VOLUME 17 NUMBER 3 DECEMBER 2008

TRANSNATIONAL CORPORATIONS

United Nations
New York and Geneva, 2008
United Nations Conference on Trade and Development
Division on Investment and Enterprise

Editorial statement

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Editor: Anne Miroux
Deputy Editor: Hafiz Mirza
Managing Editor: Shin Ohinata
Production Manager: Tess Ventura
home page: http://www.unctad.org/TNC

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Unless stated otherwise, all references to dollars ($) are to United States dollars.

ISBN 978-92-1-112762-1
ISSN 1014-9562

Printed in Switzerland

Transnational Corporations
Volume 17, Number 3, December 2008

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Editorial Preface: Article Stream in Honour of Sanjaya Lall

The late Professor Sanjaya Lall, was one of the world's leading authorities on issues related to industrialization, technological change and development. He contributed extensively to the work of UNCTAD over many years, including the Division on Investment and Enterprise (DIAE) and, among others, his intellectual footprint can be seen in a number of World Investment Reports, the Technology for Development Series, and other publications and activities of the Division. In his honour and at the initiative of Khalil Hamdani - a former Director of DIAE - a meeting of Experts on "FDI, Technology and Competitiveness" was convened by UNCTAD in Geneva on March 2007, in collaboration with Queen Elizabeth House, Oxford University. Papers were presented by prominent academics on topics related to the wide-ranging issues on which Sanjaya Lall had worked and played a part in establishing as significant areas of intellectual endeavor - from developing country TNCs to the role of technology and innovation in development.

Among the many outcomes of the Expert Meeting were a special issue of *Oxford Development Studies* and a stream of articles to be published in *Transnational Corporations* in honour of the work of Sanjaya Lall. Some of these articles are referred versions of papers presented at the Meeting, but others were received subsequently from academics that were unable to participate. The large number of papers received is a tribute to the esteem in which Sanjaya Lall was held by colleagues and peers; and this situation necessitated a *stream* of articles to be published over a number of issues, rather than a single issue. The first article in the *stream*, by Ganesh Wignaraja, appeared in the August 2008 issue of *Transnational Corporations*. The three main articles in this issue, by Dunning and Zhang, Ernst and Mathews, are also part of this stream of articles; and others will follow in later issues.

Lall originally made a name for himself in the field of transnational corporations (TNCs) and developing economies. However, because aspects of economic development interlock and influence the overall process collectively, he began to increasingly

research and publish (in collaboration with other scholars) on trade and competition, globalization and its economic consequences, industrial policy and industrialization, and innovation and technological capabilities. In consequence, the stream of articles in his honour in this journal reflects this broader perspective. Ultimately, nevertheless, the firm remained at the heart of his analysis, as he made incisive inroads into measuring technological capabilities, distinguishing between different levels of corporate knowledge and experience, as firms from developing countries negotiate the daunting currents of competition to move from price-based to product-based competitiveness. In a sense, his research began and ended with developing country TNCs - but Sanjaya Lall made sure that the black box of devilish detail, inherent in the development process, was opened and subjected to meaningful, policy-orientated analysis.

Anne Miroux, Rajah Rasiah[1], Hafiz Mirza and Shin Ohinata

[1] Professor Rajah Rasiah of the Faculty of Economics and Administration, University of Malaya has assisted in bringing the article stream in honour of the work of Sanjaya Lall to fruition.

Foreign direct investment and the locational competitiveness of countries

John H. Dunning and Feng Zhang*

The paper first examines the current state of thinking on the role of resources, capabilities and markets (RCM) and institutions (I) as the main ingredients of the competitiveness of national economies. The paper then empirically investigates how the extent, content and quality of each are associated with the level of foreign direct investment (FDI) to and from the country. Data are primarily drawn from the World Investment Report (UNCTAD) and the Global Competitiveness Report (World Economic Forum). We find that the level of competitiveness does, in general, encourage both inward and outward FDI. Moreover, the I of a country has stronger positive effects on FDI than its RCM. Further investigation shows that the effects of I are particularly strong in countries at the advanced stage of development. The findings of the paper suggest that more detailed future work focusing on countries' institutional advantages promises to yield dividends in terms of insight into the determinants of national competitiveness and FDI.

Keywords: FDI, Institutions, Country Competitiveness, Economic Development

1. Introduction

One of the several research interests the first author shared with Sanjaya Lall was on the determinants of the competitiveness of countries. In 2001, Sanjaya wrote a trenchant criticism of the quality and relevance of some of the indices used to identify and assess the competitiveness of developing countries by the *Global Competitiveness Report* (*GCR*)[1]. While endorsing many of his concerns, we believe that, in one respect at least, the GCR does help us to better appreciate the role played by two distinctive, yet interrelated, components of competitiveness, which are often treated as one in the literature.

* John H. Dunning is Emeritus Professor of International Business at the University of Reading, United Kingdom, and Rutgers University, United States. Feng Zhang is a PhD student at Rutgers University.

The final version of this article benefitted from significant comments and suggestions from Jeremy Clegg, Jean Monnet Professor, University of Leeds, United Kingdom.

[1] The 2005 edition of the annual publication of the *World Economic Forum*, which sets out 142 separate indices for 117 countries.

These are first, the resources, capabilities and markets (RCM) which make up the *physical*[2] environment in which firms and other organizations create economic well-being; and second, the institutions (together with the values and belief systems underpinning them) (I) which provide the incentive structures to make up the human environment, and which set the rules of the game for, and determine the cognition and motivation of, firms and other wealth creating entities.

All too frequently in the past, in assessing national competitiveness, the RCM and I determinants of economic activity have been treated separately. Partly this reflects the different disciplinary and methodological approaches to evaluating each. While mainstream economists, borrowing from the causal and functional analytical tools of the physical and/or biological sciences have favoured the "if-then" approach to measuring competitiveness, other social scientists, notably sociologists, have focused more on the intentionality of human decision takers, and on the institutional and other elements determining the motivation and conduct of individuals.

This dichotomy is now starting to change. The first bridges were made by institutional scholars from a variety of disciplines in the 1930s and 1940s. Perhaps the most influential of these were John Commons and Herbert Simon. Later, the contributions of Oliver Williamson, Harold Demsetz and Douglass North helped bring the subject centre stage among economists and organizational theorists. Each, in their particular ways, has attempted to unite the RCM (or *physical*) with the I (or *human*) approach to understanding the strategy of firms and the policies of governments in the wealth creating process. However, from an International Business perspective, notwithstanding the work of the internalization school (Buckley and Casson, 1976, 1985; Hennart, 1982), institutions have been incorporated into mainstream theory only very recently.[3]

Outside International Business, an understanding of institutions has traditionally been the domain of sociologists, whose interest in this subject dates back to the writings of Emile Durkheim in the mid-nineteenth century; while, latterly, organizational, international relations and legal scholars have contributed to the debate.[4] And once

[2] We use these terms as does Douglass North in his various writings. See, for example, North (2005).

[3] See e.g. the works of Oliver (1997), Henisz (2000, 2003), Mudambi and Navarra (2002), Peng (2003), Peng, Lee and Wang (2005), and Lu (2006).

[4] See e.g. several essays in Ghoshal and Westney (1993), and Williamson (2000)

one trespasses into the arena of values, cognitive science and belief systems, social psychologists, anthropologists and theologians have their contribution to make, while a branch of economics called "neuro economics" is beginning to link these behavioural elements together (Katz, 2005).

The purpose of this contribution is to examine the present state of thinking on the role of RCM and I as the main ingredients of the competitiveness of national economies; and, more particularly, of how the extent, content and quality of each are associated with the value of inward foreign direct investment (FDI) by foreign companies and the outward FDI of their own transnational corporations (TNCs). In doing so, data constraints force us to take a cross sectional approach, although, ideally, we would like to have established how the respective contributions of RCM and I may have changed over time, and at different stages of economic development. As a proxy for this, we will attempt to classify the 117 national economies (about which *GCR* provides data) into three main groups according to their GDP per head. We will also offer further breakdowns according to the economic structure and degree of openness of the economy. In particular, we shall remove some primary product-based economies from the 117 countries, as we believe that much of FDI into these economies has little to do with their overall competitiveness. Further details about our methodology of approach and data sources are set out in section 3 of this paper.

The following section sets out the theoretical justification for RCM and I as competitive influencing variables comprising the *Global Competitiveness Index* (GCI) identified by *GCR*.[5] Here, we would simply observe that although some commentators have argued that the competitiveness (as opposed to the comparative advantages) of countries is a meaningless concept (Krugman, 1994), we believe that when evaluated from the viewpoint of investing or potentially investing firms, it is by no means so.[6] TNCs, in particular, regularly compare the relative location specific (competitive) advantages of particular countries and of the indigenous firms in those countries, when deciding where to site their various value-adding activities. In this sense, firms *do* consider countries (and/or regions in countries) in terms of their ability to offer the RCMs and Is that they need to make their investments (or other forms of economic involvement) worthwhile.

[5] To quote from the 2005/6 report The Global CI aims to measure the set of institutions, policies and factors that set current and medium term levels of economic prosperity, (WEF 2005, p.22).

[6] See, for example, my riposte to Krugman (Dunning 1995)

2. Resources, capabilities and markets (RCM)

Both traditional economic theory and management related studies primarily focus their attention on the availability and quality of RCMs as the key determinant of economic welfare. The resource based theory of the firm (Wernerfelt, 1984; Barney, 1991), Michael Porter's diamond of competitive advantage (Porter, 1990) and most Western based textbooks on economics dwell almost exclusively on the *physical* environment in which firms operate[7], and on their technical efficiency in converting scarce resources into more valued goods and services, as dictated, by the market or other means. Such received wisdom has generally played down the role of the *human* environment and the intentionality of its constituents in the wealth creating process, and of its institutions, which help fashion such intentionality. Or, perhaps, it would be more accurate to describe the incentive structures assumed by neoclassical economists as being static and single dimensional, – the maximization of profits (in the case of firms), of utility (in the case of consumers) and of GDP or GDP per head of the community (in the case of governments).

Although, as we have said, in the last two or more decades, as the global economic arena has become more uncertain, volatile and complex, and as more players from widely different cultures have entered the world economic stage, the acceptance of multiple and changing intentions, and that of non-ergodic uncertainty (North, 2005) has gained scholarly credence. Most theories of competitiveness and economic well being, however, still remain firmly entrenched in the RCM tradition. Nowhere is this better illustrated than on the focus of knowledge as the competitive enhancing asset of the late twentieth and early twenty-first century.[8]

In table 1, we summarize the main components of RCM, which, it is generally agreed, firms consider when making their locational choices. Clearly the importance of these "inputs" to competitiveness will be context specific. In particular, they will vary according to the purpose of the FDI – be it inward or outward. Technology-seeking TNCs are

[7] One exception is Christine Oliver's incorporation of institutional elements into the resource based theory (Oliver, 1997).

[8] Having replaced first land, then machines, and then financial capital as the main ingredient of economic growth and competitiveness.

likely to place particular value on accessing scientific manpower and R&D facilities. Firms seeking to offshore service call centres will be most strongly influenced by labour costs, and the efficiency of cross-border communication systems. Natural resource-based assets seekers will most obviously be attracted by the availability and quality of the primary products sought. Firms which need to be in close proximity to a range of suppliers, to common inputs or to their competitors will seek out locations which favour a clustering of the related activities.

Another possible way of classifying RCM of countries (as viewed by firms) is between those owned by them and those which they may tap into, e.g. via alliances and subcontracting ventures. In their internal deployment, much will depend on the functions performed. In the case of foreign affiliates, these might vary from simple assembling to highly complex innovatory activities. This also applies to gaining access to the RCM of other firms; e.g. buying into specialized high value-adding activities (e.g. R&D) at the one end of the value chain (UNCTAD, 2005) and call centres services at the other (UNCTAD, 2004).

Finally, given the desire of companies to access or own particular RCMs, the preferred mode of entry (greenfield v merger and acquisition) might both be influenced by, and influence, their locational choice. This particularly applies in the case of asset augmenting investment, where the country specific competitiveness sought by the investing TNC may already be internalized by a domestic firm (or another foreign affiliate). In other cases, as we have already indicated, the search for complementary technologies, managerial and organizational capabilities and market opportunities, might best be accomplished by the conclusion of alliances or by participating in networks.

In our empirical study, we shall seek to classify some of the more significant RCMs identified by *GCR*, (and other sources)[9] into a number of groups, and to examine how far inbound and outbound FDI appear to be influenced by their values. In both cases, our purpose is to identify the kind of RCMs from the optimum location which will best promote the (presumed) objectives of the investing firms – and especially their own competitiveness, profitability and growth.

[9] For example, UNDP (2004) and World Bank (2004).

Table 1. Resources, capabilities and markets (the ingredients of wealth creation)

RESOURCES	• Natural resources, e.g. land, untrained labour • Created assets, e.g. technological capacity, machines, buildings.
CAPABILITIES	• Intangible assets, skills, educated/trained labour, accumulated experience and wisdom. • Organizational capacity and governance. • Vision/judgement in strategic decision taking. • Ability to frame and execute appropriate policies.
MARKETS	• Information/knowledge/availability of both domestic and foreign markets; both product and factor markets. • Ability to tap into, exploit and coordinate markets; and to understand and cater for specific (e.g. localized) needs.

Source: authors.

3. Institutions (I)

Over the last decade, there has been a burgeoning literature on the content, scope and relevance of institutions in the wealth creating activities of firms and countries. Organizational theorists, sociologists, political scientists – indeed virtually all the social science disciplines – have contributed their own perspectives and research agenda on the subject. Sometimes, the concept is very narrowly defined; for example, in terms of constraints placed on the willingness and ability of certain constituents including governments to behave improperly. Sometimes, it is treated from a purely micro economic or organizational perspective; and sometimes, from a macro-socio-economic perspective. Sometimes, it is viewed broadly as embracing each and every instrument which affects the motivation, cognition and behaviour of individuals and organizations engaged in the wealth creation process. An excellent review of these and other interpretations of institutional content is contained in Williamson (2000).

In this paper, as we are concerned with the ingredients of a country's competitiveness as viewed by investing firms, we shall embrace the broad interpretation of institutions, which, we believe, is best articulated by Douglass North in his various writings (North, 1990, 1995, 2005). It is also the one that which most international business scholars have tended to adopt (albeit with modifications).[10]

[10] See particularly Mudambi and Navarra (2002), Maitland and Nicholas (2003), Heinisz (2000), Oliver, (1997), Dunning (2005, 2006) and Dunning and Lundan (2006).

Like RCM, I comprises a galaxy of ingredients. Some of these are reproduced in table 2. The left hand column of the table sets out some different governance structures. These range from coercive and top down laws and regulations, to spontaneous and bottom up behavioural norms or customs (Dunning. 2003). In the right hand column, we identify some of the economic and social functions which, depending on their institutional content and form, might affect the cognition, motivation and behaviour of firms in their decisions on *whether* and *how* to create and efficiently utilize the RCM owned, leased or accessed by them.

Once again, the likely drawing power of such institutions to inward foreign investors, and/or their influence in determining the willingness and ability of domestic firms to engage in outward FDI is likely to be highly contextual. For example, the content and quality of domestic innovatory systems and the protection of intellectual property rights is likely to be particularly relevant for (knowledge augmenting) FDI: while fiscal incentive might tip the balance of countries seeking to attract efficiency-seeking FDI. Within a developing region, the quality and content of indigenous social capital and the extent of crime and corruption and social disfunction might be one of the decisive influences on locational choice. Institutions affecting M&A strategies and/or the performance constraints placed on foreign affiliates might also be expected to have a major influence on the ownership strategies of foreign TNCs.

Analogous to the influences exerted by RCM on the location-specific attractiveness of countries, we shall group the I variables into a number of broad categories. These are described in section 5. Our main objective is, we repeat, to identify the relative importance of these largely immobile characteristics of countries in influencing the location decisions of firms.

We would make one final point at this stage of our analysis. That concerns the distinction between the institutions and policies of national governments, and the institutions and strategies of firms. We define policies as decisions taken by governments to pursue particular courses of action to achieve certain economic, social and political objectives. We define institutions as instruments (or groups of instruments) which might both influence these actions and be influenced by them. Thus, it may be a policy decision of a government to switch its economic system, for which it is responsible, from one of central planning to that which accepts the merits of capitalism. But the (macro) institutional system which implements that new policy is the market, albeit with the

fiat of government. Similarly at the level of the firm, while strategy represents a plan or blue print for pursuing certain objectives a company sets itself, (which may or may not be influenced by its perceptions of its competitors' strategies), its institutions (and those external to the firm which affect its behaviour) represent the means by which those responsible for executing the strategy are motivated or regulated to do so in the most acceptable way.

Table 2. Institutions
(The motivation for and regulation of wealth creating activities)

A. Forms	B. Areas of institutional influence (in commercial domain)
Formal institutions • Constitutions, treaties, laws, regulations: provision for learning, upgrading cognition, knowledge, etc.	• Economic adjustment and stabilization. • Intellectual property protection • Strengthening economic motivation/entrepreneurship
Informal institutions • Tradition, cultural mores, trust, goodwill, reputation.	• Rule setting and societal guidance (e.g. reducing crime).
Enforcement mechanisms • Less formal self regulation, fear, retaliation, blackballing. • More formal. Incentives/ penalties, fines, enforced transparency, cancellation of contracts, imprisonment, etc.	• Promotion of entrepreneurship and competitive market structure. • Adequate and effective financial institutions • Education and training upgrading • Security of people and physical assets • Innovatory development • Incentives/regulation of FDI. • Social equity and access to opportunity.

4. *World Investment Report* and *World Competitiveness Report*

We have used two main sources of data in our empirical research. The first is UNCTAD's annual *World Investment Report* which provides information on both outward and inward FDI stocks and/or accumulated flows[11] for several years dating back to 1980. These data are mainly those provided by national authorities.[12] However, except in a few cases,

[11] Where FDI stocks are not available.

[12] Though the definition of FDI is broadly the same (viz. an investment of 10% by

inward FDI flows or stocks are not classified by country of origin; neither is outward FDI delineated by country of destination. All values are expressed in United States dollars and converted (usually at the end of the calendar year) at current exchange rates. Our basic propositions of this paper are fourfold.

Proposition 1: *the more pronounced the locational attractions or competitive advantages of a country are, the greater its share of the world FDI stock will be.*

Proposition 2: *the content and quality of the institutions of a country are an important influence on the extent of its inward FDI.*

Proposition 3: *the competitive advantages of firms in countries (but possibly different to those of the first kind) will be positively associated with the extent of outward FDI.*

Proposition 4: *I advantages are an important, and possibly an increasingly important, determinant of the extent of outward FDI.*

As far as the explanatory variables are concerned, the data on RCM and I, and most of their ingredients, were obtained from *GCR* (World Economic Forum, 2005). The 2005/6 version of this publication provides data on 142 separate performance indicators, 90 of which are grouped into nine pillars of competitiveness.[13] Data on these are provided for some 117 countries. Some of these indices were derived directly from national statistics (e.g. expenditure on R&D, interest rates, labour costs). Others came from the opinions of a group of some 10,993 executives from these countries[14], who were asked to rank on a Likert scale of 1-7 how far they believed in the validity of particular statements, and/or of how important they perceived a particular locational variable might be. All the data were collected or provided for the years between 2003 and 2005.

In our exercise, and taking our definitions of RCM and I, we reclassified some of the individual performance indicators to form two main groups – an RCM group comprising 72 indices, and an I group

one company in that of another, but in a different country).

[13] These pillars are respectively institutions, infrastructure, macro economy, health and primary education, higher education and training, market efficiency, labour markets and technological readiness, business sophistication and innovation. See Chapter 1.1 of World Economic Forum (2005, pp. 22–24).

[14] These countries cover 78.2% of the world's GDP between them. Details of the respondents are given in chapter 4.1 of World Economic Forum (2005).

made up of 70 indices. We further divided these two groups into three further subgroups. Market characteristics (Mc), technological capacity (T), and infrastructure and support services (Is) made up the RCM group; institutions (Ip), market efficiency (Me), and innovation Systems (In) constituted the I group.

5. The models

5.1 Inward FDI

In our empirical study, we distinguished between two alternative variants of Proposition 1[15] on the likely impact of locational competitiveness on inward FDI. The first is that such competitiveness should attract the exploitation or augmentation of the ownership specific advantages of the investing firms (i.e. by adding further value). The second is that since such competitiveness, at least partly, reflects the ownership advantages of established firms – both domestically and foreign owned, – it could be that the unique ownership advantages of foreign TNCs do not match up to those of the domestic sector, and thus there would be less FDI. Such, for example, was very much the case in the 1950s and 1960s, when there was little FDI in the United States because, among other reasons, the locational competitiveness of the country reflected the superior competitive advantages of its indigenous firms, and its institutions, *vis-à-vis* those of foreign competitors.[16]

When considering the relative locational attractions of RCM and I (and/or the individual components of each), which is the more likely to act as a deterrent in the second scenario described above? It is our proposition that, within a particular location, I is less likely to be O specific than is RCM; in other words, that the components of I (e.g. market efficiency, incentive structures and innovation systems) are likely to have a broadly similar affect on the competitive prowess of *both* foreign owned and domestic firms. Therefore, of the two, I is less likely to deter inward FDI.

[15] These alternatives propositions are: alternative 1 – locational competitiveness attracts inward FDI by adding to the O specific advantages of investing firms; alternative 2 – locational competitiveness reflects the O specific advantage of established domestic firms, and so deters inward FDI.

[16] In the language of the eclectic paradigm, if the competitiveness of RCM and I reflects the L advantages of countries rather than the O advantages of firms located in that country they will attract inward FDI. If, however, such advantages are specific indigenous firms, then they may deter (competitive) inward FDI.

Finally, we would reiterate an earlier point, viz. that other factors – notably the quality, availability and price of indigenous primary products – e.g. oil, hard minerals and agricultural goods – are less likely to be shown up in competitive indices than their counterparts in the secondary or tertiary sectors.[17] We then have two alternative hypotheses to test. The first is a generalized hypothesis which examines the significance of each host country, *relative* to all other countries of the two groups of variables. This suggests a positive relationship between the dependent and explanatory variables (see proposition 1).[18] Therefore we postulate the following relationship:

$$IFDI = f_1(RCM, I), \quad (1.1)$$

where IFDI denotes inward FDI. The second attempts to assess the significance of the components of RCM and I viz. for each country *relative* to that of all other countries (see proposition 2). Thus, we have:

$$IFDI = f_2(Mc,T,Is)\ (Ip, Me, In), \quad (1.2)$$

where Mc denotes market characteristics; T denotes technological capacity; and I_S denotes infrastructure and support services; Ip denotes extra market public and private institutions; Me denotes market efficiency; and In denotes quality of (macro) innovation systems. As already indicated, we acknowledge that these variables do not embrace *all* the possible determinants of inward FDI. Several plausible factors, such as the strategies of competing firms and the FDI policies of home governments, are excluded. We also accept that inward FDI might be deterred by the competitiveness of indigenous firms, while outward FDI of an asset augmenting kind might reflect a weakness rather of a strength of the investing firms. However, the data for those variables included are obtained from the same source, and their method of calculation is reasonably well standardized.

In testing the relationship 1.1, we have added three "other" country specific variables, not covered by the global competitiveness index, as control variables. These are: (1) population (P) to represent the size of country; (2) the proportion of exports accounted for by primary products (E_p) to represent the endowments of natural resources; and (3) the ratio

[17] In fact there are no indices of the significance of (exportable) primary produces in the GCI.

