships between foreign and local firms in Brazil. Chapter 8 discusses the role of Intel in the creation of small and medium suppliers in Costa Rica.

The empirical chapters offer policy conclusions for the countries involved specifically and developing economies in general. The book is expected to offer a further refining of existing theory and methodology involving foreign firms' role in stimulating learning and innovation in developing economies. In addition to providing new information on the selected countries, the empirical chapters also offer industry-specific dynamics of technology, export, productivity and local sourcing, and the relationships between them that have not been examined in sufficient depth in the past.

NOTES

1. This book takes the view that path-dependent scientific knowledge exists in nature and that human discoveries only quicken its appropriation. This is different from works of art such as music and paintings where similar path-dependence cannot be guaranteed.
2. The term transnational corporation was used by the United Nations Centre for Transnational

Corporations in 1974 at the insistence of Latin American and Caribbean economies who wanted to distinguish foreign-owned transnationals and joint ventures of two or more participating countries established as part of regional integration schemes. The term was earlier advanced by the United Nations Economic and Social Council, which described all enterprises that control assets – factories, mines, sales offices and the like in two or more countries (UNCTC, 1978: 158). In doing so, the book attempts to avert any ideological debate over the selection. Nevertheless, the terms foreign firms and multinationals are used interchangeably in the text.

3. Interviews carried out by the author with 21 foreign entrepreneurs in Kenya and six foreign entrepreneurs in Uganda in the period 4–27 April 2002.
4. See also Kitching (1982: 160).
5. This argument is very similar to Marx (1965) and Luxemburg's (1963) original explication, though exports and backward linkages were not explicitly elucidated by them.
6. Mathews (1996) introduced the accelerator model with strong focus on institutional dynamics which help stimulate faster catch-up through a 'pulling effect' and leapfrogging once a threshold level of capabilities is achieved.
7. Dunning (1997) developed a five-stage investment development path to offer an explanation for relocation and operation strategies of MNCs as economies evolve from the first to the fifth stage of development.
8. See Romer (1986) and Vaitos (2003) for a critique of the model as a means of demonstrating technical change.
9. The Industrial Technical Research Institute (ITRI), the Science and Technology Programme and the Hsinchu Science Park are three major initiatives the Taiwan government financed to promote R&D (see Lin and Rasiah, 2003).
10. Scitovsky (1964: 72–5) and Rosenstein-Rodan (1984: 214–16) differentiated technical and pecuniary external economies. However, their explication of technical external economies is vague (see Rasiah, 1995: 40).
11. It is believed that Henry VII was the first to introduce industrial policy instruments, which he did to promote manufacturing growth in England in 1485.
12. New growth economists such as Romer (1986) and Lucas (1988) demonstrated these ideas using elegant models.
13. The national consultant engaged became too busy to undertake the survey.