[18] Though we accept that in some circumstances and in the case of RCM the relationship could be a negative one.

between the value of privatization and inbound FDI (P_r) as a proxy for the drawing power of such schemes particularly in transition economies. We hypothesize each of these variables to be positively related to inward FDI (propositions 1 and 2). For P, we take data for 2004 from *GCR*. For E_p our data source is UNDP (2004); and for P_r we assign a dummy variable of 0–5. The full specification of equation 1.1, which again hypothesizes that each of the independent variables positively affects inward FDI, then becomes:

$$IFDI = f_3(RCM, I, P, Ep, Pr). \quad (1.3)$$

5.2 Outward FDI

The received international business literature suggests that firms will engage in outward FDI when (a) their unique competitive, or O specific, advantages make it possible for them to effectively compete with indigenous firms in the markets they are intending to serve; (b) that it is better to locate at least some of their value added activities in these markets (or elsewhere outside the home country) rather than export to the country in question and (c) that the ownership of the foreign productive facilities is preferred to selling (e.g. by licensing or other contractual means) the rights to exploit the O advantages to a foreign based firm.

More recently (since the early 1990s), an alternative explanation of outward FDI has been increasingly emphasized. In contrast to the objective of more effectively *exploiting* their existing ownership advantages (via market, natural resource and efficiency seeking FDI), some firms may wish to engage in FDI in order to *augment* their ownership advantages; and to do so by acquiring or tapping into foreign based RCM and Is. As with inward FDI, the competitiveness of home based TNCs and their countries of origin might be seen as either a strength or a weakness for going abroad.[19] Again, the question arises as to whether such FDI is likely to be of an RCM or an I kind, and whether the ownership advantages (or disadvantages) of the investing firms are common among the firms in their home country (or in the countries in which they operate) or they are specific to a particular firm or group of firms.[20]

[19] And, indeed in many cases, a combination of the two.

[20] In Alan Rugman's terminology is it likely to be countries or firm specific (Rugman, 2006)

This having been said, the content of the variables explaining outward FDI are postulated to be similar to those explaining inward FDI viz. for each home country, *relative* to all other countries competing for the same investment. So the relevant equations used to test propositions 3 and 4 set out on page 12 are:

$$\text{OFDI} = g_1(\text{RCM, I}), \tag{2.1}$$

for the generalized proposition and

$$\text{OFDI} = g_2(\text{Mc, T, Is})\ (\text{Ip, Me, In}), \tag{2.2}$$

for the components for RCM and I, where OFDI denote outward FDI. As in the case of 1.1, we also include the three control variables. Thus, the complete equation for 2.1 becomes:

$$\text{OFDI} = g_3(\text{RCM, I, P, Ep}_{,}\ \text{Pr}). \tag{2.3}$$

6. The data

We define the dependent variables in each set of equations as the ratio between a country's share of global FDI stock and its share in global gross domestic product (GDP) (as measured in dollars at the current exchange rate in 2006). We normalize for size of country as is also done for each of the independent variables. We use FDI stock (accumulated flows) figures. We believe the stock data better reflects the long term intentions of foreign investors, and their response to L specific attractions than FDI flows because over the last decade, the annual flow data have been greatly influenced by the volatility of M&As and privatization deals. For the independent and competitive related variables, we use the rankings of the 117 countries contained in *GCR*. For the control variables we extract data from World Economic Forum (2005), UNIDO (2004) and WIR (2002).

In some cases, our rankings are based on hard data, e.g. most market-based and several technology-related variables. In others, they reflect the ranking (on a scale 1–7) assigned by 10,993 business executives from the 117 countries.[21] The survey was conducted by the World Economic Forum between January and May 2005.

[21] Total country coverage in 2005 was equivalent to 98.2% of the world's gross domestic product. The response rate of business executives averaged 94.9%. Details of the way in which the Executive Opinion Survey was conducted is set out in World Economic Forum (2005), chapter 4.1, p. 213.

We divide our statistical analysis into three parts. The first presented in table 3, sets out some of descriptive statistics which relates the relationship between the average ranking of the dependent variables (viz. inward and outward FDI), for each of the 117 countries, and to those of the independent variables (RCM and I and their components). These data, we classify into 10 groups, each of which represents a different range of GDPs per capita. In the case of the explanatory variables, each is calculated as the average of the rankings assigned to their indices of competitiveness. In some cases, the assignation of a particular index to a composite index is straightforward. In others, it is based on our best judgement. In particular, we have tried to distinguish between the institutions underpinning the FDI strategy of firms and the policies of governments, and the strategies and policies themselves – and their relative success or failure.[22]

Table 3. Relationship between rankings of FDI and competitive assets in countries, classified by GDP per head (dollars)

Groups		Average GDP/Head	Range of Ranking	IFDI	OFDI	RCM				I				Global Competitiveness
						All	Is	Mc	T	All	Ip	Me	In	
1	63609 to 30062	36706	1-11	1	1	1	1	1	1	1	1	1	2	1
2	29906 to 26799	28728	12-22	3	2	2	2	2	2	2	2	2	1	2
3	25614 to 19038	21728	23-33	6	3	3	3	3	3	3	3	3	3	3
4	18817 to 11845	14463	34-45	2	4	4	4	4	4	4	4	4	4	4
5	11568 to 7901	9767	46-57	8	5	5	5	5	5	5	5	5	5	5
6	7732 to 5642	6968	58-69	9	8	6	6	6	6	6	6	8	6	6
7	5571 to 4227	4765	70-81	4	7	7	7	7	7	8	10	7	7	8
8	4072 to 2677	3437	82-93	5	9	8	8	8	8	9	9	9	8	7
9	2570 to 1728	2124	94-105	7	6	9	9	9	9	7	8	6	9	9
10	1555 to 0	1025	106-117	10	10	10	10	10	10	10	7	10	10	10

Source: World Economic Forum (2005), UNCTAD (2006) and World Bank (2006).

[22] For example, we regard some of the market related indices classified by the GCR as 'market based': to do with the size and character of markets, which we classify under RCM, while others reflect the market as an institution, which we classify under I.

The second exercise is a straightforward econometric one, and consists of investigating the propositions presented above. We earlier set out some thoughts about both of the possible directions of the relationship between FDI and the explanatory variables; and also of the relative significance of each of the two or six indices identified. Table 4 exhibits the regression equations, correlation coefficients and degrees of significance in respect of the four propositions.

Lastly, table 5 displays these equations for three groups of countries – viz. (i) lower income countries (groups 1–4 in table 3), (ii) the medium income countries (groups 5–7), and (iii) the upper income countries (groups 8–10).

7. The results

7.1 Descriptive statistics

In table 3, it can be seen that both RCM and I (as well as most of their components) correspond well to our ranking of competitiveness, viz. GDP per head, and to outward FDI. Indeed, outward FDI and market efficiency (Me) – one of the I variables – are perfectly matched. However, the correspondence between RCM and I to inward FDI is more mixed. For inward FDI, the most misaligned groups are groups 5, 6, 7 and 8. However, among these groups, we might identify several outlier countries, which may explain the irregular rankings. In group 5, for example, as column 4 shows, whereas the rankings of GDP per head for countries in this group are between 46 and 57, the ranking of inward FDI for Russian Federation is 91, for Uruguay 92, and for Botswana 104. Similarly, in group 6, while the ranking of GDP per head ranges from 58 to 69, the ranking of inward FDI for Turkey is 103 and Algeria 108. Besides, historical, cultural and political reasons that may explain these exceptions, market size seems a critical factor influencing the inward FDI.

While groups 5 and 6 have competitive indices which tend to lag inward FDI, exceptions in groups 7 and 8 suggest an opposite phenomenon. In group 7, column 4 shows whereas the ranking of GDP per head in this group is between 70 and 81, the ranking of inward FDI for Guyana, Jamaica, Morocco and Jordan are 5, 13, 31 and 36, respectively. Each of these countries displays a relatively high inward FDI compared to their GDP per head. Similarly, Azerbaijan, Nicaragua, Bolivia, Ecuador, Georgia and Honduras in group 8 reveal above average rankings in respect of their inward FDI stock compared with their GDP

per head. It can be seen that most of the exceptions in groups 7 and 8 are from Latin America and Africa. Here, we may speculate that FDI directed to resource-seeking (either natural resource or labour) activities explains most of the apparently irregular patterns.

In general, the rankings of our RCM and I variables, as well as their components, correspond relatively well to those of inward and outward FDI, and competitiveness. Therefore, we (tentatively) conclude our first proposition (set out on page 12) viz. – *the more pronounced the competitive advantages of a country, the more its share of the world inward & outward FDI stock* – is supported.

7.2 Econometric tests

The results presented in table 4 confirm proposition 3 and give some support to propositions 2 and 4; they also suggest that inward FDI is mainly market oriented (the highly significant variable Me). We also find that outward FDI is influenced by the quality of home country institutions (the highly significant I variable). In other words, the O advantages of the outward investing firms strongly reflect the institutional environment of their home country.

Table 4 reports the coefficients for the aggregate RCM and I variables, and for the breakdown of these aggregate variables into their component variables. Table 4(a) presents the complete set of results for the equations run to determine the IFDI and OFDI variables, and those relevant to Proposition 1. For ease of discussion, tables 4(b) and 4(c) group results selected from table 4(a) according to their relevance to propositions 3, 2 and 4, respectively.[23]

Relevant to Proposition 1, two of the RCM component variables in table 4(a) – viz. infrastructure and support service (Is) and technological capability (T) – are significant determinants of inward FDI (equation 1.2). However, T is found to have a significant negative effect upon inward FDI, which suggests that the competitive strengths of local firms act as a deterrent. This supports the second of our alternative versions of proposition 1, viz. locational competitiveness, at least partly, reflects the ownership advantages of established indigenous firms. This reasoning suggests that the unique O advantages of foreign TNCs are inferior within the context of the host domestic sector, thus inducing a negative

[23] In preliminary regressions it transpired that several of our variables benefited from transformation into logarithmic form.

relationship between host country strengths and inward FDI. In the same vein, when we break down the RCM variable in the outward FDI study relevant to Proposition 3, in equation 2.2 of table 4(b), the results show infrastructure and support service (Is) to be positively and significantly related to outward FDI by TNCs, which supports our third proposition that the competitive advantages of firms in home countries will be a positive determinant of outward FDI.

For propositions 2 and 4 on the role of institutional based characteristics (I), the aggregate I variable in table 4(c) shows a positive relationship with both inward FDI and outward FDI (equations 1.1 and 2.1), although this variable loses significance in equation 1.3 (for inward FDI, relevant to proposition 2) when control variables are added. In the breakdown analysis for the I variable (equations 1.2 and 2.2) market efficiency (Me) shows a strong positive correlation with both inward FDI and outward FDI. In equation 2.2, extra-market public and private institutions (Ip) has a positive effect on outward FDI at the 10% significant level. The quality of the indigenous innovation system (In) demonstrates a significant contrary negative relationship in equation 2.2 for outward FDI, which suggests further investigation is required. Collectively, the results presented in table 4(c) offer some support for propositions 2 and 4. In particular, support for Proposition 2 is given by the finding that the content and quality of the institutions of a country are an important influence on the extent of its inward FDI. For Proposition 3; the finding that I advantages are an important, and possibly an increasingly important, determinant of the extent of outward FDI. In other words, the aggregate institutional variable I, and its components, play an important role in determining both inward and outward FDI. Further results relevant to propositions 2 and 4 are presented in table 5, and are discussed in the following section. To conclude the present section we briefly discuss the control variables and report the results of a supplementary stepwise regression procedure.

Of the control variables, privatization schemes (Pr), when run with the RCM variable, appears to be significantly associated with outward FDI. The role of this variable is to control for the fact that privatization encourages the development of entrepreneurship. However, population (P) is negatively related to inward FDI, in table 4, which is controlling effectively for the fact that global FDI is predominantly directed towards the less populous industrialized countries.

Table 4. The determinants of inward and outward FDI

(a) The general and specific equations (for both IFDI and OFDI)

Models / Variables	IFDI			OFDI		
	1.1	1.2	1.3	2.1	2.2	2.3
RCM	-0.0012		0.0001	0.0115***		0.0141***
I	0.3052*		0.2347	0.3439***		0.2281*
Is		0.0102*			0.0135***	
Mc		0.0105			0.0028	
T		-0.0151*			0.0072	
Ip		-0.2665			0.2377*	
Me		0.7297***			0.3382***	
In		-0.0088			-0.0164***	
P			-0.0102***			-0.0025
Ep			-0.0013			0.0014
Pr			-0.0436			0.1258**
p-value	0.0138	<.0001	0.0001	<.0001	<.0001	<.0001
Adj R^2	0.0561	0.2749	0.1673	0.5272	0.6063	0.5537

(b) The general and specific equations. (For Proposition 3)

Models / Variables	OFDI		
	2.1	2.2	2.3
RCM	0.0115***		0.0141***
Is		0.0135***	
Mc		0.0028	
T		0.0072	
P			-0.0025
Ep			0.0014
Pr			0.1258**

(c) The general and specific equations. (For Propositions 2 and 4)

Models / Variables	IFDI			OFDI		
	1.1	1.2	1.3	2.1	2.2	2.3
I	0.3052*		0.2347	0.3439***		0.2281*
Ip		-0.2665			0.2377*	
Me		0.7297***			0.3382***	
In		-0.0088			-0.0164***	
P			-0.0102***			-0.0025
Ep			-0.0013			0.0014
Pr			-0.0436			0.1258**

Notes: * Level of significance is 0.10
** Level of significance is 0.05
*** Level of significance is 0.01

To identify those RCM and I variables that correlate most closely with FDI stocks (propositions 3 and 4), we executed a stepwise test for all variables, and examined the isolated effects of each variable (the results are presented in appendix A). The order of entry of the variables is determined by the results from SAS stepwise procedures. For inward FDI, an adjusted R^2 of 0.0718 is obtained using the aggregate I variable alone, while adding the aggregate RCM variable improves it by only 0.0006. Therefore, we conclude that the I advantages of the host countries would appear to be the major determinants of inward FDI in equations 1.1 and 1.2 in table 4. However, when including the control variables, in 1.3, we can note that population (P) becomes the key variable for inward FDI (it adds 0.1260 to equation R^2). This is not a surprising result for control variables, as their role is already established; it is to be expected that the main variables, by virtue of their experimental nature, will record less predictable results. In order of explanatory contribution, of the components of RCM and I, market efficiency (Me) is shown to have the most important positive impact, followed by Ip, T, Is, In, and Mc.

For outward FDI, RCM alone obtains an adjusted R^2 of 0.4998 in explaining outward FDI, while adding I only improves the equation's explanatory power by 0.0356. This would then suggest that RCM is the more important of the two generic variables in determining outward FDI. Among the control variables, population (P) and privatization schemes (Pr) have the strongest effect. Of the components of the main variables, the following order in terms of explanatory contribution is obtained: Ip, Is, Me, T, In, and Mc. The supplementary stepwise analysis supports the results in table 4, and our findings.

7.3 Economic development and FDI

We now turn to consider the possibility that the results so far described might be related to the stage of development of a country. To test the relationship between the stage of economic development of a country and the interaction between its competitiveness & RCM/I and FDI, we divided the 117 countries identified by the GCR into three groups, based on their GDP per head, with Group 1 being the lowest income group (for details, see Appendix B). The results are set out in table 5. In the third (high income) group, which includes all the richest countries around the world, RCM is significantly correlated with outward FDI, and supports Proposition 3 (see table 5 (b)). But contrary to expectations, the variable I in this group is not significant in determining inward FDI and outward FDI (see table 5 (c)); indeed it appears to be

negatively associated with both inward FDI (when run in conjunction with the control variables) and outward FDI. Again we can invoke the deterrent effects of strong firms within advanced host economies to explain the negative relationship between I and inward FDI. To account for the negative relation between I and outward FDI it is possible to argue that a reduced incentive to invest abroad might apply when the institutional environment at home is superior to foreign locations. We should also bear in mind that a large proportion the inward and outward FDI associated with advanced economies results from intra-Triad M&As; and these are primarily explained by firm- or industry-specific variables not captured in our research design. For income groups 2 and 3, neither RCM nor I are significantly related to inward FDI in the first two stages. The fact that the adjusted R^2 of most equations are low is an indication that the use of aggregate variables, while intended to capture determinants that are general to all countries, may suffer from theoretical limitations. In other words, the approach is still too much influenced by the experience of the highest income countries of the world.

The incorporation of the component variables provides deeper insights into relationships between FDI and level of development. For inward FDI, at low development levels, extra market public and private institutions (Ip) and technological capacity (T) are positively and significantly related to inward FDI, while T has a negative coefficient. In middle development group, Ip records a significant negative relationship with inward FDI, while market efficiency (Me) becomes the most important positive determinant of inward FDI. In the third (high income) group, along with the similar effects of Ip and Me to those in group 2, infrastructure and support services (Is) become one of the major elements effecting inward FDI. This is clearly one of the most important locational attractions of developed countries.

We should note that, for the component study of outward FDI, only equation 4.2 for the high income group of countries achieves an adequate R^2. Here, infrastructure and support services (Is) and market efficiency (Me) of such countries are found to be positive and significant, while the coefficient of the quality of the home country's innovation system (In) is negative. Additionally, the coefficients of the variable In in each of the outward FDI equations, as well as in the last two groups of the inward FDI equations, are negative. This may suggest the existence, or legacy from, some form of techno-nationalism associated with economic development for some countries.

Therefore, from the above analysis in table 5, we can conclude that there is some support for our propositions 2 and 4. With the level of economic development, aggregate variables RCM and I display an increasing importance for inward FDI and outward FDI, although this is less apparent for inward FDI. Some of the components of RCM (especially Is) and I (especially Me) individually reveal a stronger relationship with inward FDI and outward FDI as the level of development rises.

For the control variables, population (P) once again manifests a strong influence on inward FDI in all three groups. As we expected, the proportion of exports accounted FDI by a country (Ep) is positively related to inward FDI in the first two groups and achieves 10% significant level in the second group, whereas it turns to be negatively related to inward FDI in the third group comprising the advanced economies. In other words, at least some inward FDI to primary producing, or developing economies are resource-seeking kinds of investments, corresponding to our earlier conjecture that firms seeking natural resources will be most be attracted by the availability and quality of the relevant primary products.

Finally, we looked at the key variables identified in the stepwise study, which provided further information of determinants of inward and outward FDI under different development stages. Shifts in the determinants of inward FDI is demonstrated by the coefficients and the significance levels of variables. This follows an order, from Ip in the low income group, to Me in the more developed levels (the second and third groups). As Ip and Me are both institutional variables, this progression corresponds with the results in table 4 and supports our Proposition 2. Furthermore, for outward FDI, RCM component (Is) and I component (Me) become significant in the third group, which not only demonstrates a balancing of the determinants among RCM and I factors, but also indicates the increasingly important role played by institutional advantages in determining outward FDI, along with the economic development of countries (as suggested by Proposition 4).

Table 5. The determinants of inward and outward FDI, grouped by stage of development

(a) As related to GDP per head (for both IFDI and OFDI)							
Variables \ Models		IFDI			OFDI		
		3.1	3.2	3.3	4.1	4.2	4.3
Group 1	RCM	-0.0084		-0.0082	0.0016		0.0016
	I	0.4655		0.7249	0.0976		0.0834
	Is		0.0049			-0.0019	
	Mc		0.0117			0.0048	
	T		-0.0322***			0.0012	
	Ip		1.0216*			0.2238	
	Me		-0.0003			0.0147	
	In		0.0004			-0.0047	
	P			-0.0094***			0.0003
	Ep			0.0001			0.0016
	Pr			-0.1800*			-0.0556
	p-value	0.5696	0.0765	0.0289	0.3907	0.5474	0.4290
	Adj R^2	-0.0159	0.1028	0.1367	-0.0016	-0.0181	-0.0002
Group 2	RCM	0.0008		0.0092	0.0016		0.0106
	I	0.1938		0.1757	0.2850		0.1926
	Is		0.0152			0.0019	
	Mc		-0.0129			0.0013	
	T		0.0186			0.0077	
	Ip		-1.241**			0.1750	
	Me		1.4343***			0.1869	
	In		-0.0191			-0.0109	
	P			-0.0094**			0.0008
	Ep			0.0109*			0.0095**
	Pr			0.0108			0.1473**
	p-value	0.7379	0.0060	0.0617	0.2404	0.6149	0.0050
	Adj R^2	-0.0468	0.3686	0.1877	0.0311	-0.0507	0.3534
Group 3	RCM	0.0284		0.0275	0.0441**		0.0546**
	I	0.1107		-0.0881	-0.0520		-0.2324
	Is		0.0800**			0.0862***	
	Mc		0.0225			0.0162	
	T		-0.0250			-0.0107	
	Ip		-0.5619*			-0.1142	
	Me		0.9516***			0.5280**	
	In		-0.0329			-0.0426*	
	P			-0.0235***			-0.0132**
	Ep			-0.0206**			-0.0061
	Pr			-0.0735			0.1037
	p-value	0.2180	0.0015	0.0169	0.0164	0.0005	0.0183
	Adj R^2	0.0422	0.4826	0.3089	0.2151	0.5394	0.3032

Notes: * Level of significance is 0.10
** Level of significance is 0.05
*** Level of significance is 0.01

Table 5. The determinants of inward and outward FDI, grouped by stage of development (continued)

b) As related to GDP per head. (for Proposition 3)

	Models / Variables	IFDI			OFDI		
		3.1	3.2	3.3	4.1	4.2	4.3
Group 1	RCM	-0.0084		-0.0082	0.0016		0.0016
	Is		0.0049			-0.0019	
	Mc		0.0117			0.0048	
	T		-0.0322***			0.0012	
	P			-0.0094***			0.0003
	Ep			0.0001			0.0016
	Pr			-0.1800*			-0.0556
Group 2	RCM	0.0008		0.0092	0.0016		0.0106
	Is		0.0152			0.0019	
	Mc		-0.0129			0.0013	
	T		0.0186			0.0077	
	P			-0.0094**			0.0008
	Ep			0.0109*			0.0095**
	Pr			0.0108			0.1473**
Group 3	RCM	0.0284		0.0275	0.0441**		0.0546**
	Is		0.0800**			0.0862***	
	Mc		0.0225			0.0162	
	T		-0.0250			-0.0107	
	P			-0.0235***			-0.0132**
	Ep			-0.0206**			-0.0061
	Pr			-0.0735			0.1037

(c) As related to GDP per head. (for Propositions 2 and 4)

	Models / Variables	IFDI			OFDI		
		3.1	3.2	3.3	4.1	4.2	4.3
Group 1	I	0.4655		0.7249	0.0976		0.0834
	Ip		1.0216*			0.2238	
	Me		-0.0003			0.0147	
	In		0.0004			-0.0047	
	P			-0.0094***			0.0003
	Ep			0.0001			0.0016
	Pr			-0.1800*			-0.0556
Group 2	I	0.1938		0.1757	0.2850		0.1926
	Ip		-1.241**			0.1750	
	Me		1.4343***			0.1869	
	In		-0.0191			-0.0109	
	P			-0.0094**			0.0008
	Ep			0.0109*			0.0095**
	Pr			0.0108			0.1473**
Group 3	I	0.1107		-0.0881	-0.0520		-0.2324
	Ip		-0.5619*			-0.1142	
	Me		0.9516***			0.5280**	
	In		-0.0329			-0.0426*	
	P			-0.0235***			-0.0132**
	Ep			-0.0206**			-0.0061
	Pr			-0.0735			0.1037

Notes: * Level of significance is 0.10
** Level of significance is 0.05
*** Level of significance is 0.01

8. Conclusions

This paper has investigated the relationship between inward and outward FDI and the locational competitive advantages of some 117 countries. In doing so, it has made use of data for 2005 (or the nearest date) primarily obtained from UNCTAD (2006) and World Economic Forum (2005). We fully recognize the limitations of our data; neither would we presume to have established any causal relationships between FDI and host or home country competitiveness. To do this, we would need to relate FDI in time t to competitiveness in an earlier time period t–1,…n, or to undertake a time series exercise. Unfortunately the GCR data, although quite comprehensive for 2003/5, do not allow us to do this.

The best we can do then is to indicate whether the relationships established are at least consistent with the analytical framework set out in section 3 of the paper. In general, we think this framework is a robust and useful one. The level of competitiveness does, in general, encourage both inward and outward direct investment, though there are some exceptions to this general statement – especially with respect to asset-augmenting FDI. This it not to deny or minimize the considerable data problems relating to the definition and interpretation of both FDI and the explanatory variables. In particular, it is difficult to isolate the impact of the locational attractions of countries that are available to indigenous firms and foreign investors on an equal basis, and those which are largely "internalized" – i.e. primarily taken advantage of by indigenous firms – to separate the competitiveness of related variables from the other determinants of inward and outward FDI. A third challenge is to distinguish between the ways in which asset-augmenting and asset-exploiting FDI respond to different kinds of country specific competitiveness.

But, at the very least, we hope this contribution takes the debate on competitiveness and FDI – a topic so dear to Sanjaya's heart – a stage further.

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Appendix A: Stepwise test

Model / Variables	IFDI 1	2	3	4	5	6	7	8	9	10	11	Corr
I	0.2680***	0.3052*	0.2034	0.2326	0.2347							0.1
RCM		-0.0012	0.0012	0.0007	0.0001							0.0
P			-0.0099***	-0.0101***	-0.0102***							0.1
Pr				-0.0455	-0.0436							0.0
Ep					-0.0013							-0.0
Me						0.4375***	0.7577***	0.7566***	0.6972***	0.7405***	0.7297***	0.2
Ip							-0.4017***	-0.4029***	-0.2311	-0.2969*	-0.2665	0.1
Mc								0.0001	0.0127**	0.0101	0.0105	0.0
T									-0.0163**	-0.0212***	-0.0151*	0.0
Is										0.0087	0.0102*	0.0
In											-0.0088	0.0
p-value	0.0035	0.0138	<.0001	<.0001	0.0001	0.0367	<.0001	<.0001	<.0001	<.0001	<.0001	
R^2	0.0718	0.0724	0.1984	0.2014	0.2007	0.1914	0.2502	0.2502	0.2904	0.3045	0.3124	

Model / Variables	OFDI 1	2	3	4	5	6	7	8	9	10	11	Corr
RCM	0.0194***	0.0115***	0.0130***	0.0135***	0.0141***							0.5
I		0.3439***	0.2510**	0.2305*	0.2281*							0.0
Pr			0.1367***	0.1279**	0.1258**							0.0
P				-0.0026	-0.0025							0.0
Ep					0.0014							0.0
Ip						0.7040***	0.3918***	0.3325**	0.2289*	0.2248*	0.2377*	0.5
Me							0.3917***	0.3795***	0.3892***	0.3622***	0.3382***	0.1
In								0.0023	-0.0105**	-0.0162***	-0.0164***	0.0
Is									0.0164***	0.0142***	0.0135***	0.1
T										0.0088	0.0072	0.0
Mc											0.0028	0.0
p-value	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	
R^2	0.4998	0.5354	0.5621	0.5707	0.5730	0.5001	0.5565	0.5590	0.6183	0.6255	0.6267	

Notes: * Level of significance is 0.10

** Level of significance is 0.05

*** Level of significance is 0.01

Appendix B. Country Groups Based on Income Level

	Country		Country		Country
Group 1	Albania	Group 2	Argentina	Group 3	Australia
	Algeria		Bahrain		Austria
	Armenia		Botswana		Belgium
	Azerbaijan		Brazil		Canada
	Bangladesh		Bulgaria		Cyprus
	Benin		Chile		Denmark
	Bolivia		Costa Rica		Finland
	Bosnia and Herzegovina		Croatia		France
	Cambodia		Czech Republic		Germany
	Cameroon		Estonia		Greece
	Chad		Hungary		Hong Kong SAR
	China		Jamaica		Iceland
	Colombia		Korea, Rep		Ireland
	Dominican Republic		Latvia		Israel
	East Timor		Lithuania		Italy
	Ecuador		Malaysia		Japan
	Egypt		Malta		Kuwait
	El Salvador		Mauritius		Luxembourg
	Ethiopia		Mexico		Netherlands
	Gambia		Panama		New Zealand
	Georgia		Poland		Norway
	Ghana		Portugal		Qatar
	Guatemala		Romania		Singapore
	Guyana		Russian Federation		Spain
	Honduras		Slovak Republic		Sweden
	India		Slovenia		Switzerland
	Indonesia		South Africa		United Arab Emirates
	Jordan		Taiwan		United Kingdom
	Kazakhstan		Trinidad and Tobago		United States
	Kenya		Turkey		
	Kyrgyz Republic		Uruguay		
	Macedonia, FYR		Venezuela		
	Madagascar				
	Malawi				
	Mali				
	Moldova				
	Mongolia				
	Morocco				
	Mozambique				
	Namibia				
	Nicaragua				
	Nigeria				
	Pakistan				
	Paraguay				
	Peru				
	Philippines				
	Serbia and Montenegro				
	Sri Lanka				
	Tajikistan				
	Tanzania				
	Thailand				
	Tunisia				
	Uganda				
	Ukraine				
	Vietnam				
	Zimbabwe				

Appendix C
(i) Country Groups Based on Openness

	Country		Country		Country		Country
Group 1	Albania	Group 2	Azerbaijan	Group 3	Armenia	Group 4	Argentina
	Algeria		Bangladesh		Austria		Bulgaria
	Australia		Belgium		Benin		Cambodia
	Bahrain		Brazil		Bolivia		Cameroon
	Bosnia and Herzegovina		Chad		Botswana		Denmark
	Canada		Colombia		Chile		Egypt
	China		Czech Republic		Costa Rica		Guatemala
	Dominican Republic		Ethiopia		Croatia		Honduras
	East Timor		Finland		Cyprus		Hungary
	Estonia		Germany		Ecuador		Iceland
	Gambia		Ghana		El Salvador		India
	Ireland		Greece		France		Indonesia
	Italy		Japan		Georgia		Jordan
	Jamaica		Luxembourg		Guyana		Korea, Rep
	Kazakhstan		Macedonia, FYR		Hong Kong SAR		Kuwait
	Latvia		Malawi		Israel		Kyrgyz Republic
	Mauritius		Moldova		Kenya		Lithuania
	Paraguay		Mozambique		Malta		Madagascar
	Philippines		New Zealand		Mongolia		Malaysia
	Qatar		Nigeria		Morocco		Mali
	Serbia and Montenegro		Pakistan		Namibia		Mexico
	Slovak Republic		Panama		Nicaragua		Netherlands
	Slovenia		Portugal		Norway		Peru
	Sri Lanka		South Africa		Poland		Romania
	Switzerland		Spain		Taiwan		Russian Federation
	Trinidad and Tobago		Tunisia		Tanzania		Singapore
	Ukraine		United Arab Emirates		Thailand		Sweden
	Uruguay		United Kingdom		Turkey		Tajikistan
	Venezuela		Vietnam		Uganda		United States
							Zimbabwe

Appendix C

ii) Econometric Test for Country Groups Based on Openness

Variables \ Models		IFDI			OFDI		
		5.1	5.2	5.3	6.1	6.2	6.3
Group 1	RCM	-0.0180*		-0.0116	-0.0019		0.0016
	I	1.0157**		0.7793*	0.8475***		0.7014**
	Is		-0.0280**			0.0023	
	Mc		-0.0111			-0.0058	
	T		0.0118			0.0263**	
	Ip		-0.3425			0.4633	
	Me		1.2308***			0.3626	
	In		0.0112			-0.0226**	
	P			-0.0094**			0.0004
	Ep			0.0015			0.00001
	Pr			0.0022			0.1389*
	p-value	0.0189	0.0012	0.0266	<.0001	<.0001	<.0001
	Adj R^2	0.2063	0.4960	0.2760	0.6225	0.6555	0.6312
Group 2	RCM	0.0086		0.0058	0.0187***		0.0198***
	I	-0.2049		-0.1747	0.0015		-0.0738
	Is		0.0219			0.0171	
	Mc		0.0427**			0.0193	
	T		-0.0561**			0.0141	
	Ip		-0.2266			0.1405	
	Me		0.1284			0.0913	
	In		0.0004			-0.0367**	
	P			-0.0163***			-0.0067
	Ep			-0.0044			0.0024
	Pr			-0.2375			0.0838
	p-value	0.6099	0.0992	0.0578	0.0004	0.0012	0.0029
	Adj R^2	-0.0367	0.1860	0.2145	0.4099	0.4977	0.4196
Group 3	RCM	-0.0040		-0.0042	-0.0035		0.0017
	I	0.3187		0.3317	1.4004***		1.2470**
	Is		0.0206**			0.0168**	
	Mc		0.0127			-0.0191**	
	T		-0.0407**			-0.0059	
	Ip		-0.6361**			0.5033**	
	Me		1.2483***			0.9939***	
	In		-0.0022			0.0052	
	P			-0.0094			-0.0046
	Ep			-0.0015			0.0038
	Pr			0.0682			0.1491
	p-value	0.8763	<.0001	0.7224	<.0001	<.0001	<.0001
	Adj R^2	-0.0660	0.6223	-0.0832	0.6173	0.8419	0.6286
Group 4	RCM	-0.0026		-0.0021	0.0055		0.0069
	I	0.4516**		0.3880	0.4295**		0.3857*
	Is		0.0185*			0.0154*	
	Mc		-0.0021			-0.0018	
	T		-0.0121			-0.0013	
	Ip		-0.0688			0.4324*	
	Me		0.6883**			0.2240	
	In		-0.0100			-0.0113	
	P			-0.0074			-0.0007
	Ep			-0.0067			0.0019
	Pr			-0.1220			0.0498
	p-value	0.0039	0.0159	0.0078	<.0001	<.0001	<.0001
	Adj R^2	0.2880	0.3277	0.3483	0.6092	0.6424	0.5725

Notes: * Level of significance is 0.10
** Level of significance is 0.05
*** Level of significance is 0.01

Asia's "upgrading through innovation" strategies and global innovation networks: an extension of Sanjaya Lall's research agenda

Dieter Ernst *

This paper demonstrates that the late Professor Sanjaya Lall's framework for analysing Asian pathways to development remains valid today. This is done by extending the framework to apply in circumstances where globalization of markets has moved beyonds goods and finance to technology and knowledge workers. The concept of "industrial upgrading" is used to identify conditions under which Asian countries could reap the benefits of innovation offshoring. The analysis shows that Lall was right to emphasize a divergence between the private interests of the TNCs and the social interests of the host economy in terms of long-term technology development. His plea for industrial policy is even more relevant today, since the stakes and risks have become much greater, as countries seek to move beyond the "global factory" model to "upgrading through innovation" strategies.

Keywords: innovation, industrial upgrading, global innovation networks, global production networks, learning, innovation policies, capabilities, TNCs, Asian development strategies

1. Introduction

I first met Sanjaya Lall in the late 1970s, when we were both consultants for Surendra J. Patel's Technology Division at UNCTAD. Since then, his writings have had a lasting impact on my research.

This essay is a very personal homage to Lall's work on technological change and industrialization, in particular his pioneering study on technological capabilities, prepared for the OECD Development Centre (Lall, 1990). I will not seek to add yet another review of Lall's work. Instead, I will sketch a roadmap for extending Lall's research agenda to explore the challenges resulting from the rise of global innovation networks (GIN) for Asian attempts to upgrade its industries through innovation. I will demonstrate that Lall's framework remains valid as globalization now extends beyond markets for goods and

* Dieter Ernst is a Senior Fellow at the East-West Center, Honolulu, Hawaii. Contact: ernstd@EastWestCenter.org

finance to include markets for technology and knowledge workers[1]. As a result of such transformations, Asia's integration into global production networks is now complemented by its integration into GINs, which adds a new dimension to the research agenda pursued by Lall. If not mentioned otherwise, the evidence used to support my arguments in this paper draws on a unique data base of GINs for a sample of now almost 150 companies in the information and communications technology industry (Ernst, 2008b).[2]

In the next section of this essay, I will introduce what I consider to be the essence of Lall's work, summarized in five propositions. In the rest of the paper, I will use these propositions to study the link between "upgrading through innovation" strategies and GINs. In section 3, I introduce a conceptual framework to examine how specialization, learning and innovation enhance the potential for industrial upgrading. Section 4 addresses the international dimension of industrial upgrading, and discusses the characteristics and drivers of GINs and explore implications for learning and knowledge diffusion. Section 5 presents policy suggestions.

2. Important lessons from Lall's research

For me, a defining characteristic of Lall's work is his assertion that industrialization in Asia has been shaped by the interplay of *global* forces (embodied in international trade and investment flows) and *local* strategies (pursued by host country firms and governments).

Specifically, Lall's research taught me the following important lessons. First, integration into the global economy and foreign direct investment (FDI) can act as important catalysts for change, but there is likely to be a "divergence between the private interests of the multinational company and the social interests of the host economy in terms of long-term technology development" (Lall and Urata, 2003, p. 4). Policies need to be based on a thorough understanding of these

[1] The term "knowledge workers" is defined to include science and engineering personnel, as well as managers and specialized professionals (in areas like marketing, legal services and industrial design) that provide essential support services to research, development and engineering.

[2] The sample includes large global brand leaders from Asia, Europe and North America, as well as specialized suppliers of technology, core components and product development services. We have also collected information on mini-GINs for small trans-Pacific start-up companies of foreign-born engineers from China, India and Taiwan Province of China that are headquartered in Silicon Valley.

divergent interests, and they need to adjust to changes in the strategies of transnational corporations (TNCs).

Second, liberalization of trade and investment should not be equalized with the retreat of the state: "[a] consideration of the technology development process at the micro-level provides a strong and valid economic case for industrial policy, and the East Asian case provides the empirical backing" (Lall, 2000, pp. 13, 14).

Third, as a country becomes more exposed to globalization, this increases the importance of local capabilities and innovation, because "technical efficiency in each location becomes the final determinant of success (Lall, 2003, p.46). The more a country depends on exports and financial markets, the more it is vulnerable to boom-and-bust cycles of global product and financial markets. To cope with this challenge, both firms and governments need to develop sophisticated management approaches and policies. Lall was one of the first to argue that the more a country moved up the industrial ladder, the more important advanced capabilities and innovation became. Specifically, Lall emphasized that while FDI could facilitate the development of basic operational capabilities required for the production and use of foreign technology, they might be "less efficient means of deepening capabilities, particularly into design and innovation" (Lall, 2003, p. 13).

Fourth, the key to success is generating a virtuous circle of building institutions and firm-level capabilities. Lall highlighted the following requirements for successful industrial upgrading: "skill development, industrial specialization, enterprise learning and institutional change are needed to create *cumulative* and *self-reinforcing processes* to promote further learning" (ibid, p. 47).

Fifth, Lall's writings consistently emphasize that host countries strategies to foster industrial upgrading need to be context-specific and are hence likely to differ from country to country. Lall's extensive research on Asian industrial policies showed that different policies were "successful in its own way in boosting export competitiveness, though each faces different… (risks and)… strategic challenges" (Lall, 2003, p. 4). There are no "one best way" solutions. Instead, policies and strategies need to be continuously adjusted to the vagaries of business cycles and, even more importantly, to the structural transformations of markets and technology.

Asia's rise as the global factory provides a fascinating example for Lall's proposition that industrialization in this region has been shaped

by the interplay of *global* forces and *local* strategies. But this framework can also be used to analyze how integration into GINs affects Asia's "upgrading through innovation" strategies.

3. Conceptual framework

3.1 Industrial upgrading

The concept of "industrial upgrading" can serve as a focusing device for Asia's attempts to move beyond the "global factory" model and to unlock new sources of economic growth. The main objective is to exploit the productivity-enhancing potential of innovation in order to avoid a "race to the bottom" that is driven solely by cost competition. Hence, in general terms, industrial upgrading must focus on improvements in specialization, local value-added, productivity and linkages, all of which necessitate a broad base of knowledge and innovation (Ernst and Lundvall, 2004).

I distinguish two aspects of industrial upgrading that are of greatest policy relevance: "firm-level upgrading" from low to higher end products and value chain stages, and "industry-level linkages" with support industries, universities and research institutes.[3] Firm-level upgrading is the key dimension – Asian firms must develop the capabilities, tools and business models that will allow them to cope with the new challenges from integration into GINs.

But for firm-level upgrading to succeed, upgrading must take place simultaneously with the formation of "industry linkages". As

[3] Three other forms of "industrial upgrading" discussed in the literature are: (i) inter-industry upgrading from low value-added industries (e.g. light industries) to higher value-added industries (e.g. heavy and higher-tech industries); (ii) inter-factor upgrading from endowed assets (i.e. natural resources and unskilled labour) to created assets (physical capital, skilled labour, social capital); and (iii) upgrading of demand within a hierarchy of consumption, from necessities to conveniences to luxury goods. See Ozawa (2000) for discussion of upgrading taxonomies. Most research has focused on a combination of the first two forms of industrial upgrading, based on a distinction between low-wage, low-skill "sun-set" industries and high-wage, high-skill "sunrise" industries. Such simple dichotomies, however, have failed to produce convincing empirical results for two reasons (Ernst, 2001b). First, there are low-wage, low-skill value stages in even the most high-tech industry, and high-wage, high-skill activities exist even in so-called traditional industries like textiles. Second, both the capability requirements and the boundaries of a particular "industry" keep changing over time. An example is the transformation of the personal computer industry from an R&D-intensive high tech industry to a "commodity" where success depends on the optimization of supply chain management.

Powell and Grodal observed, "collaboration across multiple boundaries and institutional forms" is the norm today, and innovation networks "are now core components of corporate strategy" (Powell and Grodal, 2004, pp. 57, 58). This reflects the growing geographic mobility of knowledge (Ernst, 2003) and the emergence of information technology (IT)-enabled governance mechanisms to coordinate dispersed knowledge units (Ernst, 2005c).

To broaden the pool of firms that are capable of sustained firm-level upgrading, strong support industries and linkages with universities and research institutes are required. The challenge is to enable firm-level upgrading and industry-level linkage formation to interact in a mutually reinforcing way so as to create a "virtuous circle".

Asia's industrial upgrading efforts also face a second challenge. As its companies are integrated into multiple global networks of corporate production and innovation and informal knowledge communities, it is obvious that international linkages are critical for industrial upgrading. Hence, we need to distinguish the domestic (local) and international (global) elements.

Finding the right balance between firm-level upgrading and industry-level linkage formation, and between domestic and international aspects poses a continuous challenge for policy makers and corporate planners. The "right balance" is a moving target, it is context-specific and requires continual adjustments to changes in markets and technology. I argue that all four elements support each other; a strategy that neglects one element at the detriment of the others is unlikely to create sustainable gains. The stronger the links between those four elements and the better they interact, the greater are the chances that Asian firms shape markets, prices and technology road maps.

The international dimension of industrial upgrading will be addressed in section 4. Our focus in this section is on the domestic elements. I first explore how learning and innovation support one another. I will then turn to the role of specialization in products and types of production.

3.2 Learning and innovation

A fundamental insight of innovation theory is that learning and innovation are "the two faces of R&D" (Cohen and Levinthal, 1989, p. 569). Learning-by-doing establishes the routines – "the firm becomes more practiced, and, hence, more efficient, at doing what it

is already doing"(ibid, p. 570). But a firm's growth depends on the firm's capacity to engage in a second type of learning, namely acquiring external knowledge "that will permit it to do something quite different" ("absorptive capacity").

For effective knowledge conversion to productive learning, two important elements are required: an existing knowledge base or competence and the intensity of effort or commitment (Ernst and Kim, 2002, p. 1425). In fact, a critical prerequisite for absorptive capacity is that a firm conducts in-house basic research. This is in contrast with the current fashion of "open innovation" (e.g. Chesbrough, 2003), which downplays the importance of a decline in corporate basic research. Cohen and Levinthal argued that that a firm needed to sustain a critical mass of internal basic research, "to be able to identify and exploit potentially useful scientific and technological knowledge generated by universities or government laboratories, and thereby gain a first-mover advantage in exploiting new technologies" (Cohen and Levinthal, 1989, p. 593). The same reasoning applies with regard to benefiting from spillovers from competitors' innovation.

What exactly then is innovation? Schumpeter's distinction between invention and innovation and his focus on "new combinations of existing resources" are a good starting-point. To capture the essence of innovation, I suggest a broad definition: innovation converts ideas, inventions and discoveries into "new combinations of existing resources" that lead to new products, services, processes and business models. It is important to emphasize that innovation is more than research and product development; users must perceive an advantage worth paying for the innovation. It is also worth emphasizing that "entrepreneurs" are not limited to just the founders of internet start-ups, but they vary in terms of size, business model and organization of their operations.

Innovations differ with regard to opportunities and barriers to learning. They also differ in the capabilities required from the firms. Four types of innovations may be distinguished: *incremental, modular, architectural* and *radical* innovations (Ernst, 2008a, drawing on Henderson and Clark, 1990).

(i) Incremental innovations

"Incremental" innovations adopt existing component designs and architectures, but improve on cost, time-to-market and performance. Their purpose is to exploit as much as possible the potential of a given

"design", by introducing relatively minor changes to an existing product or process (Nelson and Winter, 1982). These innovations do not require substantial input from science, but they do require considerable skill, especially "soft" entrepreneurial and management capabilities, as defined in Ernst (2007a).[4]

(ii) Modular innovations

"Modular" innovations introduce a new component technology and plug it into fundamentally unchanged system architecture.[5] They have been made possible by the division of labour in product development: "[m]odularity is a particular design structure, in which parameters and tasks are interdependent within units (modules) and independent across them" (Baldwin and Clark, 2000, p. 88). One consequence of modularization has been the fragmentation of the innovation value chain as well as its dispersion across firm and geographic boundaries, giving rise to "innovation offshoring" through GINs (Ernst, 2006a).

It is important to emphasize that, although modularity has created opportunities for industrial latecomers, the barriers to successfully undertaking modular innovations are substantial. High technological complexity requires top scientists and experienced engineers in different fields. In addition, investment requirements can be very substantial (e.g. up to $4.5 billion for a state-of-the-art semiconductor fabrication plant), as are risks of failure.

(iii) Architectural innovations

"Architectural" innovations are "innovations that change the architecture of a product without changing its components" (Henderson

[4] Examples of incremental innovations are improvements in the organization of manufacturing, distribution and support services, like Dell's "direct sales" model and its integration of factory automation and supply chain management. Other examples are new approaches to subcontracting arrangements, pioneered especially by IT firms from the Taiwan Province of China, like original design manufacturing (ODM), foundry services (for integrated circuit fabrication) and design implementation services. Incremental innovations may also involve continuous improvements in industrial design that help attract the attention of customers and that enhance the user-friendliness of a product and its performance.

[5] This type of innovation has been a defining characteristic of the PC industry - within each generation of the Wintel architecture (combining Microsoft's Windows operating system and Intel's processor architecture), specialized suppliers have introduced new component technology, for instance for memory, storage and display devices.

and Clark, 1990, p. 9). They use existing component technologies but change the way they work together. Architectural innovations tend to have far-reaching implications for market shares and profitability of innovating firms. As highlighted by Henderson and Clark (1990, p. 9), architectural innovations can threaten incumbent market leaders – they "destroy the usefulness of the architectural knowledge of established firms, and since architectural knowledge tends to become embedded in the structure and information-processing procedures of established organizations, this destruction is difficult for firms to recognize and hard to correct".[6]

(iv) Radical innovations

Finally, "radical" innovations involve both new component technology and changes in architectural design. They require breakthroughs in both architectural and component technology.[7] Radical innovations require profuse interaction with leading-edge science – top scientists and engineers are needed who work at the frontier of basic and applied research in a broad range of disciplines. In addition, to implement radical innovations requires a broad set of complementary assets (as defined by Teece, 1986**)** and investment thresholds tend to be high.

In short, such innovations are costly and risky, and failure can destroy even large companies. They are beyond the reach of most companies in Asia (outside of Japan and the Republic of Korea), although they may be undertaken by public-private consortia coordinated by the government.

3.3 Innovative capabilities

To determine what kind of capabilities are required to foster innovation, we can draw on the growing literature that has followed Lall's pioneering study on technological capabilities (Lall, 1990). Particularly useful for our purposes are studies that have developed operational data sets for measuring firm-level innovatory and R&D capabilities, based on questionnaire surveys and structured firm interviews (e.g. Ernst and O'Connor, 1992; Hobday, 1995; Ernst, Mytelka and Ganiatsos, 1998; Jefferson and Kaifeng, 2004; Ernst, 2005d).

[6] Henderson and Clark (1990) use the decline of Xerox and RCA to illustrative the destructive power of architectural innovations.

[7] Examples include the discovery of new drugs, or the invention of the Internet.

Building on this literature, I propose to use a broad definition of "innovative capabilities" to emphasize that, in addition to R&D capabilities, complementary "soft" entrepreneurial, management and system integration capabilities are of critical importance. I define "innovative capabilities" to include the skills, knowledge and management techniques needed to create, change, improve and commercialize successfully "artefacts", such as products, services, equipment, processes and business models (Ernst, 2007a).

Innovations require R&D capabilities, especially in high-tech industries. Yet, research on successful IT innovations demonstrates that technology is the easy part to change. The difficulty is in social, organizational and cultural aspects. In order to create products and services that customers are willing to pay for, the following "soft" innovative capabilities are critical:

- to sense and respond to market trends before others ("entrepreneurship");
- to recruit and retain educated and experienced knowledge workers who are carriers of new ideas;
- to search globally for core components, reference designs, tools, inventions and discoveries;
- to raise finance required to bring an idea quickly to the market;
- to deliver unique and user-friendly industrial designs;
- to develop and adjust innovation process management (methodologies, organization and routines) in order to improve efficiency and time-to-market;
- to manage knowledge exchange within multidisciplinary and cross-cultural innovation projects;
- to participate in and shape global standard-setting;
- to combine protection and development of intellectual property rights; and
- to develop credible and sustainable branding strategies.

3.4 Specialization and upgrading potential

Specialization is an important indicator of the degree of industrial upgrading that a country or region can realistically expect to achieve. Specialization patterns reflect differences in product mix

(e.g. homogeneous versus differentiated products) and in the type of production, i.e. "routine" and "complex" production.[8] These differences in specialization, in turn, give rise to divergence in the complexity of technology, demand patterns and market structures. Most importantly, differences in specialization shape a country's (a region's) upgrading potential, in terms of learning opportunities, capability requirements, value-added and linkages.

A critical policy issue is how to identify conditions under which specialization and upgrading potential are linked by a *virtuous circle*. In fact, a narrow specialization on homogenous products or on "modular" production may well make sense at an earlier stage of development. Yet, this very same specialization may later on hinder a transition to differentiated products or "integrated" production.

(i) Product specialization

Homogenous products ("commodities") have only a limited upgrading potential, in terms of learning opportunities, capability requirements, value-added and linkages. The opposite is true for differentiated products.

For our purposes, it is useful to establish a link between product specialization and the product life cycle (PLC) theory. Following Vernon (1966), differentiated products are typically associated with the early stage of the PLC, while homogenous products are most likely to be found in the later stages. Take the PC industry, a typical example of a "late-stage" industry, which is an important part of the IT industries in China and Taiwan Province of China. As a "commodity", the PC has very limited upgrading potential. The root cause is that Intel and Microsoft are in almost complete control of the standards and technologies, with a result that expected returns on innovation for PC manufacturers is low, while the cost of innovation is high.

In contrast, the scope for differentiation is broader for high-end handsets (especially smart phones) and for the mobile network industry. Both are examples of "early PLC stage" industries that are important for China, the Republic of Korea and Taiwan Province of China. While entry barriers in terms of investment and technology are high in both

[8] I use these distinctions to move the research agenda beyond the popular, but somewhat schematic dichotomy of "Fordist mass production" versus the "Post-Fordism Flexible Specialization". For a detailed theoretical discussion based on evidence from chip design, see Ernst (2005b).

industries, there are ample opportunities for new entrants to upgrade through innovation.

(ii) Routine versus complex production

The potential for industrial upgrading also differs for different types of production. For "routine" production, the upgrading potential is obviously lower than for "complex" production that needs to combine diverse technologies and may require customization, quick responses to changes in market and technology, and the provision of integrated solutions. The reward for upgrading to "complex" production can be high. If firm successfully implements complex processes, it may benefit from greater profit margins, which in turn could be used to finance further R&D. The downside, of course, is that a successful entry requires substantially higher costs and efforts.

Take, for instance, chip designing, where "routine" functions ("design implementation") are distinguished from "complex" stages of design that centre on conceptualization, circuit architecture and system specification. The requirements for making the transition from design implementation to conceptualization are quite demanding. Entry barriers are extremely high, as design costs at the 90 nano-meter technology (the current best-practice) can be as high as $20–30 million (Ernst, 2005a).

These new challenges are likely to impose far-reaching changes on industry structure, business models and firm organization, illustrating again how closely inter-related firm-level upgrading and industry-level linkage formation are.

4. The International dimension

As Asia's production and innovation systems are increasingly integrated into complex global network arrangements, it is obvious that industrial upgrading does not end at the national border. Nor should one assume that industrial upgrading occurs only if improved specialization leads to the formation of linkages *within* a particular region or within the national economy. Hence, international linkages are critical for the region's industrial upgrading efforts.

4.1. Global production and innovation networks

A "closed economy" assumption became unrealistic, once liberalization and information technology (IT) drastically increased

the international mobility of goods and services as well as finance and investment, giving rise to geographically dispersed ("fragmented") global production networks (Venables, 2006; Jones and Kierzskowski, 2000; Borrus, Ernst and Haggard, 2000; Ernst, 1997, 2002b). Asia's integration into these networks has created cross-border linkages that need to be exploited by its industrial upgrading strategies.[9]

Recent shifts in the global innovation system have further increased the importance of international linkages for industrial upgrading. As globalization has extended beyond markets for goods and finance into markets for technology and knowledge workers, this has increased the organizational and geographical mobility of innovation.[10] Global corporations are at the forefront of these developments. Profound changes are transforming their innovation management, and an increasing vertical specialization ("fragmentation") of innovation is giving rise to GINs.

According to the United States National Science Board, "the speed, complexity, and multidisciplinary nature of scientific research, coupled with the increased relevance of science and the demands of a globally competitive environment, have … encouraged an innovation system increasingly characterized by networking and feedback among R&D performers, technology users, and their suppliers and across industries and national boundaries" (National Science Board, 2004, pp. IV–36). As a result, global corporations are increasingly relying on "innovation offshoring" through GINs (Ernst, 2006).

4.2 How important is Asia?

Since the turn of the century, GINs have been extended well beyond the traditional high tech regions in the United States, EU and Japan. Global corporations construct such networks to improve the productivity of R&D by recruiting knowledge workers from cheaper, non-traditional locations.

Asia's role in these networks is increasing fast (albeit from a low base) and the resurgence of China and India obviously plays an important role. Take Intel as an example of an intra-firm innovation network that is expanding most rapidly in China and India. Its labs in

[9] Empirical research on Asia's leading export economies documents that progressive integration into global production networks has typically increased intra-industry trade, giving rise to growing "input imports', i.e. purchases of components and machinery from overseas sources, primarily in Japan and the United States (e.g., Ng and Yeats, 2003; Ernst and Guerrieri, 1998).

[10] The following draws on Ernst (2006a, 2005 a, 2005b, 2003 and 2002a).

Santa Clara, Folsom and Austin in the United States remain the primary locations for core technology development and applied research, while the lab in Haifa, Israel, (established as early as 1974) focuses on processor research and the lab in Nishny Novgorod, Russia, on software development. Intel has established seven R&D labs in Asia (outside Japan), and it is planning to expand rapidly both the number of labs and their headcounts. Bangalore has Intel's largest lab outside of the United States. With a workforce of around 3,000, the Bangalore lab conducts leading-edge dual processor development. Intel's management plans a substantial expansion in India, most likely in second-tier cities that have lower labour costs than Bangalore. In Shanghai, Intel has recently expanded its R&D team to focus on applied research to identify new applications for China and other emerging markets.

The Bangalore labs of Texas Instruments (TI) illustrate the speed and depth of innovation offshoring to Asia. Established in 1985, Bangalore is Texas Instruments' largest lab outside the United States, with a workforce of more than 2,800. Since 1998, this lab has conducted integrated development projects for highly complex system-on-chip design. It now has the global mandate for co-developing 3G wireless chipsets. Since 2003, TI Bangalore has been assigned the global product development mandate for leading-edge single-chip modems. As a result, TI Bangalore has successfully completed more than 500 patent filings at both the United States Patent and Trademark Office and the European Patent Office.

Global firms also outsource some stages of innovation, especially those related to product development, to specialized offshore suppliers as part of complex *inter-firm* GINs. For instance, global brand leaders for laptops (like HP, Dell, Acer and Lenovo) use design services provided by so-called original design manufacturers (ODMs), mostly from Taiwan Province of China, for new product development.[11] In addition, global system companies (like IBM) and integrated device manufacturers (like Intel) are outsourcing to Asian design houses the development of specific design building blocks and design implementation services (Ernst, 2005a, 2005b).

[11] These ODMs either implement a detailed set of design specifications provided by the global brand leader. Or they provide their proprietary integrated "turnkey" solution to basic performance parameters requested by the global brand leaders. ODM service providers from the Taiwan Province of China now account for 95% of the global notebook market – with three firms (Quanta, Compal and Wistron) accounting for 71%. It is important to emphasize that tier-3 suppliers, especially for power supply (Delta and Lite-On) and connectors (HonHai), are highly profitable and are investing heavily in the development of their innovative capabilities.

Over time, GINs have become increasingly diverse, bringing together R&D teams from companies that drastically differ in size, business model, market power, location and nationality. The flagship companies that control key resources and core technologies – and hence shape these networks – are still overwhelmingly from EU, Japan and the United States. However, there are also now network flagships from Asia (outside Japan). New Asian players develop their own networks and unique ("hybrid") networking strategies.

Huawei, China's leading telecommunications equipment producer, provides an example of a highly sophisticated GIN. The company has pursued a two-pronged strategy (Ernst and Naughton, 2007). It is building a range of linkages and alliances with leading global industry players and universities, while concurrently establishing its own GIN. In fact, Huawei has developed a web of project-specific collaboration arrangements with major suppliers of core components, such as Siemens (as part of China's TD-SCDMA project), 3Com (with a focus on sales and joint product development), as well as Intel and Qualcomm. As for Huawei's own GIN now includes, in addition to six R&D centres in China, five major overseas R&D centres in the United States (Plano/ Texas and San Jose/California), Sweden (Kista/Stockholm), the Russian Federation (Moscow) and the United Kingdom (as part of British Telecom's list of eight preferred suppliers for the overhaul of its United Kingdom fixed-line phone network).

4.3 Driving forces and enabling factors

Corporate strategies shape the pace and contents of the global knowledge economy; they increase the mobility of innovation by constructing GINs. Global corporations construct these networks to cope with increasing pressures to internationalize innovation. Our research through interviewing global corporations suggests that GINs are expected:

- to increase the return on investment on R&D, despite rising cost, complexity and uncertainty of R&D;
- to facilitate entry into emerging markets to compensate for the slow demand growth in core OECD countries;
- to accelerate speed-to-market in line with shortening product life-cycles;
- to gain access to low-cost pools of knowledge workers;

- to tap into the resources and innovative capabilities of emerging economies and new innovation hubs; and
- to bypass social and environmental regulations.

It is important to emphasize the systemic nature of the driving forces. We find that global firms are attracted by supply-related factors, especially the lower cost of employing a chip design engineer in Asia, which is typically 10–30% of the cost in Silicon Valley. However, demand-related factors are equally important. Global firms emphasize the need to relocate R&D to be close to the rapidly growing and increasingly sophisticated Asian markets for communications, computing and digital consumer equipment and to be able to interact with Asia's lead users of novel or enhanced products or services. The main prize is the Chinese market which provides: the largest market for telecom equipment (wired & wireless) and may become a test bed for next generation (4G) mobile systems; the largest market for semiconductors and handsets; the second-largest market for cars and digital consumer electronics; a major export market for Japan, the Republic of Korea, Taiwan Province of China and the United States; and "bottom of the pyramid" markets for less over-engineered products and services with substantially lower costs of acquisition and operation.

Furthermore, some firms in Asia, especially in China and India, that are accumulating resources and innovative capabilities that are attractive to global corporations. For instance, it is projected that, by 2010, China will produce more science and engineering doctorates than the United States (National Science Board, 2008).[12] In addition, China's areas of scientific excellence now include materials science, especially nano-science, where China ranks third (after Japan and the United States) in the number of nanotech publications, and where the Chinese Academy of Science is ranked fourth for nano-science citations, after UC Berkeley, MIT and IBM. China's researchers also excel in areas like voice and image recognition, computer graphics, analytical chemistry, rice genomics and stem cell biology.

At the same time, a powerful mix of enabling factors has facilitated the construction of these networks by reducing uncertainty and the cost of transaction and coordination. The result has been a rebalancing of

[12] According to the National Science Board (2008), 64% of China's 23,446 Ph.D. degrees in 2004 are in science and engineering. Between 1995 and 2003, first year entrants in science and engineering Ph.D. programmes in China increased six-fold, from 8,139 to 48,740.

the "centripetal" forces that keep innovation tied to specific locations and the "centrifugal" forces that reward geographical dispersion. The latter have become more powerful, although the former have hardly disappeared.

There are two root causes of this rebalancing and the resultant increase in the mobility of knowledge: (1) the improvement of the information and communication infrastructure and its extension around the world, and (2) the liberalization of international economic policies that allows this technological change to be exploited more fully by firms and organizational networks.[13]

Institutional change through liberalization has played an important role in reducing constraints on the organizational and geographical mobility of knowledge. Hence, liberalization has acted as a powerful catalyst for the expansion of GINs.

The overall effect of liberalization has been to reduce the cost and risks of international transactions. Global corporations have been the primary beneficiaries. Liberalization provides them with:

- a greater range of the modes of entry, e.g. via trade, licensing, subcontracting, franchising (*locational specialization*);
- better access to external resources and capabilities that they may need to complement their core competencies (*outsourcing*); and
- fewer constraints on the geographic dispersion of the value chain (*spatial mobility*).

Technological development, especially the rapid improvement and diffusion of information and communication technology, has also increased the mobility of knowledge. The high cost and risk of developing IT has forced companies to search for lower-cost locations for R&D. Equally important is that IT and related organizational innovations provide effective mechanisms for constructing flexible network arrangements that can link together and coordinate economic transactions among geographically dispersed locations. IT-enabled network management reduces the cost of communication, helps to codify knowledge through software tools and data bases, and facilitates exchange of tacit knowledge through audio-visual media.

[13] Additional powerful enabling factors are the progressive globalization of IP protection (through TRIPS and TRIPS-Plus agreements) and standards (through formal but especially through informal standard-setting bodies). See Ernst (2008c).

In essence, IT has fostered the development of leaner and more agile production and innovation networks that cut across firm boundaries and national borders. IT-enabled network management has facilitated the exchange of knowledge among diverse knowledge communities at distant locations that work together on an innovatory project.

It is now possible to create and connect teams of knowledge workers in distant locations. This is true even for innovative activities that require complex knowledge. To the extent that the diversity of network players, locations, business models and network arrangements is increasing, this provides opportunities for knowledge diffusion, enabling Asian network participants to enhance learning, absorptive capacity and innovative capabilities.

4.4 Will network integration foster innovation?

The result, however, is by no means a flatter world. There is clear evidence that Europe, Japan and the United States retain their dominance in science and in high-impact intellectual property. In 2002, for instance, all 15 leading companies with the best record on patent citations were based in the United States, with nine of them in the IT sector (CHI/MIT, 2003). The 700 largest R&D spenders (mostly large United States firms) account for 50% of the world's total R&D expenditures and more than two-thirds of the world's business R&D (UNCTAD, 2005a). And, more than 80% of the 700 largest R&D spenders come from only five countries (United States dominates, followed by Japan, Germany, United Kingdom, and France).

Nevertheless, non-OECD countries account for a growing share of the world's R&D (OECD, 2008, p. 56). In 2005, the non-OECD countries accounted for 21.4% of global R&D expenditures (expressed in current United States dollars, PPP), up from 17% four years earlier. China made by far the largest contribution, accounting for 55% of the non-OECD share. China's R&D intensity (i.e. the ratio of R&D to GDP) has grown much faster than in Japan, the United States or any European country.[14] However, at 1.5%, China's R&D intensity is still way behind the global leaders (e.g. 2.6% for the United States).

Probably the most telling indicator of the persistent high concentration of innovative capabilities is the unequal control over resources and decision-making in standard-setting consortia in the IT

[14] Between 1999 and 2004, an average annual growth rate of more than 12% has been recorded for China's R&D intensity, compared to -0.2% for the United States.

industry (Ernst, 2008c). In many of these consortia, standards are highly "impure public goods" that are used by incumbent industry leaders to block competitors and to deter new entrants.

Clearly, the new geography of knowledge has dispersed innovative capabilities to new players, but overall, the spread of innovatory activities remains highly concentrated. For Asia, our data show that integration into GINs has created a handful of new, yet very diverse and competitive innovation offshoring hubs.[15]

There are concerns, however, that integration into GINs may be a poisoned chalice. It is feared that, apart from a few prestige projects that might provide limited short-term benefits, R&D by global corporations may not provide the means for upgrading the host country's industry to higher value-added and more knowledge-intensive activities.

The findings from our research confirm some of these concerns. We have found that Asian emerging economies face massive challenges before they can reap the benefits of network integration. Nothing is automatic about these processes, and they cannot be left to market forces. To cope with market failures identified a long time ago by Kenneth J. Arrow[16], appropriate policies need to be in place to develop absorptive capacity and innovative capabilities both at the firm and industry levels.

For instance, foreign R&D centres often intensify competition for the limited domestic talent, giving rise to bouts of localized wage inflation for knowledge workers (especially for experienced project managers). Inward R&D by global industry leaders may also give rise to a reverse "boomerang effect", providing global firms with valuable insights into business models and technologies developed by domestic firms.[17] Furthermore, foreign R&D centres typically show limited interest in sharing knowledge with domestic firms and R&D labs.

[15] Take chip design. In addition to the established global centres of excellence (like Silicon Valley), there are now a handful of rapidly expanding new clusters emerging in Asia, such as Hsinchu, Taipei, Tainan in Taiwan Province of China; Shanghai, Suzhou, Hangzhou, Beijing, Shenzhen, Xián in China; Seoul, Incheon, Daedok Science Town in the Republic of Korea; Bangalore, Noida, Chennai, Hyderabad, Mumbai, Puneh and Ahmedabad in India; Penang, Kuala Lumpur in Malaysia; and Singapore.

[16] Arrow (1962) argued that markets were weak in generating learning and knowledge, as both were subject to externalities, creating a gap between private and social rates of return on investment.

[17] Examples are attempts by IBM and Accenture to copy the successful business model of Indian IT service providers like Tata Consulting Services or Infosys.

Vigorous policies must be in place to reduce the potentially high opportunity costs of inward R&D investment that may result from "brain drain" (both domestic and international), when global firms are crowding out the local market for scarce skills. Other costs discussed in the literature include a possible deterrence effect of global labs on local R&D; acquisition by global firms of innovative local companies; and the large benefits that may accrue to a foreign parent company (UNCTAD, 2005a).

Support policies for local firms are required. As emphasized by Tassey (2007), substantial investment is needed in "human science and engineering capital" and "innovation infrastructure". An important objective is to improve the efficiency of a nation's innovation systems and to reduce the risks of innovation through "more comprehensive growth policies implemented with considerably more resources and based on substantive policy analysis capabilities" (Tassey, 2008, p. 2).

5. Generic policy suggestions

In short, Asia's progressive integration into GINs may well act as a catalyst for accelerating the development and the diffusion of innovative capabilities, provided, of course, that appropriate policies and firm strategies are in place to enhance local innovative capabilities.

There is no doubt that the innovative capabilities of Asian firms continue to lag substantially behind global industry leaders. Reducing the gap will take time. Hence, host country policies in Asia must continue to cajole and assist local firms by signalling opportunities, reducing risks, engaging in R&D and providing critical public goods. Liberalization and WTO regulations have reduced the scope for such policies. The challenge is to design new policies and institutions that help reduce the "divergence between the private interests of the multinational company and the social interests of the host economy in terms of long-term technology development" (Lall and Urata, 2003, p. 4).

Asia's emerging knowledge economies face a strategic dilemma. If they choose to compete as low-cost R&D contractors, this would result in a "commodity price trap", squeezing their profit margins and hence their ability to finance further innovatory activities. This implies that there is not much choice but to pursue "upgrading through innovation" strategies. Asian firms need to create unique products and solutions, addressing user and social needs that global firms have neglected.

However, deeply entrenched structural weaknesses and persistent inequality constrain the push for innovation.

The key to success is leveraging on integration into GINs to catalyze, not to replace, domestic innovation efforts. In other words, innovation offshoring can only produce sustainable long-term economic benefits for Asian countries if policies exist to develop strong local companies that can act as countervailing forces to the accumulated strengths of global firms. This is in line with the findings of Lall's research. But for Asia to cope with the complex challenges and opportunities of innovation offshoring, new policies are required that are very different from earlier top-down, "command economy"-type industrial.

To reap the benefits of integration into GINs requires the active involvement of the state, i.e. local, regional and central government agencies, as well as a variety of intermediate institutions (Ernst, 2005b). Policies associated with the traditional East Asian development model are too rigid to cope with the complex challenges and opportunities of today's global network economy that have been explored in this study. Nor can the old policies cope with the conflicting needs of multiple and increasingly vocal domestic actors. In addition, command-economy type industrial policies are unable to deal with the high uncertainty and rapid changes in technology and markets that are typical for the new geography of knowledge.

In order to facilitate a continuous upgrading of local innovative capabilities through participation in GINs, new policy approaches are required that:

- strengthen the state's steering and coordination capacity;
- provide public goods in critical bottleneck areas (infrastructure, training and education);
- facilitate access to and diffusion of knowledge and balance this with the need to protect intellectual property rights;
- encourage overseas investment of leading local companies, to expose them to leading-edge innovation management approaches;
- encourage innovations in the financial sector;
- generate dialogues at various levels among multiple participants (local and foreign) in production and innovation networks;
- foster interactive learning and innovation;

- provide social protection and retraining options for those who lose out from economic transformation; and
- facilitate international knowledge sourcing through corporate networks, institutional collaboration and diverse social networks (global knowledge communities and expatriates).

There is, of course, no one best optimum formula for such policies. Their instruments and institutions need to differ from sector to sector, in scope, in kind, and in impact, as documented in Mowery and Nelson (1999, p. 377).[18]

Policies also need to differ across countries. A critical prerequisite to find out more about such policy variations is the construction of relevant country classifications. But most such classifications remain problematic.[19] Drawing on Lall (1990), Ernst, Mytelka and Ganiatsos (1998) and Ernst and O'Connor (1989), it is possible to suggest a broader country classification scheme that focuses on the following criteria:

- the size and structure of markets and the relative focus on internal versus external markets;
- production structures, including industry structure and firm size, extent of inter-industry linkages, and "core industries";
- degree and form of reliance on foreign technologies;
- role of the state in industrial and technological development;
- state of development of indigenous scientific, technological and innovative capabilities;

[18] Ernst (2005a) provides a case study of chip design that highlights characteristic features of global design networks, and the resultant specific implications for the development of local innovative capabilities. Future research needs to conduct similar case studies for sectors that are of particular importance for developing countries, such as textiles, footwear, food processing, chemicals, pharmaceuticals, transportation equipment, mechanical engineering, as well as software and information technology services. For each of these sectors, there are likely to be substantial differences in host country policy responses to innovation offshoring.

[19] For instance, the World Bank's research on strategic approaches to science and technology in development uses the RAND Corporation's matrix of science and technology capacity in the developing world that distinguishes three categories: 24 "scientifically proficient" countries, 24 "scientifically developing" countries and 80 "scientifically lagging" countries (Watson and Farley, 2003, Appendix 2).

- peculiar characteristics of economic institutions (i.e. labour and financial markets and education systems); and
- social, cultural and political factors that shape national, regional and sector-specific innovation systems.

Future research needs to examine realistic options for "upgrading through innovation" strategies in different groupings of Asian countries, and how each of these policies can maximize benefits from participating in GINs. For instance, Ernst (2005b) introduces a taxonomy of four strategies (i.e. "catching-up", "fast-follower", "technology diversification", and "technology leader") and explores capabilities local companies need to master in order to implement each of these four different strategies. Drawing on this taxonomy, the UN Millennium Project Report on Science, Technology and Innovation (UN Millennium Project, 2005, p. 127) recommends "technological diversification" as a particularly attractive policy to upgrade industries through innovation.

6. Conclusions

In this paper, I have demonstrated that Lall's framework for analyzing Asian pathways to development remains valid for today's global economy where globalization has extended beyond markets for goods and finance to reach markets for technology and knowledge workers. As offshoring has moved beyond industrial manufacturing into services, engineering and research, new opportunities and challenges arise for Asian economies.

To examine what this implies for Asia's "upgrading through innovation" strategies, I have introduced a concept of "industrial upgrading" that links specialization with firm-level and industry-level upgrading and integration into global networks. This concept allows us to identify conditions under which Asian countries could reap the benefits of innovation offshoring.

Our analysis shows that Lall was right to emphasize a divergence between the private interests of the TNCs and the social interests of the host economy in terms of long-term technology development. His plea for industrial policy is even more valid today, as the stakes and risks have become much greater, as countries seek to move beyond the "global factory" model to "upgrading through innovation" strategies.

Lall was also right to emphasize that, the more a country moves up the industrial ladder, the more important advanced capabilities and

innovation become. I argue that there is room for cautious optimism that a host country's progressive integration into GINs could facilitate its efforts to push ahead with industrial upgrading.

Most importantly, we have seen that, in line with Lall's research, the key to success is to generate a virtuous circle of accumulating institutions and firm-level capabilities.

Finally, the paper also supports Lall's argument that there is no "one best way" solution. Instead, policies and strategies need to be continuously adjusted to the vagaries of technological change and business cycles, and to the structural transformations of global product and financial markets.

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Energizing industrial development

John A. Mathews *

The role of energy sources in the choice of industrial development pathways has not been widely acknowledged outside the energy literature. Indeed, as oil prices rise, traditional fossil fuel-intensive industrial development pathways now imperil development prospects around the world. As energy security becomes a major issue, developing countries have everything to lose by simply following fossil-fuel based industrialization, and everything to gain by recasting their development strategies around the prospects for renewable energies and biofuels. This paper argues that the time is therefore ripe for developing countries to re-evaluate their stance on renewable energy sources generally, and on biofuels in particular.

Key words: energy choices, renewable energies, biofuels, peak oil, industrial development, latecomer strategies

1. Introduction

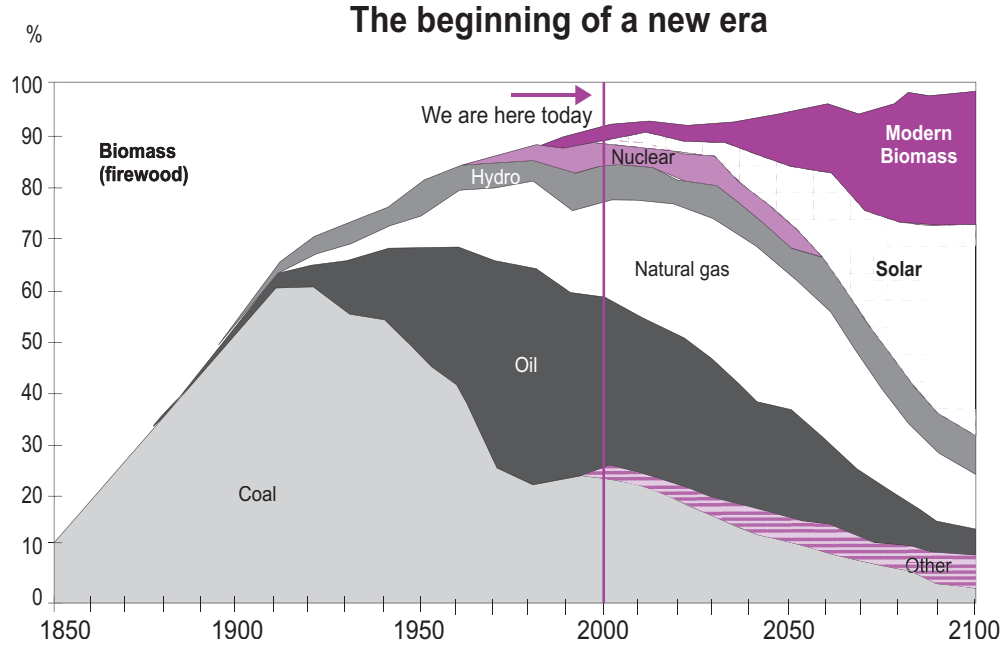
Ever since David French offered his "Ten Commandments" on renewable energy use in developing countries, over 25 years ago, the issue of the role to be played in industrial development by energy choices has been largely neglected. However, recent years have seen convulsions in the world of energy, with a new realization that greenhouse gas emissions from burning fossil fuels is causing potentially irreparable climate changes, and that global supplies of oil as the principal fossil fuel are peaking. At the same time, large developing countries including Brazil, China and India are now becoming major drivers of the uptake of renewable energy technologies. These developments suggest that the role of renewable energy sources, and energy options more generally, should be seen as having greater salience in discussions of world industrial development.

While many economists and policy specialists have addressed this issue, most see the developing world blindly following in the footsteps of the polluting developed countries; few, if any, see developing countries as part of the solution (e.g. Stiglitz, 2006). Herein lies the attractiveness of supporting biofuels and renewable energies for developing countries and development

* John A. Mathews is Professor of Strategic Management at Macquarie Graduate School of Management, Sydney, Australia. Tel: 612 9850 6082, email: john.mathews@mgsm.edu.au.

agencies like the World Bank. By doing so, they take the lead in moving the world to its destined future independence from fossil fuels, as envisaged by numerous scholars and captured most effectively by the IIASA/WEC study, *Global Energy Perspectives*, published in 1998, as shown in figure 1.

Figure 1. Changes in primary energy shares, 1850 to 2100

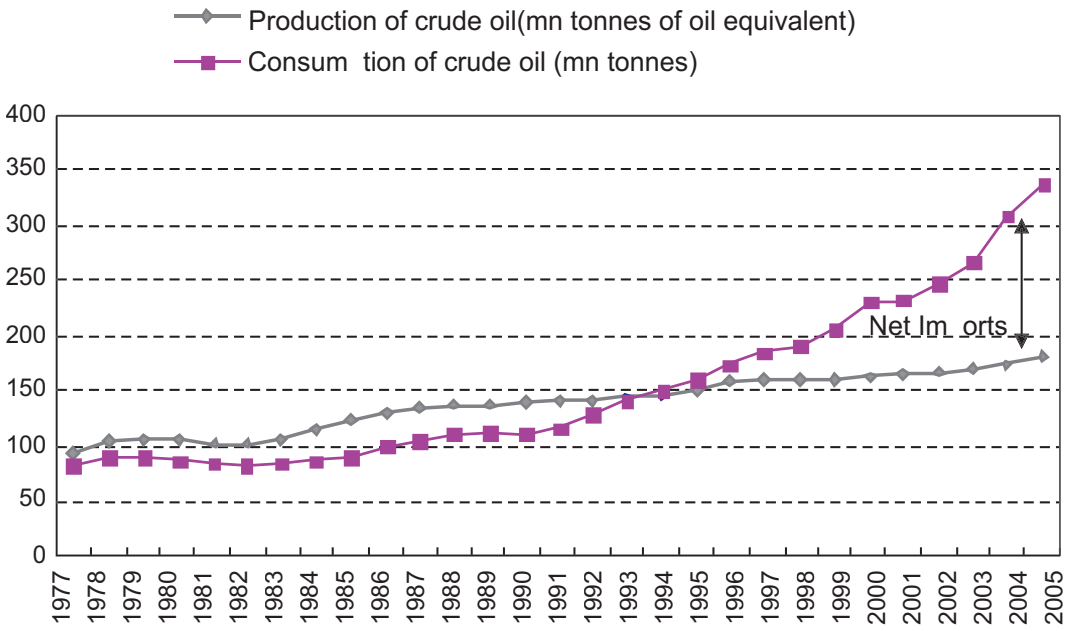


Source: Nakicenovic et al (1998) Fig 5.7 Scenario C1

As a way of illustrating the issues involved, consider the case of oil dependence in China, India and Brazil. China lost oil independence in 1993, when domestic consumption overtook production.[1] Since then, as shown in figure 2, the rise in China's oil imports has been alarmingly fast and has driven the country's frantic search for oil supplies around the world. The situation in India is even worse: the country has never enjoyed oil independence, and oil imports currently account for 75% of total oil consumed (figure 3). Rising oil prices make it unthinkable for both China and India to continue their industrialization based on fossil fuel imports. By contrast, Brazil has recently made itself oil independent, with its state-owned oil company, Petrobras, now producing more than the country consumes. Petrobras is also leading the country into a new era of biofuels, both in terms of ethanol blends for cars and biodiesel derived from vegetable oils for trucks, buses and heavy equipment.

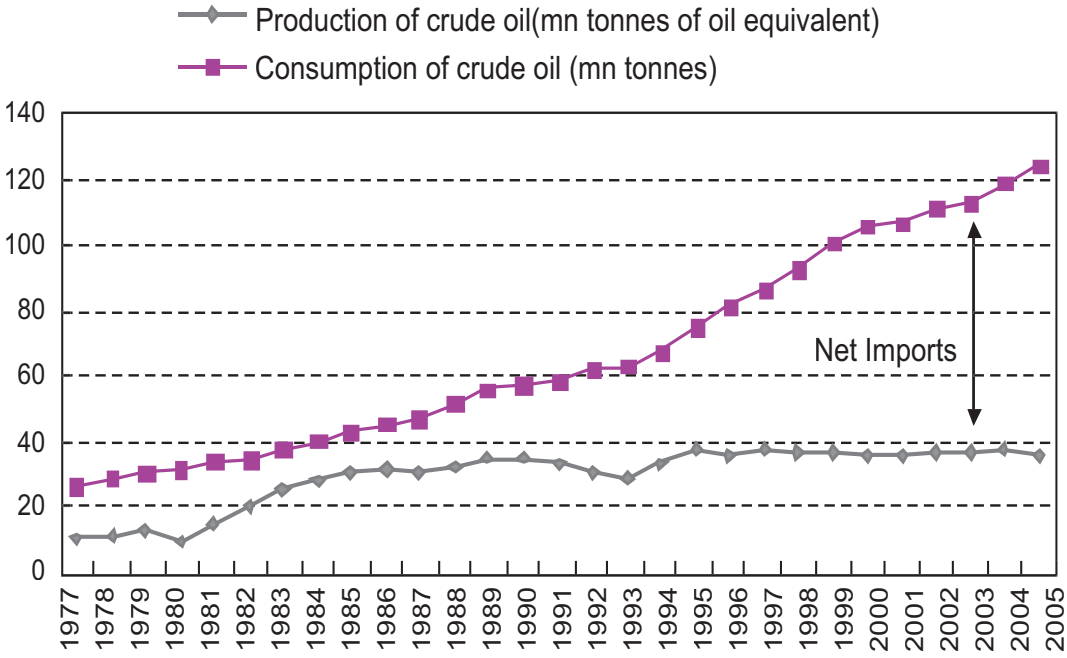
[1] The same thing had happened to the United States over 20 years earlier in 1970.

Figure 2. China's oil production and consumption, 1977-2005



Source: Based on BP Amoco, BP Statistical Review of World Energy © Euromonitor International 2006.

Figure 3. India's oil production and consumption, 1977-2005



Source: Based on BP Amoco, BP Statistical Review of World Energy © Euromonitor International 2006.

The report by Goldman Sachs, *Dreaming with BRICS: The path to 2050*, made the widely noted prediction that by 2050, China would become the world's largest economy, India the third largest, and Brazil the fifth largest (Goldman Sachs, 2003). This report was a wake-up call

for many, showing that economic growth was likely to take today's developing countries to world leadership by halfway through the century. Yet curiously, the Goldman Sachs report made no mention of energy – not of fossil fuels, nor of biofuels, nor of any other renewable energy resource. But with the double influence of peaking of global oil supplies and of the rising apprehensions related to emissions of greenhouse gas emissions, such neglect of fundamental energy questions is no longer feasible.

This paper canvasses the issues involved, probing the likely implications for the industrial development process of the peaking of global oil supplies and of the rise of concerns over global warming, and also the prospects for developing countries to move towards (and indeed take leadership in) the application of renewable energy options. The purpose of the paper is to ask explicitly what effects the choice of energy options would entail on countries' industrial development prospects. This is a typical question posed by Sanjaya Lall in his many discussions of technological capabilities and the sources of advance on the part of developing countries. In one of his later contributions, made together with Carlo Pietrobelli, Sanjaya examined the prospects for development in Sub-Saharan Africa and the role to be played in the process by institutions of technology transfer and indigenous R&D, and concluded on a pessimistic note (Lall and Pietrobelli, 2005). Yet, with the rise of renewable energies as options for such developing countries, and in particular the grasping of opportunities in the field of biofuels, it is precisely the role of technology transfer institutions that is vital to the eventual success of such projects. Sanjaya himself would no doubt agree, were he to be able to witness these new and arresting developments in the fields of renewable energies and biofuels.

2. Energy choices and development

Until recently, it was the conventional wisdom that renewable energies would be a marginal and costly alternative, that might make some headway over a century or more as technologies improved. But the case of Brazil, China and India shows that renewables – led by biofuels and in particular ethanol – are competitive here and now, and moreover represent an exceedingly attractive option for developing countries.

The advantages for developing countries of ethanol and biodiesel over their fossil fuel counterparts as transport fuels are many, and include the points that:

- they are currently cheaper than oil;
- they provide energy security as opposed to dependence on imports from unstable oil regimes;
- they burn more cleanly;
- they generate fewer greenhouse gases;
- they promote rural development;
- they can generate new export industries for developing countries; and
- even countries with a less advanced level of science and technology can get a start with biofuels.

Strategizing around renewable energy options, it will be argued, is fundamentally different from securing strategic supplies of fossil fuels, in particular oil. To engage in global strategic games (with their deadly consequences in the form of resource wars) in pursuit of security of oil supplies is one thing – and Brazil, China and India are all playing that game, with increasing sophistication and success, to the consternation of the United States and its western allies. The key issues here are military strength, international political and military alliances, and diplomatic manoeuvring.

But to strategize around renewable energy sources calls for calculations of a quite different kind. It calls for interventionist industry policies to kick-start new renewable energy industries, such as those based on growing and distilling biofuels; on capturing solar energy (e.g. manufacturing PV solar cells); or on building wind farms (e.g. manufacturing wind turbines). But more than this, it calls for a sophisticated design of the institutional settings in which a transition to utilization of renewable energy may be effected – from mandating the use of ethanol-petrol blends in motor vehicles, and extending such mandates to diesel-powered machines; to mandating rising proportions of electric power generation from renewable sources; to implementing tax measures that offer incentives to move towards energy conservation and efficient fuel usage and disincentives to inefficient fuel use (such as indiscriminate use of SUVs in cities); and to creating incentives to encourage firms to become active in the supply chains that feed renewable energy supply systems.

Brazil has taken an early lead in biofuels, driven by its huge domestic ethanol programme that has seen its use as a blended fuel mandated by the federal government, backed by subsidies to sugar producers to enable them to produce ethanol as well as sugar. Now Brazil has a thriving export industry for biofuels, with firms operating

bioreactors at its core. In these reactors, the decision to produce sugar or ethanol can be taken on a daily basis at the flick of a switch, depending on the prevailing world prices. In 2005, Brazil started to replicate its success with bioethanol through a biodiesel programme. Already by late 2006, this programme had generated 100,000 jobs in the northeast of the country, producing biodiesel from oil crops such as castor oil and palm oil. The Brazilian national energy company, Petrobras, introduced a new biodiesel product, dubbed H-Bio, in 2006, the first in the world to do so.

China and India are Brazil's largest export markets for ethanol, and are themselves rising fast as producers: they are now third and fourth largest ethanol producers in the world. They are also rising fast in the biodiesel stakes as well. Many other tropical developing countries in Asia and in Central America are also becoming active in biofuels. In promoting renewable energy, in their own interests, developing countries can thereby create a new agenda for solving the wider problem of global warming. China is developing a range of alternative energies, including wind energy, solar thermal and photovoltaics and biogas digesters, which represent the seeds of a new low-carbon economy. India, too, is developing renewable energy industries, with firms like Suzlon becoming a world leader in wind turbines manufacture, and with institutional innovations such as a Ministry of Non-Conventional Energy Sources to coordinate developments.

The pattern of development of renewable energy sources in developing countries is likely to follow its own "latecomer effect" logic. While in the developed world, dependence on biofuels is an expensive option (because of intensive land use and need for fertilizers for fuel crops) in the developing world, such as Brazil and Africa, biofuels can be produced at much lower costs. And, many developing countries have much larger land resources to devote to generating energy – from crops, from sun (PV cells) and from wind. The developing world can adapt an "agricultural model" to cultivating renewable energy sources – or what might be called an *ergocultural* model. The twenty-first century is likely to see major scientific and technical advances in the use of land for food (agriculture) and for energy (ergoculture), with the developing world taking the lead in both.

Thus, the era when industrial development strategies could be formulated without reference to energy sources looks to be over (Asif and Muneer, 2007; Barnwal and Sharma, 2005; Wright, 2006). When we look just at developing countries, of the world's 47 poorest countries,

no fewer than 38 are net oil importers, and 25 are completely dependent on oil imports – victims of commitments made during the times when the price of oil was seen as low forever (Ren21, 2006). Yet, these are the countries that have generally favourable conditions for producing energy from renewable sources.

If the argument of this paper is sound, then it means that renewable energies – starting with biofuels – represent a unique opportunity for developing countries, and one that has the potential to change the terms of world trade in energy and tip the balance favourably towards industrial development in tropical countries around the world. The key to their success is mastery of the technologies involved, many of which will have to be imported from developed countries, through licensing, FDI or through movement of human capital – exactly as described by Sanjaya Lall in his numerous studies on this process.

3. Arguments in favour of a fossil fuel-independent strategy

The conventional development wisdom has it that developing countries will have to follow the energy steps of the developed world, emulating their pathways to development. But what the conventional wisdom failed to foresee was that some developing countries would find an alternative pathway – one based not just on fossil fuels and extreme dependence on oil imports, but on a different trajectory, namely one of energy independence and in particular independence from fossil fuels.[2] Unlike Russia, which is playing strategic games with its vast oil and gas reserves, Brazil, China and India are strategizing so as to build energy independence through a variety of renewable fuels and energy sources, starting with liquid biofuels, partly in order to reduce their vulnerability to balance of payments difficulties due to rising oil import bills. In this way, the debates over renewable energy, which rose to prominence in developed countries during the 1970s but died away as oil prices fell,

[2] It has to be recognized that China and India will remain large-scale users of coal for many decades to come, just as the European countries and the United States in the 19th century used coal as the primary energy source. The point being made is that alongside their use of coal these countries are demonstrating that they can "energize" their development with renewable sources as well, and actually utilize them as seeds of new industries that can compete with those of the advanced world, and capture latecomer advantages in so doing. At the same time, they can deploy advanced technologies such as combined cycle power generation to reduce greenhouse gas emissions from their use of coal – as China is planning to do, in advance of the developed world.

are now being replayed in the developing world – and this time with real prospects of success.

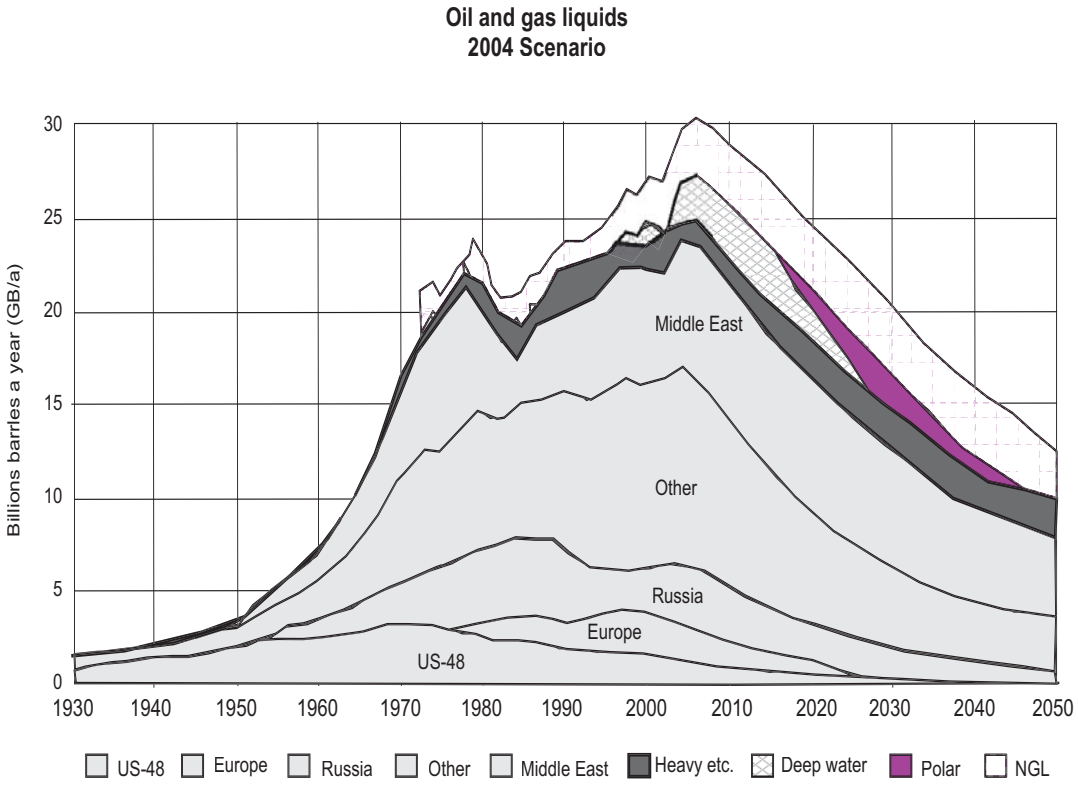
The issues to be considered as developing countries move vigorously towards promotion of renewable energy and biofuels industries may be rehearsed under the following ten headings, to emulate the approach of French (1982):

- Energy security and the peaking of oil supplies globally;
- Biofuels as tested substitutes for fossil fuels;
- Abundance of land for producing energy crops in tropical countries;
- Biofuels' potential to reduce fuel import bills and fossil fuel dependence;
- Biofuels production is a rural industry and can promote social inclusion;
- Countries with even low levels of science and technology can get a start in biofuels, and they can create thereby a "development bloc" that can drive industrial development;
- Biofuels are potentially greenhouse gas neutral and can earn countries carbon credits;
- Developing countries can develop their own distinctive latecomer institutional innovations to capture benefits;
- Biofuels represent simply the first step on a clean technology development trajectory; and
- A Biopact between countries of the South exporting sustainably produced and certified biofuels and countries of the North importing them could resolve concerns over biofuels and break the world trade logjam.

4.1 Energy security and the peaking of oil supplies globally

The relentlessly rising long-term costs of oil pose a major brake on industrializing efforts by developing countries. Looking at the global picture, the data reveal a relentless build-up of consumption, with production trying to keep up; but the discovery of new fields is in steep decline. Indeed, new discoveries peaked in the 1960s. Production must fall following these declines eventually. Just when this occurs is currently the subject of intense debate (Kerr and Service, 2005). The graphic utilized by the Association for the Study of Peak Oil and Gas is shown in figure 4.

Figure 4. Peaking of global oil supplies



Source: www.peakoil.net.

Here, we see how oil production in the United States peaked in 1970; then Russia emerged as a source, but is now declining; and how Europe – largely through the North Sea – also had its time in the sun, but is now rapidly fading. Other sources such as Latin America, West Africa and now Central Asia have also come to play a role, but they will see steep declines even as early as 2010. Non-conventional sources of oil and gas, such as tar sands, will simply not be able to pick up the slack, because of high costs, technical difficulties or political resistance as in the case of drilling in Arctic areas. In the face of such difficulties, with their widely expected impact in terms of rising oil prices, developing countries should adopt a conservative posture, namely to assume the worst and prepare for it. This would imply making provision with all due speed for renewable energy sources.

4.2 Biofuels as tested substitutes for fossil fuels

There is tension in the scientific community over the extent to which biofuels can fill the looming gap in fuel supplies. Writing in

Science in 2006, Professor Hoffert and his colleagues offer the view that "All renewables suffer from low areal densities". They go on to comment, "… photosynthesis has too low a power density (~0.6 W/m2) for biofuels to contribute significantly to climate stabilization" (Hoffert et al., 2002, p. 984). But it turns out that they are considering the case only for developed countries. Against this, Steven Koonin states unequivocally in the same journal that "with plausible technology developments, biofuels could supply some 30% of global demand in an environmentally responsible manner without affecting food production" (Koonin, 2006, p. 435).

The reality is that for developing countries where sunshine and desolate landscapes are not in short supply, there is vast scope for producing biofuels, particularly from degraded and abandoned land.[3] In India, for example, there are now several major investment programmes underway in ethanol and biodiesel production, utilizing vast areas of degraded or under-utilized land, and planting under-utilized crops such as *Jatropha curcus*. These projects can also capture latecomer advantages through utilizing the latest in biorefinery technology – as described in a recent article in *Science* (Ragauskas et al., 2006).

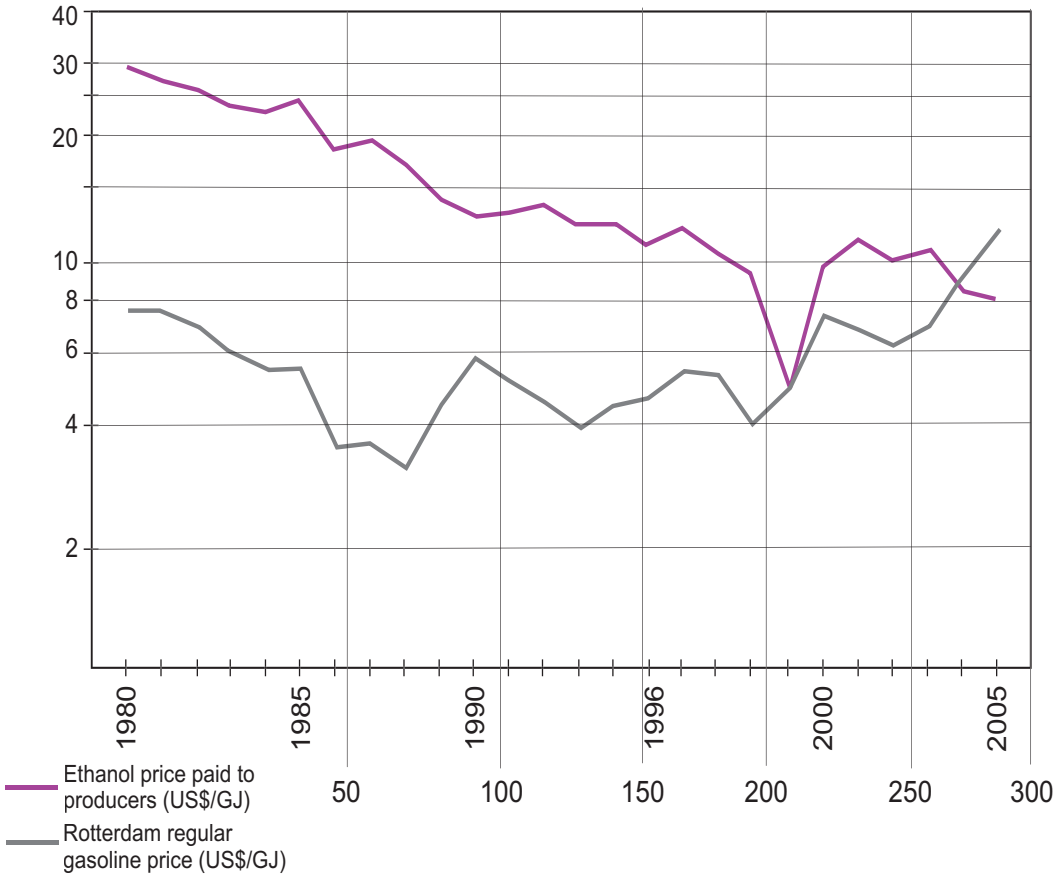
There is a huge literature hostile to biofuels, accusing them of being energy-intensive in cultivation; taking land from food crops; and encouraging monoculture. But these are largely arguments stemming from developed countries and describing developed country conditions – particularly in the United States and northern Europe. But the situation in developing countries is quite different. Brazil produces ethanol from sugar cane (the fastest growing crop on the planet) with an energy gain of up to 8:1, because of the favourable conditions in which the fuel is produced.[4]

[3] Campbell et al (2008) provide a reliable scientific estimate of the availability of such degraded lands in countries of the South, in opposition to the common claim that biofuels are being driven by deforestation.

[4] On the experience with biofuels in Brazil, see Goldemberg et al (2004) for a succinct summary, and Macedo (2005) for a collection of studies on the efficiency and energetics of Brazilian ethanol production based on sugar cane, including the estimate of energy yield of 8:1. The most recent estimates for the sugar cane crop of 2005/06, by Macedo, Seabra and Silva (2008), raise the energy gain to 9.3:1, while GHG savings were 2181 kg CO2eq per cubic metre of E100 ethanol, compared with release of GHG emissions from ethanol production of 436 kg CO2eq per cubic metre – a gain of 1745 kg CO2eq per cubic metre of ethanol.

Developing countries, led by Brazil, China and India, are in fact taking the lead in the development of biofuels as alternatives to fossil fuels (Barnwal and Sharma, 2005; Li et al., 2005; Liming, 2007). In Brazil, the programmes go back to the 1970s, when the Proalcool programme was launched, involving the mandated use of an ethanol blend for gasoline, known as gasohol. This generated a huge rural industry growing sugarcane for ethanol production as well as sugar. The comparative advantages Brazil enjoys in such production – land, sunshine and cheap labour – have been enhanced through the country's own R&D efforts, which resulted in the development of better crop strains and understanding of soil types; these have led to reductions in production costs so that ethanol is now cheaper than oil – as shown in figure 5. This demonstrates that developing countries can reap benefits from renewable energies and biofuels through adding their own R&D and innovations to those technologies adopted from the developed world.

Figure 5. Price paid to ethanol producers and gasoline cost



Source: Datagro.

4.3 Abundance of land for producing energy crops in tropical countries

Tropical developing countries are not as limited in their choice of feedstock as temperate, developed countries. They have the options of using sugar cane itself, as well as a variety of starchy inputs such as cassava and, for biodiesel, any of a variety of oilseeds that have traditionally been viewed purely as foodstuffs. In fact, many of the oilseeds now being cultivated for biodiesel are inedible – such as castor oil. In India, the wonder oilseed, *Jatropha curcus*, which is also being investigated in Brazil, grows in hostile conditions on degraded land. As such, there is little question of the cultivation of these crops competing with food supplies or with land that is potentially cultivable for food. Indeed, one area where intensive R&D efforts are needed is the investigation of the potential of existing and little known plants for biofuel production in developing countries. These options are being explored by Brazilian, Chinese and Indian ethanol and energy producers in tropical countries.

But, of course, land can be misused in the pursuit of biofuel crops, and clearances of rain forest in the Amazon and in South-East Asia (e.g. in Borneo and Sarawak) represent the front line of such concerns. Countries that allow unchecked clearances of forests are defeating the very conditions that give them a developmental advantage – and giving rise to global campaigns such as those concerned with the threat to the habitat of the orang-utan (FoE, 2005). If developed countries can be given an excuse to block imports of biodiesel from tropical countries on the grounds that it is derived from mass clearance of rainforest, then clearly the whole biodiesel enterprise is imperilled. That is why countries of the South have every reason to seek the most stringent certification processes for their biofuel production as meeting sustainability targets, and can best do so through negotiation of a global Biopact – as discussed in subsection 4.10 below.

4.4 Biofuels' potential to reduce fuel import bills and fossil fuel dependence

For a developing country, it is all the more perverse to neglect the biofuel option while imports of oil are placing an ever-increasing burden on the country's balance of payments. Brazil has estimated the savings on its fuel import bills since the launch of the Proalcool programme to be of the order of $50 billion per year – which is far larger than the country has spent in promoting ethanol. Likewise, the savings for China

and India in foregone oil imports will be of the order of hundreds of billions of dollars – the difference between success and catastrophe in their development efforts. Since the lack of foreign exchange is a major barrier to industrialization, displacement of fossil fuel imports represents a major strategic advantage.

This issue also has the developmental advantage in that the country is forced to consider its energy production as an industrial issue calling for business and developmental strategy, and not just as an issue of importing "stuff" from abroad. To "grow" industries is the core of the development process – and it can start with energy as with any other branch of production, as discussed in the context of seeding "development blocs" in subsection 4.6 below.

4.5 Biofuels production as a rural industry and promotion of social inclusion

Brazil sees biofuels production as a way to promote rural industry and to curb the migration to the cities from the countryside. Biodiesel produced from castor beans in Brazil's arid northeast *sertao*, for example, is promoted not just for the biodiesel but also for the fact that it creates thousands of jobs in this otherwise impoverished region. Promotion is through fiscal incentives, such as tax breaks offered to families producing the raw materials needed for biodiesel production. The more the production of castor beans for biodiesel and sugar cane for ethanol production spreads, the greater the rural employment generating possibilities are, which help to curb migration to the big cities. In India, the production of biodiesel from Jatropha is also explicitly promoted as a rural industry capable of generating village-based enterprises and local employment. Indian national firms, like Reliance Industries, already a player in the oil business, are now moving into production of biodiesel from plantations established in Andhra Pradesh.

4.6 Biofuel development strategies for countries with low levels of science and technology

Biofuels in tropical countries can be grown with scarcely more input than seed, land, sunshine and labour. If the country has a comparative advantage in labour-intensive activities, then it can start with production activities with a low level of technical sophistication – and move up from there. Brazil is demonstrating how this can be done, through its ethanol programme involving sugar cane, and now its

biodiesel programme involving vegetable oil seeds such as castor and soybean crops. In the words of the country's president, Luiz Inacio Lula da Silva, this programme had, by July 2006, already generated 100,000 new jobs in growing soybeans and other oil crops in the northeast of Brazil. The biodiesel programme has been designed as much with social goals as with fuel supply goals. The point is that a country in Africa can emulate this example and devote large tracts of land to fuel crop production. Domestic consumption can provide an initial market, since the fuel produced can substitute for expensive oil imports. As technical sophistication is acquired, export markets may be opened up. As the industry develops, advanced distillation systems installed, and technological know-how in the country can be enhanced. This will then have spillover effects in other sectors.

As a biofuel industry becomes established, it is likely to drive industrial development through linkages and complementarities. Biofuels and other renewable energies promise to play the role of a critical "development bloc" for Brazil, China and India in the first instance, and for wider swathes of developing countries through the tropics more generally. The concept of *development bloc* was introduced and defined by the Swedish development economist, Erik Dahmén in 1950, based on his studies of entrepreneurship in the Swedish economy (Dahmén, 1950/1970, 1989). He defined it as "sequences of complementarities which by way of a series of structural tensions, i.e. disequilibria, may result in a balanced situation" (Dahmén, 1989, p. 111). Such a suprafirm system provides a striking description of how firms may collectively strategize in the context of a disequilibrium economy, and build on each others' efforts to improve their own prospects. J. P. Carlsson and Eliasson (2003) have taken up the concept and renamed it *competence bloc* to emphasize that such a collective capability is needed to support and sustain technological innovation. If the technological system represents the supply side of industrial dynamics, then the development bloc or competence bloc represents the demand side. The competence bloc captures the notion that if new technologies are to be taken up, or absorbed, then firms must have the requisite capabilities, and the product ranges, to be able to make use of the technologies. It is the blockages due to such inadequacies and bottlenecks that accounts for poor uptake of new technologies, rather than unwillingness or conservatism on the part of managements. Thus a development bloc represents the systemic counterpart to the consideration of market demand as well as supplier competence in the microdynamics of technological trajectories. It generates the forward and backward linkages that can drive industrial

development. Development blocs formed around value chains involved in renewable energy production and bioenergy are precisely the kinds of industrial templates needed for development today. And renewable energies are already providing the business around which transnational corporations (TNCs) from the South are already forming – as demonstrated by such firms as Petrobras and Bunge from Brazil (in biofuels); Suzlon from India (in wind turbines manufacturing); and Suntech Power from China (for photovoltaics production).

4.7 Biofuels are potentially greenhouse gas neutral and can earn countries carbon credits

Biofuels like ethanol are potentially greenhouse gas neutral, in the sense that every carbon atom burned is simply replacing a carbon atom taken by the plant during photosynthesis. This is by far their most appealing feature from a long-term environmental perspective. Of course, this neutrality has to be qualified by the fact that fossil fuels are consumed along the value chain producing the ethanol – but again much of the concern voiced on this issue emanates from a developed country perspective and is much less relevant in a developing country. For example *The Washington Post* ran a story in July 2006 captioned "The false hope of biofuels" in which the main charge was that the energy gain is little after deducting amounts involved in fertilizer, harvesting, transport, processing, etc. These considerations change dramatically when considered in the context of a low-cost developing country, where input resources including land and sunshine are abundant, and processing takes place close to where the crops are grown. The greenhouse gas emission abatements can then serve to generate carbon credits under the Kyoto protocol.

Again indiscriminate clearance of forest to plant energy crops defeats the gains in greenhouse gas emissions that are potentially there for the taking. It is to curb such behaviour and hold governments to a standard of accountability that is one of the principal arguments for global institutions like the World Bank to become more directly involved in promotion (and to some extent regulation) of the development of biofuels.

Developing countries have the opportunity to take a fresh initiative on this matter, and channel part of their biomass into production of biochar (produced through slow pyrolysis) which can then be put back into the soil as a fertilizer substitute. Biochar was actually invented by

pre-Columbian civilizations of the Amazon, where it created fertile soil patches named by the Portuguese as *terra preta*. Its reintroduction into biofuel production by tropical developing countries would thus be a means of reclaiming this ancient invention, and provide the basis for producing biofuels that are demonstrably *carbon-negative* – in the sense that they sequester more carbon from the atmosphere than is put back through burning of the fuel. Biochar amendment of the soil is a way of drastically enhancing fertility while conserving soil, avoiding run-off, enhancing water retention, reducing nitrogen emissions and providing the opportunity for production of carbon-negative bioenergy.[5]

4.8 Biofuels and renewable energies as a first step on a clean technology development trajectory

Biofuels and renewable energy options are not an end in themselves, and it will be necessary to lead a country along a trajectory that will involve many more biofuel innovations and clean technologies. Brazil for example started with ethanol, and, since 2005, it has launched a biodiesel programme that promises to rapidly take the country to world leadership in biodiesel. All developing countries can expect to pass through the same two phases, probably in an accelerated manner. Within the next decade, a third phase can be expected to become significant, namely the use of biomass generally (such as through forest plantations, or municipal waste) as feedstock for general bioreactors (Somerville, 2006). This phase will depend on the development of enzyme packages that are currently in the test stage in R&D companies such as Iogen. But it is highly likely that this stage will be accelerated through innovations developed in Brazil, China and India, given their track record.

Countries do not need to see biofuels or any other source of renewable energy as a total solution or substitute for fossil fuels. They all contribute to a portfolio of renewable energy options that will vary depending on the comparative advantages of the country concerned. Even the simplest kinds of renewable energy options, such as biodigesters producing gas, electricity, heat and light from biomass or village waste, represent powerful ways of enhancing energy per capita usage in advance of electrification grids and without promoting heavy fossil fuel-dependent industrialization.

[5] See Mathews (2008a) for a discussion of carbon-negative biofuels, utilizing biochar amendment of soil, and Lehmann (2007a, 2007b) as a representative sample from a fast growing literature on the scientific evaluation of biochar's properties.

4.9 Developing countries distinctive latecomer institutional innovations in biofuels

Brazil, having accomplished a successful biofuels industry, shows other countries how it can be done. In the 1970s, it suffered under a dictatorship, but out of that experience came an understanding as to how the country could benefit from its comparative advantages in sugar cane growing and processing, turning these into competitive advantages. In the most recent period, Brazil has seen its use of biofuels leap ahead under the twin impact of flex-fuel vehicles (FFVs) and the mandated provision by fuel companies of ethanol blends (from E25 to E85) all across the country.

Other developing countries can learn from this example, without having to go through all the painful episodes of Brazil's history of the past 40 years. They can accelerate their uptake of biofuels, with all the advantages that this can bring (in terms of energy security, savings from reduction in oil imports, rural development and cleaner city air) to create new and vibrant export industries, simply through the double measures consisting of:

1) mandating supply of flex-fuel vehicles (directed at the automotive industry); and
2) mandating provision of ethanol-petrol blends (starting with E10 and moving to E25) within a few years.

So much of the discussion of the past decade on renewable fuels has been driven by supply-side considerations, namely costs and technologies. But the key to getting these new industries off the ground – as in every successful case of deliberate industry creation – is to influence demand; in this case, the demand from the automotive industry for cars that run on ethanol blends, and demand from the motoring public for such ethanol blends.

So any developing country today can benefit from this experience, and move to establish a biofuel industry with relative certainty as to the outcomes. The key is to start with ethanol blends ("gasohol") rather than seeking to jump straight into pure ethanol or other biofuels, and to do so at a measured pace, building demand for the ethanol blend by drawing the automotive sector and oil sector along with the programme.

The institutions established to drive the uptake of biofuels are likely to have a knock-on effect, facilitating the development of other industrial sectors, formed initially as support sectors for the biofuel

industry. Good institutions develop during an economic activity. When a committed government engages in a partnership with a proactive private sector, they jointly begin to design and implement appropriate institutions. So while institutions are the key, the causation may be from the start of an activity in response to a government trigger (tax break for example), to the unfolding of institutions that help to trouble shoot as the process rolls along. Of course, the process will be highly inefficient in the beginning, as countries learn to make these institutions work more effectively. This is best illustrated in Brazil's own follow-up to the ethanol programme, namely its Biodiesel programme.

Brazil's biodiesel programme – a successful latecomer strategy

This latest biofuel initiative from Brazil shows just what can be achieved by a developing country that focuses its institutional innovations on capturing its latecomer effects. The Brazilian biodiesel programme, which was launched in January 2005, has been well crafted and executed. We can identify at least four latecomer institutional features to the programme that have not been widely recognized.

First, it is a carefully managed incremental programme, moving through three phases that have been widely discussed in Brazil. The first, voluntary phase, brings the country up to a level of 2% biodiesel, following the example of the Proalcool programme. By 2008, this 2% minimum becomes mandatory, and rises to 5% minimum blend by 2013, athough the success of the programme in its first 18 months means that it is widely anticipated that the mandatory 5% blend (B5) will take effect at an earlier date, possibly as early as 2010. Thus, the country as a whole is being brought to a position where it produces 5% of all diesel requirements from vegetable oils by 2013 at the latest (and possibly as early as 2010), bringing it abreast of world leaders. The programme is overseen by the Ministry of Mines and Energy.

Secondly, the capacity of the country is being ramped up in the initial, voluntary stage, by means of staging national auctions for biodiesel. Ten such auctions had been staged by the end of 2008, by the National Petroleum Agency (ANP), the motor fuel standards agency (now renamed the National Agency for Petroleum, Natural Gas and Biofuels). These auctions have encouraged bids from potential suppliers who are thereby induced into the market. The state-owned oil company, Petrobras, acts as the buyer of last resort, thereby ensuring that the auctions bear some relationship to market reality.

Third, there is a distinct and explicit social goal to the biodiesel programme – again, learning from the experience of the Proalcohol programme. The Ministry of Agrarian Development (MDA), which is pro-small farmers, has shaped the biodiesel programme with its "seal of social responsibility" meaning that small farmers have to contribute over 50% to a large trader's or distributor's biodiesel. It is only with such a seal that large companies receive tax credits and are allowed to bid at the auctions. The impact has been dramatic, President Lula, who backs this programme as the central initiative of his presidency, claims that 100,000 jobs have been created in Brazil's impoverished northeast region through growing oilseeds (mainly castor oil).This is backed by data from the MDA showing that since the launch of the programme, just over 200,000 small family-owned farms have been induced into growing oilseeds. Moreover the favoured oilseeds are castor oilseed and palm oil (from a variety of native Brazilian species), rather than soybeans that are grown in the centre and southeast of the country. This is in addition to the 500,000 rural jobs maintained by the Proalcool program, plus the 500,000 jobs indirectly linked to rural alcohol production.

Fourth, Brazil is backing a wide variety of oilseeds in these early stages of the programme to see which ones turn out to be best in a tropical country (and bearing in mind that European experience is confined exclusively to rapeseed and United States experience to soybean). Certainly, output is currently dominated by soybean and palm-oil, but cottonseed and castor oil are also picking up, under the influence of the MDA's social inclusion or rural smallholder development strategies. New candidates are coming on to the scene, such as the wonder oilseed, Jatropha curcus, widely utilized for biodiesel in India.[6] There are as well conventional but under-utilized sources such as beef tallow, obtained from slaughterhouses. The broader Brazil's scope of oilseed culture is, the more it is able to take advantage of changes in world prices for these vegetable oil commodities, switching between them. Thus, it is a smart latecomer strategy to invest in variety at this early stage of the biodiesel industry. The oilseed varieties in use in Brazil are shown in table 1.

Note that these four central features of the programme are driven by four Ministries, all in the pursuit of highly creative latecomer strategies: the Ministry of Mines and Energy, backing renewable energies generally; the ANP, safeguarding standards and conduct the auctions; the MDA, launching a new land reform programme with the biodiesel

[6] Jatropha curcus grows under harsh conditions; it is a perennial that can be harvested regularly; and above all it is inedible, meaning that its cultivation will never be seen as a threat to food supplies.

Table 1. Biodiesel and Brazilian vegetable oil sources

	Castor oil	Sunflower	Soy	Palm	Cottonseed
Crop yield (kg/ha)	1,500	1,500	3,000	20,000	3,000
Oil contents (Per cent)	47%	42%	18%	20%	15%
Oil yield (kg/ha)	705	630	540	4,000	450
2005 production in Brazil ('000 cubic meter per year)	90	23	5,600	151	315

Source: Petrobras.

projects, in its direct appeal to "social inclusion" as a national goal of the programme; and the Ministry of Agriculture, promoting a wide variety of oilseed crops and not just soybean. The success of the programme to date indicates successful collaboration between these four ministries.

This Brazilian strategy stands in marked contrast with the cautious approach to biofuels and bioenergy development advocated by NGOs such as Oxfam (2008), which continue to see biofuels as agents of lopsided development or even of under-development. As Oxfam puts it:

> For poor countries that tend to have comparative advantages in the production of feedstocks, biofuels may offer some genuine development opportunities, but the potential economic, social, and environmental costs are severe.
>
> Oxfam recommends that developing countries move with caution and give priority to poor people in rural areas when developing their bioenergy strategies (Oxfam, 2008, p. 4).

This is of course precisely what Brazil has done. But Brazil does not assume that merely allocating land and identifying "rural groups" is enough to grow a new industry – as is apparently assumed by Oxfam. Instead, it requires careful nurturing and the building of institutional support. This is the best defence that countries of the South can mount to the threat of invasion into their nascent renewable energy and bioenergy

industries by TNCs from the North. There is no magic formula by which such companies can be utilized without letting them dominate an industry – as successful cases of development such as Singapore, and now increasingly China itself, can demonstrate.

The fact that biofuels attract a hostile press in the advanced countries of the North should be seen as an opportunity for the countries of the South – provided they can secure some form of recognition, or certification of the sustainability of their bioenergy efforts (Van Dam et al., 2008). One way to move towards such certification in the North for biofuels grown in the South is through a Biopact.

4.10 A Biopact between South and North could break the world trade logjam

Will biofuels unleash a new round of protectionism on the part of the developed world, to rival the trade barriers already erected against foodstuffs? Already, there is substantial momentum behind the enactment of subsidies to encourage production of ethanol in northern temperate climates – from corn in the United States and from sugar beet in Northern Europe – where the costs of producing the final product are far higher (two to three times) than in Brazil or India. It would make so much more sense for the developed world to produce ethanol on a small scale for their own energy security, and import the bulk of their supplies from tropical countries in Africa, Asia and Latin America. The United States, for example, operates a tariff of $0.54 per gallon against ethanol imports, at the behest of corn-belt ethanol producers, in addition to the substantial subsidies paid by state and federal government programmes and tax breaks offered to these producers (dominated by giants such as Cargill and ADM). If countries of the North were persuaded to end subsidies to their own domestic producers of bioenergy feedstocks (such as corn), then the major source for the inflation of food prices worldwide would be addressed.[7]

It is trade between the South as producer of biofuels and the countries of the North (i.e. the OECD) as consumers of biofuels that will finally make the difference. There is an historic opportunity to achieve a global trade agreement, that would open the markets of the North to products from the South, subject to tropical countries agreeing

7 Again, the debate over the impact of biofuels production on food prices reflects practices in the countries of the North rather than those of the South. For a balanced presentation of the issues, see the report by DEFRA (2008).

to Codes of Practice that ensure that biofuels be produced sustainably and responsibly. Such a comprehensive agreement might be termed a Biopact (Mathews, 2007). It is the countries of the South that need to take the determined diplomatic initiative to propose such a Biopact to the countries of the North (e.g. those grouped in the OECD) and to do so quite consciously as a step towards resolving the long-standing impasse in world trade issues where the markets of the North have been closed to primary commodity exports from the South.[8] Here, the WTO has an enormously important role to play, in ensuring that the coming biofuels century is not wrecked at the outset by short-sighted protectionist measures enacted by the developed world to obstruct global trade in biofuels.[9]

5. Conclusion: energizing industrial development

Energy options are now an essential component of a country's development strategy. Building a development pathway around renewable energies and biofuels has the potential to unlock a chain reaction of favourable activities: creating a successful national and export industry; promoting a space for local entrepreneurship and particularly rural entrepreneurship; creating an advanced science and technology-based industry that will create an incentive to stay abreast of technological developments in biofuels and bioreactors generally; demonstrating the significance of government policy in creating the right conditions for the industry to develop; and breaking down resistance to other renewable energy industries, like solar and wind, thus putting a country onto a development trajectory less dependent of fossil fuels.

Developing countries, in addition to all these advantages, can kick-start their own process of industrial development by focusing seriously and urgently on the building of a biofuels industry and on all its concomitants, such as the promotion of entrepreneurship, exports and

[8] See the letter from John Mathews to the *Financial Times*, "Biopact could end deadlock on Doha", 23 April 2008.

[9] A group of energy and biofuel experts met at the Rockefeller Foundation's Bellagio conference site on Lake Como in March 2008 to discuss these issues, and drafted a Consensus document calling for such a Biopact between countries of the South and of the North. The Sustainable Biofuels Consensus placed emphasis on a Biopact embodying the most stringent certification procedures for ensuring sustainability of the biofuels being produced. For the text of the Consensus, see: energybulletin.net/43021.html

cluster development. But the opportunity opened up by past dithering on the part of developed countries over whether to get behind renewable energies and biofuels in a big way is likely to close soon. If the World Bank were to promote biofuels industries for developing countries as a major priority, and if this commitment were matched by initiatives in developing countries themselves to build renewable energy industries, then the results could be dramatic. Not only would there emerge unexpected solutions to peak oil and greenhouse gas emission problems, but the countries concerned could energize their own development strategies.

The success of developing country programmes to harness renewable energies and biofuels for industrial development efforts as well as energy security, depends on their capacity to mobilize the technological capabilities involved – exactly as foreseen by Sanjaya Lall. In his numerous studies on this theme, such as the work conducted with UNCTAD and with UNIDO where I collaborated with him, the key to progress was always seen to be the building of technological capabilities that would enable countries to become players in the industrial dynamics of the time. The time now calls for the building of technological capabilities in renewable energies and biofuels, as keys to non-fossil fuelled development. Sanjaya would no doubt be fascinated to see these developments, and would be gratified by the role that his insights will play in bringing them to a successful conclusion.

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RESEARCH NOTES

Emerging economies' transnational corporations: the case of Tata*

Andrea Goldstein**

The Tata Group plays a central role in the Indian economy and is currently at the fore of the internationalization efforts by its companies. This paper assembles available evidence on the internationalization of Tata firms and considers the relative importance of underlying factors driving the process: market access for exports, sourcing of raw materials, and horizontal or vertical integration. It then analyses how internationalization is changing the nature and corporate culture of Tata, and the implications of some of the conglomerate's specific features, including the role played by Tata Sons and Tata Industries in coordinating financial and managerial activities and managing the Tata brand, as well as the strong emphasis on corporate social responsibility, mainly, though not exclusively, through the Tata trusts.

Keywords: globalization, India, emerging multinationals, business groups, post-merger integration

1. Setting the stage

The international expansion of large companies from emerging markets is a new and dynamic feature of the global investment landscape.[1] The Indian corporate sector has been an active participant in this phenomenon. The total value of outward foreign direct investment (FDI) from India, which stood at $2.3 billion in the 2004/05 fiscal year, is projected to reach $26.5 billion in 2008/09 (Economic Advisory Council to the Prime Minister, 2008). Among Indian companies expecting to engage in M&A in the next few years, 94% of them consider it likely to be a cross-border acquisition (Grant Thornton, 2006).

* This paper is a much-condensed and updated version of Goldstein (2008). I acknowledge the assistance of A. Vishwanath at Tata Sons and RIS in Delhi. For helpful comments and suggestions on earlier drafts, I also thank Suma Athreye, Dilek Aykut, Neil Gregory, Devesh Kapur, Sandeep Kapur, John Mathews, Ravi Ramamurti, Alan Rosling, Jayati Sarkar, and Mira Wilkins, as well as Masahiro Kawai, Arvind Panagariya and other participants at the 2007 TCFGS conference in Tokyo and the 2008 MERIT workshop in Maastricht. The author is solely responsible for the content. The views expressed do not represent those of the OECD or its Members.

** At the time of writing, Andrea Goldstein was Senior Economist at the OECD Development Centre, Paris.

1 See, for example, Goldstein (2007) and UNCTAD (2006).

While this is not the first extended period of internationalization for large Indian businesses[2], the geography and the circumstances of outward FDI differ from earlier periods. Most investment deals are directed at more advanced markets, reflecting the increasing competitivness of Indian companies arising from cost advantages, production efficiency, managers' willingness to take on risk, and exposure of domestic companies and their management to Western and Japanese competitors. Following the progressive relaxation of foreign exchange controls, Indian companies can now invest up to 300% of their adjusted net worth without prior permission. Government is also playing its role, providing political support to Indian companies and managing the economy and the rupee in a way that is conducive to outward FDI.

A number of recent studies have tried to shed light on the intriguing phenomenon of the rise of transnational corporations (TNCs) from what is still one of the world's poorest countries. Kumar (2007) finds that Indian enterprises draw their ownership advantages from accumulated production experience, cost effectiveness of their production processes and other adaptations to imported technologies made with their technological effort, and sometimes with their ability to differentiate product. Ramamurti and Singh (2009) identify four "generic internationalization strategies", each based on a different set of competitive advantages, governed by a specific logic, and resulting in a different choice of target markets and modes of entry. Elango and Pattnaik (2007) find that Indian firms draw on the international experience of their family and overseas networks to build capabilities to operate in international markets.

In this paper, I focus on one of India's two largest conglomerates, the Tata group.[3] Which Tata firms are at the forefront of internationalization, and why? How do they internationalize, and in which countries? Does the business group structure of Tata impact on the way the affiliates internationalize? Finally, what impact is internationalization having on Tata firms' values and culture?

The methodology for answering these questions is narrative and inductive. The analytics is embedded in the eclectic literature that has analyzed big businesses in emerging economies like India. In particular, insights are sought from the work of Tarun Khanna, who has shown – in his writing with Krishna Palepu (Khanna and Palepu, 2005) and Yishay

[2] Already in the 1970/1980s, Indian firms invested abroad, but mostly in countries less developed than India (Lall, 1983).

[3] Reliance (Mukesh Ambani) is at present the largest business group.

Yafeh (Khanna and Yafeh, 2007) – that in a typical medium-developing country, the lack of capital and other markets has spurred the formation of conglomerates as a proxy for such missing institutions. From this perspective, concentrated ownership plays a socially useful role, contrary to the views that it serves to perpetuate the domination of few business entities and stifle competition. Another study that is relevant for studying a group like Tata is Amsden (2001), which observed that, partly because of the weak development of such markets in emerging economies, the state has played (and may still play) an important role in nurturing successful domestic enterprises, which have often taken the form of conglomerates in order to diversify widely into unrelated activities.

Section 2 presents a short summary of Tata history, before turning, in section 3, to three features that make it distinctive: the conglomerate nature; the role of the two different "financial heads" at the top of the pyramid in providing a broad range of services to the business units; and the strong emphasis on corporate social responsibility and philanthropy. Section 4 then reviews Tata's internationalization process and the implications, especially in terms of the sustainability of these three distinctive features.

2. A brief history of Tata[4]

The Tata Group is almost 150 years old. It currently comprises 96 operating companies,[5] which together employed some 330,000 people and had revenues of $28.8 billion in 2006–2007, the equivalent of about 3.2% of India's GDP. Tata is active in seven major business lines: information systems and communications, engineering, materials, services, energy, consumer products and chemicals. At the end of June 2008, its 27 publicly listed companies had a combined market capitalization of $49.6 billion, which is the largest among Indian business groups in the private sector, and a shareholder base of almost 3 million. The Group has operations in more than 54 countries and its companies export products and services to 120 countries.

[4] In preparing this section, I accessed the Tata Group websites in July–September 2007 and July 2008. Tata provides an unusually large amount of information on its site, including independent media reports which are not necessarily favourable to its management.

[5] The number of companies controlled by the group peaked at 150 in 1969 (Tripathi and Jumani 2007, p. 160).

Founded by Jamsetji Tata in 1868, the group has always been controlled by the Tatas, a Parsee family of the close-knit Zoroastrian community, and the Tata Trusts.[6] Prior to independence, the Tata Group pioneered several "firsts" in India's industry, including the first private sector steel mill, the first private sector power utility, the first luxury hotel chain, the first production of ammonium sulphate, and the first international airline. Table 1 describes the diversification pattern of the group. In 1938, the group had 14 companies (Piramal 1998, p. 432). After 1947, the Nehru government awarded several projects to J.R.D. Tata (who had been elevated to the top post in the Tata Group in 1938) as part of the nation-building effort. For example, Telco collaborated with the government and Hindalco to set up Hindustan Aeronautics.

Tata also helped revolutionize business practices in India. From instituting the eight-hour work day and paid leave to providing a retirement gratuity, it created a standard by which other companies measured themselves. J.R.D. Tata blended humane business practices with political savvy and a pioneering spirit; he is remembered as India's most important and influential business leader. Nonetheless, the relationship with the government soured, notwithstanding the financial support that Tata kept providing to the Congress government (Das, 2002). Other groups – most notably Birla and Reliance – rapidly built political, social, and reputational capital in the 1970s and began to challenge Tata's prominence. Still, when the coal mines were nationalized in 1971, mines owned by Tata Iron and Steel Company were left untouched "on the ground that [they] 'would provide a model for the nationalized mines'" (Piramal, 1998, p. 557).

Strong connections with foreign groups and a well-built brand value enabled the Tatas to enter into new sectors in the 1980s, when a limited liberalization process started. Nonetheless, the conglomerate became unwieldy, as some of the operating companies independently diversified into new businesses, sometimes with little coordination. As explained in more deteail in the following section, the governance of the group traditionally left considerable leeway to individual operating

[6] Despite the fact that "the Tatas are not a fecund family" (Piramal 1996, p. 367), the sole non-Tata chairman was Sir Nowroji Saklatvala in 1932–1938. Construction magnate Shapoorji Mistry and his son Pallonji S. have owned a 17.45% (later increased to 18.37%) stake since the late 1930s, making them the single largest shareholder of Tata Sons. The Mistrys bought out a 12.5% stake in Tata Sons from the estate of solicitor F.E. Dinshaw sometime in the 1930s. They increased their stake later in the decade from some members of the Tata family.

Table 1. Diversification pattern of the Tata Group

Industry	Indian operations	Foreign operations (excluding sales offices)	Tata equity stake	
			1992	2007
Textiles	1874-2001		n.a.	n.a.
Hospitality	1902	1982	41	28.28
Steel	1907	2005	8	30.52 [1]
Power	1910		17	33.41 [2]
Cement [3]	1912–1990s & 1993–		n.a.	n.a.
Soaps and toiletries	1917–1983 [4]		n.a.	n.a.
Insurance	1919–1956 [5] and 2001	1920	n.a.	n.a.
Printing and publishing	1931–2003		n.a.	n.a.
Aviation	1932–1953 [5]		n.a.	n.a.
Chemicals	1939	2005	30	31.60
Consumer electronics	1940		n.a.	n.a.
Cosmetics	1952–1998		n.a.	n.a.
Air-conditioning [6]	1954		22	27.61 [7]
Pharmaceuticals	1958–1998		n.a.	n.a.
Tea and coffee	1962	2000	30	32.34 [8]
ICT	1968	2005	n.a.	81.65
Locomotives	1970		n.a.	n.a.
Financial services	1984		100	100
Real estate	1984		100	100
Watches	1984	2007 [9]	25	47.11
Management consulting	1991	2005	n.a.	n.a.
Telecom services	1994	2005	n.a.	50.11
Auto components	1995	2005	n.a.	n.a.
Motor vehicles	1998	2004	n.a.	33.43
Retail	1998	n.a.	n.a.	29.81
Car components	2005	n.a.	n.a.	100
Retail (electronics)	2006	n.a.	n.a.	100 [10]
Fresh Produce	2007	n.a.	n.a.	50 [11]
Defence	2007	n.a.	n.a.	100
Retail (supermarkets)	2008	n.a.	n.a.	50 [12]

1 Including Tata Sons (24.08) and Tata Motors (4.45).
2 Including Tata Sons (30.26), Tata Iron and Steel (2.57) and other entities.
3 Tata Cement was sold to Lafarge in 1999. TCL's cement plant was set up in 1993 as a means of handling the effluents generated in the production of soda ash and is therefore small, ancillary to the main activities at Mithapur.
4 Sold to Hindustan Lever.
5 Nationalized.
6 Acquired Volkart Brothers, a Swiss trading firm operating in Bombay since 1851.
7 Including Tata Sons Ltd. (23.79) and Tata Investment Corporation (2.87).
8 Including Tata Sons (19.10), Tata Chemicals (7.31), and Tata Investment Corporation (4.88).
9 Announced an assembly plant in Viet Nam; opened boutiques in Malaysia, Pakistan and the United States in 2008.
10 Croma is owned by Infiniti Retail, a 100% affiliate of Tata Sons, while Woolworths of Australia provides technical and sourcing support.
11 TCL stake in a JV with Total Produce of Ireland.
12 Star Bazaar's exclusive franchise agreement with Tesco.

Source: Lala (2004, p. 216) for 1992 Tata's stakes in selected affiliates; annual reports and Tata.

affiliates.[7] In 1996, Tata Sons held a minority stake in these companies varying from 3% to 13%; the Tata companies together owned almost 13% of Tata Sons. According to Jaipuria (2002), "the professional management of each of the Tata companies in operation had total control on the companies and ran it as their fiefdom. However, they still fell back on the Tata name when it suited their purpose like raising funds or asking the central Tata management for a bail-out" (p. 4). In fact, the paradox is that, despite being a confederation of loose entities, there was a lot of activity among Tata companies in the form of intra-group loans, cross-shareholdings, and interlocking directorates.

This lack of central control was the fundamental problem facing Ratan Tata in 1993, when he took the helm following the death of J.R.D. Tata.[8] Tata had then sales of approximately $2 billion, although this number is misleading when it comes to appreciating the complexity of the conglomerate. It comprised 84 companies of which 39 were listed. Trucks (i.e. Tata Motors, previously Tata Engineering and Locomotive Company, Telco) made up for 30% of sales, steel (i.e. Tata Iron and Steel Company, Tisco) 23%, and chemicals (i.e. Tata Chemicals) 16% (Piramal, 1996, p. 368). The number of employees were 242,000 in 1993, comparable to General Electric, which had 222,000 employees in the same year (Khanna and Palepu, 2000, p. 871). In 1998, Tata trimmed the lines of businesses from 25 to 12 and reduced the number of group-affiliated firms from 80 to 30 (Naik, 2001).

To tackle the problem of limited central control, Tata Sons made a rights issue, to which operating companies more or less had to subscribe. Even now, the group would like to increase the stakes in its major holdings to 51% over time to give it even firmer control.[9] Ratan Tata created a corporate office of directors with enough clout to enforce discipline on the operating units.[10] In addition, he gave up some companies in traditional industries, such as textiles, and focused on other areas, such as automobiles. Under Ratan Tata, the group has entered a

[7] In fact, it is doubtful whether the practice of holding minority – often very small – stakes in listed companies helped to augment the Tatas' financial lever. In India, corporate control is gained with a 26% stake.

[8] Ratan had chaired Tata Industries since 1981. In 1982, he had drawn up a master plan for restructuring the group that was largely ignored ("Transforming Tata", *Business Week*, 21 March 1994).

[9] "Magna Tata", *CFO Asia*, December 2005/January 2006.

[10] "Reinventing Tata", *The Economist*, 17 February 2001.

few new businesses, of which by telecoms is the most important (Table 1 above).[11]

The group revenue has more than trebled since the fiscal year 1999–2000, to reach $29 billion in 2006–2007, of which over 37% is from exports and foreign production (table 2). the group turnover is increasingly concentrated in the three largest business segments, with a participation that has gone up from 53% to 78%, while that of the next two largest ones has decreased from 22% to 13% (Table 3).

Table 2. Tata Group basic financial data since 1999

Year	Group revenue	International revenue incl. exports ($ bn)	International revenue incl. exports (%)
1999-00	8.91	n.a.	n.a.
2000-01	9.04	n.a.	n.a.
2001-02	10.37	n.a.	n.a.
2002-03	11.21	2.54	22.67
2003-04	14.24	3.19	22.41
2004-05	17.79	4.72	26.54
2005-06	21.88	6.76	30.89
2006-07 (estimate)	28.81	10.73	37.25

Source: Tata.

Table 3. Evolution of Tata Group main business segments since 2000

Revenue	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07
Materials	23	19	21	22	21	23	22
Engineering	28	25	25	29	31	32	30
Energy	9	8	9	8	8	7	6
Consumer goods	11	8	7	7	6	5	5
Chemicals	6	5	5	5	5	4	5
ICT	12	26	23	22	19	20	26
Services	11	9	10	9	10	9	7
Total	100	100	100	100	100	100	100
3 largest	*53*	*60*	*69*	*73*	*71*	*75*	*78*
5 largest	*75*	*77*	*88*	*90*	*89*	*91*	*91*

Source: Tata.

[11] Videsh Sanchar Nigam Limited (VSNL) was privatized in February 2002, with Tata buying 45%. Privatization in India has advanced less than in other developing countries and the resulting lack of diversification opportunities may have played a role in the recent trajectory of the Tata Group.

Engineering is the principal area of operations. In the 1990s, Tata Motors was the first car maker in a developing country to engineer and produce cars from the ground up. The pioneering use of concurrent engineering initiatives helped Tata Motors to reduce the product development cycle time (Bowonder, 2004). The time needed to change a die on the passenger car assembly line went from two hours in 2000 to between 12 and 15 minutes. Thanks in part to making dies for Jaguar, Ford, General Motors and Toyota and allowing Mercedes to run made-in-India vehicles through its paint shop, Tata Motors's break-even point for capacity utilization is one of the best in the industry worldwide. Tata Motors was listed on the New York Stock Exchange in 2004. It exports 11% of output, mostly to South Africa.[12]

Materials, and steel in particular, is the second core area. In the early 2000s, Tata Steel improved management of raw materials and halved its workforce, from 75,000 to 40,000, to become one of the world's most efficient producers.[13] In 2005, Moody's assigned Tata Steel the Baa2 fundamental rating – one notch above the sovereign rating for India at the time – and World Steel Dynamics named it "the best steel company in the world".

Finally, information and communication technology (ICT) services have emerged over the past 15 years as the fastest-growing large-scale business segment. Tata Consultancy Services (TCS), established in 1968, is the oldest and largest of India's outsourcing specialists. TCS first championed the "global delivery model", whereby cheap but highly-educated workers in the subcontinent are put to work writing software and managing computer systems and business processes for clients in the West. Its ambition is to be among the top-ten biggest business consulting and ICT services groups in the world by 2010. In 2004, Tata Sons floated TCS, selling 19% of the company and raising $1.2bn in India's biggest ever initial public offering.

3. Tata's current structure

Tata is a conglomerate like many others in the developing world, although each of its two "financial heads" performs a different role.

[12] Nonetheless, truck and bus sales plunged by 40% in 2000 and the company lost $110 million. Between 2000 and 2006, nearly 6,000 workers were made redundant with early-retirement deals ("The Next People's Car", *Forbes*, 16 April 2007).

[13] For details of relative cost for different categories, see "Tata Shows the Way", *Far Eastern Economic Review*, 12 February 2004 and "Unusual steel link-up that could make sense", *Financial Times*, 11 October 2006.

What makes the group peculiar, if not unique, is the fact that one of these two heads is more than a simple financial holding, as it also centrally manages the Tata brand and provides high-level training. Moreover, the value of the brand itself is associated with the philanthropy activities performed by the trusts that control the two promoter companies.

3.1 Conglomerate

Tata Sons and Tata Industries (TIL) are the two promoter companies. Tata Sons was established as a trading enterprise in 1868 and continued to promote and manage all major Tata companies until 1970 when the managing agency system was abolished. Tata Sons is the owner of the Tata name and the Tata trademark, which are registered in India and several other countries. Although the group is no longer a legal construct, it still holds the bulk of shareholding in these companies. The chairman of Tata Sons has traditionally been the chairman of the Tata Group. TIL was set up by Tata Sons in 1945 as a managing agency for businesses it promoted. TIL's mandate was recast in the early 1980s to promote the entry into new and high-tech areas. These ventures are often partly financed by Tata Sons and the main Tata Group companies, with TIL generally maintaining a 10–20% stake.

The Tata Group is currently headed by Ratan Tata. The Group Executive Office (GEO) and the Group Corporate Centre (GCC) are the two decision-making bodies that define and direct the business operations of the Tata Group. Created in 1998, the GEO defines and reviews the business activities of the Tata Group, to make it more synergistic and create a shared understanding of a Tata company's current activities, its strengths and its weaknesses. The mandate of the GCC is to guide the future strategy and direction of the Tata Group and to work in close coordination with the GEO.

3.2 Coordination mechanisms

Tata Group companies have various mechanisms of coordination. Tata Administrative Services, now known as TAS, ensures the recruitment of talented managers. In the 1950s, J.R.D. Tata conceived TAS to select and groom some of the best young Indians, provide them opportunities for professional growth, and use that pool of talent as a group resource. The importance of TAS as a form to mould and socialize Tata managers, however, has declined over the years – nowadays only one of the 14 (all male) CEOs is a TAS graduate, although two CEOs also joined the group as trainees and one is a family member (Goldstein 2008, Table D).

In 1996, Tata Sons introduced a "Brand Equity and Business Promotion Agreement". All companies wishing to use the Tata name and brand must sign the agreement, pledging to pay an annual royalty to Tata Sons equal to between 0.1% and 0.2% of their revenues. The agreement also forces companies to adhere to the Tata Code of Conduct and to adopt the Tata Business Excellence Model (TBEM), a quality management system based on the Malcolm Baldridge Model.

From a strictly legal point of view, in terms of governance the Tata companies does not outshine the rest of corporate India. The fact of being "associated with a large family business group […] compensated for this institutional void, particularly through the availability of an internal market for capital and labour" (Udayasankar and Das 2007, p. 265). The situation has changed rather rapidly in recent years – TCS now boasts six independent directors out of eight on the company's board, while at Tata Motors, the four independent directors comprise more than one third of the total on the board.[14]

3.3 Philanthropy and social engagement

Another special aspect of Tata is the fact that nearly two-thirds of the equity of Tata Sons is held by philanthropic trusts. In a short note on Jamsetji Tata, N.S.B. Gras (who held the first chair in business history at Harvard's Graduate School of Business) wrote that "he saw clearly that the business man was in effect but a trustee of wealth; that, since he could not take all his wealth with him, he should during his life provide for its use on behalf of the Indian people" (Gras, 1949, p. 150). The Sir Ratan Tata Trust was established in 1918 following the death of Sir Ratan Tata, Jamsetji's younger son, and it operates to further "the advancement of education, learning and industry in all its branches". The Sir Dorabji Tata Trust was established in 1932 by Sir Dorab Tata, Jamsetji's elder son, who bequeathed all his wealth, including the famed 245-carat Jubilee diamond, just before his death. The Trust is known for promoting pioneering institutions of national importance. The "allied trusts" component of the Sir Dorabji Tata Trust comprises the Tata Social Welfare, RD Tata, Tata Education, JRD Tata, JRD and Thelma

[14] In family-controlled groups, intergenerational transfer is an additional issue. Tata Sons averted a succession crisis in July 2005 by temporarily extending the retirement age of non-executive directors from 70 to 75, allowing Ratan to stay on until 2012. Pallonji Mistry's son-in-law Noel Tata is Ratan's half-brother and Managing Director of Trent, the group's retail flagship. It is sometimes rumoured in corporate circles that he may become Tata Sons' chairman ("Missing the action", *Businessworld*, 16 October 2006).

Tata, Jamsetji Tata, JN Tata Endowment, Lady Meherbai Tata Memorial, and Lady Meherbai Tata Education Trust. The Tata Social Welfare Trust and the Tata Education Trust were founded in 1990. The Trusts' trustees mostly belong to the family, although selected executives from outside the family are also appointed.

In 2007, Tata Trusts' total grants amounted to $58 million and the Tata companies' "contribution to social welfare" was $61 million. Individual companies' examples are illustrative of the scale and scope of this engagement. In 2001, Jamshedpur Utilities and Services Company Limited (JUSCO), a wholly owned affiliate of Tata Steel, was running 23 schools with 22,474 pupils and a hospital with a capacity of 1,200 beds.[15] Tata Motors' code of conduct is formulated around the ILO Declaration on Fundamental Principles and Rights at Work. The company requires its SME vendor companies to guarantee freedom of association and compliance with national labour legislation, including the minimum wage. Dagaur (1997) found that Telco provided apprenticeship training to more than the prescribed number of apprentices. Tata-AIG has developed an innovative micro-insurance delivery model. Building around TBEM, the Tata Council for Community Initiatives (TCCI) helps Tata companies in streamlining social development, environmental management, biodiversity restoration and employee volunteering objectives into corporate processes. TCCI is headed by Kishor Chaukar, a member of the Tata GCC, and counts 43 chief executive officers of Tata companies among its members. TCCI is also involved in assisting Tata companies address the sustainability subject through the United Nations' Global Reporting Initiative.

4. Internationalization by the Tata group

4.1 Main trends

The Tatas' outlook has been outward-oriented from the very beginning. Tata Limited was established in London in 1907 as the Tata Group's representative in Europe. During the Second World War, the Tatanagar, a light armoured car, "was used extensively by the British Army engaged on the North African front" (Tripathi and Jumani 2007, p. 129). Immediately after the Second World War, Tata Incorporated was established in New York as the representative office of the Tata Group in the Americas.

[15] "Galvanised by freedom from social duty", *Financial Times*, 10 July 2001.

The Tatas' personal backgrounds have also been very international. Sir Ratan owned York House in Twickenham, London, and many Tatas are buried overseas. J.R.D. Tata was educated in France, Japan and England before being drafted into the French army for a mandatory period of one year. A fascination with planes led J.R.D. Tata to create Air-India through befriending the son of Louis Bleriot, the French flying pioneer. Finally, social engagement has also transcended national borders. Between November 1909 and August 1912, Sir Ratan donated £5,000 to assist Mahatma Gandhi's fight for the rights of the Indians in South Africa. In 1912, the Sir Ratan Tata Foundation gave seed research funds to Sidney and Beatrice Webb, the founders of the London School of Economics.

In the 1950s, various Tata companies cooperated with foreign partners, such as Daimler Benz and the World Bank. As developing countries gained independence, the group implemented many donor-funded turnkey projects in Africa and West Asia. Tata International was established in 1962 to offer value-added services in international trading focused on leather and engineering. It also managed customer support facilities for Tata vehicles and design studios for leather products. Established in 1972, Singapore-based Tata Precision Industries specializes in high-precision machining, precision fine blanking, engineering plastic moulded parts and tool design.[16] Nonetheless, the Tatas' international reach at the time was much smaller than other large Indian conglomerates such as the Birlas, the Thapars or the Kirloskars (Tripathi and Jumani 2007).

In the 1990s, globalization led to new institutional innovations. A wholly-owned affiliate of Tata International, Tata Africa Holdings, was established in Johannesburg in 1994. Tata Limited in London became an agent for the global procurement of goods and services for the entire Tata Group. Switzerland-incorporated Tata International AG and its trading affiliates promote and invest in various enterprises and projects overseas. All these milestone notwithstanding, the Tata Group's operations were mostly India-focused until recently. Even in the case of tea, possibly the most outward-looking business, international sales accounted for only 12% of total sales (Chattopadhyay and Lege, 2005). Similarly, while Titan is one of the world's top six watch manufacturers, its overseas operations are limited to a commercial presence.

[16] The Tata Government Training Centre (TGTC), supported by the Government of Singapore, was the first training institute of its kind in Singapore.

In a 2004 interview, Ratan Tata "visualize[d] in the next few years the following companies to be the international face of the group: TCS, Tata Motors, Indian Hotels Co., and to some extent, one which won't be that visible, is Tata Power".[17] He has been preaching the need to internationalize in giants strides, not in token, incremental steps.[18] As it turned out, two other companies in the stable have made the largest acquisitions. In 2000, Tata Tea acquired Tetley in a £271 million ($432 million) leveraged buyout that was the largest takeover of a foreign company by an Indian one to that date. (A short analysis of the post-merger trajectory is presented in the following section.) In early 2007, Tata Steel acquired Anglo-Dutch firm Corus for $11 billion – the largest acquisition by an Indian firm and the fourth-largest ever in the steel industry – and secured the largest loan ever for an Indian company. Then in June 2008, Tata Motors completed the acquisition of the Jaguar and Land Rover (JLR) businesses from Ford, in an all-cash $2.3 billion transaction.

Notwithstanding these notable exceptions, most other acquisitions have been relatively small – in the sense that the target company is much smaller in size than the Tata company making the bid.[19] The total sum of the acquisitions for which the value of transation is available is just over $18 billion, of which 65% corresponds to the Corus takeover and 68% to Tata Steel in general. In terms of the host country, the United Kingdom accounts for 82% – largely due to the Corus deal. Finally, operations concluded in 2007 alone account for 67% of the post-2000 total.

The extent of corporate internationalization can be gauged through different indicators, including the proportion of assets, sales and employment outside one company's home country. Unfortunately, such data are not available for Tata companies in a way that would be consistent with the UNCTAD methodology for computing a transnationality index. Table 4 provides (incomplete) information on the importance of foreign operations for Tata affiliates. It shows that sales (by location of customer) are very internationalized for TCS and Tata Tea, but also for pre-Corus Tata Steel (by location of affiliate). While the very high figure for TCS clearly reflects the fact that the majority of the business is export of services performed in India, the share of non-Indian employees is also

[17] "Ratan Tata's trials and triumphs", *Business Week*, 26 July 2004.

[18] "Ratan Tata's Global Quest", *Businessworld*, 9 October 2006.

[19] This is different from the pharmaceutical industry, where Indian companies have grown by large acquisitions in OECD markets.

very substantial (with no fewer than 67 nationalities represented in the payroll).[20]

Table 4. Tata companies' internationalization profile

Company	Motivation	Main mode of outward investment	Regions of outward investment			Foreign assets (% of total assets)	Foreign sales (% of total sales)	Foreign employment (% of total)	Directors
			A[1]	EMs[2]	ICs[3]				
Indian Hotels Company	Market-seeking (serve Indian travellers)	Greenfield and management contracts (failed attempt to acquire Orient Express)	√		√	22.85[4]	n.a.	n.a.	1/9
Tata Chemicals	Resource-seeking (source natural soda ash)	Acquisitions		√	√	n.a.	n.a.	n.a.	0/10
Tata Motors	Efficiency-seeking	Acquisitions			√	n.a.	9.54	n.a.	0/11
Tata Steel	Market-seeking	Acquisitions		√	√	n.a.	41.01	n.a.	4/14
Tata Tea	Market- and efficiency seeking (brands)	Acquisitions	√	√	√	n.a.	74.95	n.a.	2/10
TCS	Market-seeking	Greenfield	√	√	√	n.a.	91.00	9.6[5]	5/8[6]
Titan Industries	n.a.	n.a.				n.a.	5.54	n.a.	0/10
Voltas	n.a.	n.a.				n.a.	n.a.	n.a.	0/8
VSNL	Market-seeking	Greenfield		√	√	n.a.	n.a.	n.a.	0/11

Notes: (1) Asian emerging markets, excluding Korea; (2) non-Asian emerging markets, including Central and Eastern Europe; (3), industrial countries, including Korea; (4) number of properties weighted per stars (Luxury Hotel = 5, Business Hotel = 4, Leisure Hotel = 3, and Ginger Hotel = 2); (5) refers to non-Indian employees, regardless of location; (6) including non-resident Indians Aman Mehta and Venkatraman Thyagarajan.

Sources: companies' annual reports, 2007.

Directorship and management composition constitute another dimension of internationalization. At Tata Sons, besides Group chairman Ratan Tata, the GEO comprises five Indian nationals and one foreigner. The same six individuals sit on the GCC, which also comprises three additional Indian nationals. Out of the 11 Tata Sons directors – all of them male – five have received foreign degrees, although only four seem to have worked abroad prior to joining the Tata Group (Goldstein 2008, Table F).[21]

Each company has its own management, which is more international, with two Americans among the Group's top 13 executives.[22]

[20] An interesting anecdote is that TCS has more than 600 Uruguayan employees even though India has no embassy in Montevideo!

[21] Alan Rosling worked with Jardine Matheson Group in Hong Kong. In 1996 Jardine Matheson bought 20% of TIL and Rosling represented the Hong Kong *hong* on the boards of TIL and Tata Automotive Components. He was also managing director of Concorde Motors, a Jardine-Tata joint venture.

[22] At this level there is one interlocking directorate (Tata Motor managing director Ravi Kant is also on the Voltas board) and only one top executive has worked for

Among the operating affiliates, non-Indian residents account for a large percentage of directors for TCS and post-Corus Tata Steel only (Table 4). With the appointment of Andrew Robb as non-executive independent director and Deputy Managing Director in November 2007, there are now five Corus directors in the 14-member board of Tata Steel. TCS is the only Tata company with multiple Indian directors based overseas – a practice that other Indian corporates such as Infosys have also adopted to raise their global profile (Khanna and Palepu, 2004).

4.2 Drivers and determinants

With so many large companies and so many M&A deals, it is fair to say that Tata's overseas expansion fits into all of Dunning's standard categories for explaining internationalization. A textbook case of resource-seeking internationalization is Tata Chemicals, the world's third-largest manufacturer of soda ash after the acquisition of Brunner Mond's three plants, the second-largest producer in Europe, in December 2005. Strategically, Tata Chemicals can complement its stake in Indo Maroc Phosphore (IMACID) with a cheaper source of natural soda ash from Magadi, Kenya. The operation is unique in that the soda ash at that site is naturally produced and replenished, making it one of the lowest cost producers in the world.[23] Similarly, Tata Power has purchased a 30% equity stake each in two major Indonesian thermal coal producers and a related trading company. The companies are together among the top three largest exporting thermal coal mines in the world.

In the case of acquisitions in more developed markets, a combination of efficiency-, market-, and asset-augmenting motives can be detected. TCS acquired Switzerland-based TKS-Teknosoft to possess marketing and distribution rights to the QUARTZ® platform for wholesale banks, to add new products in the private banking and wealth management space, and for its track record of successful implementation of large and complex key technology projects in Europe. In the case of Tata Steel, the acquisitions of Singapore's NatSteel and Thailand's Millennium Steel in 2005 strengthened its position in higher value finished products in growing Asian markets. The acquisition of Corus brought access to the markets in the EU, especially in higher-value quality steel products. More generally, the aim of Tata Steel is to avoid the tariffs on imported finished steel products by producing in major steel consumer economies. In the case of Tata Motors, the purchase of Daewoo's commercial truck operation in 2004 served to combine

[23] The cost of producing natural soda ash is roughly 50% of synthetic soda ash.

Korean skills in end-uses for trucks, such as cement mixers and tippers, with the Indians' expertise for manufacturing chassis.[24] The acquisition of Incat, also by Tata Motors, in 2005 aimed at integrating engineering and design services skills into the auto business.

For Videsh Sanchar Nigam Limited (VSNL), competition at home has been the main driver.[25] VSNL's monopoly on international long distance voice – which accounted for nearly 90% of its revenue – came to an end two months after Tata took it over. In the period 2003–2005, three overseas acquisitions enabled VSNL to access advanced voice, data and signalling capabilities and more than 200 direct and bilateral agreements with leading voice carriers. VSNL has recently purchased a small French virtual network operator to target the European SME market and learn lessons applicable to India.[26]

While most Tata companies are growing by acquisition, TCS has invested more in greenfield projects. It opened a software centre in Hungary in 2001, reckoning that while outsourcing business processes to India may not be difficult for American and British companies, in non-English speaking countries India seemed remote. In China, operations started off as a back-up site staffed by Indians serving United States clients worried about what might happen in the event of an Indo-Pakistan war. Now TCS operation in the country is focused on the domestic market and employs 1,200 Chinese staff. TCS was the first Indian BPO company to invest across Latin America to provide near-shore services for United States clients and plans to open a facility in Cincinnati to qualify for IT outsourcing work that can only be done onshore, such as government contracts.

Finally, Indian Hotels, best known for its Taj luxury hotel chain, provides an interesting model of aggressive growth in different business and regional segments. The hotelier has earmarked $1.5 billion for international expansion to open new luxury properties in countries where it expects most of the customers to be Indian. In other venues, Taj has bought existing properties. In September 2007, it paid $211 million for a 10% stake in Orient-Express Hotels, the owner of iconic brands such as the Hotel Cipriani in Venice, and hinted at a deeper "possible

[24] "Giant stung into singing its praises", *Financial Times*, 22 March 2005. Tata Motors has also become the second-largest shareholder of Hispano Carrocera after the Múgica brothers.

[25] VSNL was renamed as Tata Communications on 31 October 2007.

[26] "L'indien Tata se lance à l'assaut des télécommunications européennes", *Le Monde*, 18 January 2007.

association", though the United States-based chain turned down the offer.

4.3 Challenges

Possibly the biggest challenge may be that the accumulation of acquisitions has undermined the focus on the core business. The case of Tata Motors is telling. Five years after Ratan first mentioned his dream of building a one-lakh (about $2,500) car, the Nano went on sale in 2008. In emerging markets, making cheap goods for customers at the "bottom of the pyramid" makes business sense. At the same time, in summer 2007, Tata Motors joined in the bidding for two of the world's most luxurious brands, Jaguar and Land Rover. The question has been raised as to whether winning trophy brands is a correct strategy when the ultimate objective is to gain the appropriate production scale and technology to be the world's lowest-cost car producer. More broadly, Tata as a group remains interested in promoting new businesses (Table 1), with some accompanying risks, e.g. launching a full-service bank may bring expose Tata to the complexity and pitfalls of intra-group lending.[27]

Second, integration issues are responsible for the relatively high failure rate of international M&As (Søderberg and Eero, 2003).[28] Tata companies have tried to develop an ability to understand the culture and business environment of the host country as a strategic tool for handling post-merger issues. In the Tata-Corus combine, a Strategic and Integration Committee chaired by Ratan Tata has been formed to facilitate integration and create a virtual organization across the combined businesses.

Although it is impossible to generalize on the basis of only one case, a study of Tetley suggests that Tata Tea has overcome some of the problems in post-merger integration.[29] As the acquisition was agreed by the Tetley's Board, employee resistance was reduced. The Tetley Group CEO became a Non-Executive Director of Tata Tea Limited in June 2000. In January 2002, Boston Consulting Group was appointed

[27] The necessary data on inter-operating company financial transfers to test the extent to which Tata group behaves like a proxy capital market (as per Khanna and Kalepu, 2005) is not available. At any rate, so far it is unlikely that this has happened in a scale comparable to South Korea, for instance (Sarkar, forthcoming).

[28] While not an acquisition, Tata Motors' partnership with MG Rover of the United Kingdom, signed in 2003, soon proved problematic and was terminated in 2004.

[29] Goldstein (2008) for more details.

to work out an integration agenda.[30] Two taskforces were created to identify specific areas where integration could be beneficial.[31] Tata Tetley became an affiliate of Tata Tea in December 2005. The Tata Tea and Tetley R&D teams have been integrated, as has been the IT, finance and communication infrastructure in order to fulfil stringent reporting and governance requirements.

The paradox is that the emphasis on collaboration rather than controlling as the adaptive model may make it more difficult to keep the distinctiveness of the Tata Equity Brand. In fact a crucial issue being debated within Tata is to what extent a group strategy, including a country-specific one, is needed to maintain coherence. In South Africa and, to a lesser extent, Bangladesh, Tata seems to be looking at opportunities for diversification into seemingly unrelated businesses along the lines of the home country trajectory (Goldstein, 2008, Table G). In contrast, no such strategy has been followed in the United Kingdom, although no fewer than 18 Tata companies operate there and generate $1.6 billion in sales in 2006–2007.[32] Although not explicitly stated as such, the reason may in fact be that operating as a conglomerate has advantages in a developing country context and not in an industrial one – despite the difficulties that Tata faces in Bangladesh for political reasons.

In keeping with the commitment to societal responsibilities, Tata Group has been actively involved in initiatives that promote the social and economic development of host countries. All the ten principles of the United Nations' Global Compact are incorporated in the Tata Code of Conduct.[33] Tata Steel is a founder member of the Global Compact and its Managing Director sits on the 20-member board of the Global Compact. The city of Jamshedpur is one among six in the world to be chosen to participate in the UN Global Compact Cities Pilot Programme.

The Adult Literacy Project in South Africa is of particular interest as the community development programme is adapted from TCS's computer-based functional literacy initiative that was implemented in India. The project was replicated in the North Sortho (Sepedi)

[30] Arun Maira, chairman of The Boston Consulting Group in India since 2000, held senior positions at Tata Administrative Services between 1964 and 1989.

[31] "Tata Tea, Tetley integration process to start next month", *Business Line*, 11 January 2002.

[32] "Ratan Tata's Global Quest", *cit*. In June 2007, the Jamsetji Tata Trust has pledged £1.8 million to the London School of Economics and Political Science to support research collaboration with the Tata Institute of Social Sciences.

[33] Tata Metaliks and Tata Tea were suspended from the Global Compact in 2005.

language in partnership with the WDB Trust, an organization that works in the areas of micro finance, entrepreneur training and education of impoverished rural women. Other synergies have been created in a skills-development program in rural South Africa that allowed trainees to be trained in jewellery making at the Titan plant in Bangalore and in decorating ceramic ware at Tata Ceramics in Kochi.

An additional issue is lack of recognition and the ever-lingering risk that an Indian company is treated as a sub-standard entity.[34] Again various Tata companies have started post-merger integration by bringing the board of the acquired foreign companies to India to show them the new owners' facilities.[35] As part of the drive to get the group's message across, the group is also opening offices in key countries.[36]

5. Conclusion

This paper has offered a first modest contribution in analyzing the time and geographic dimensions of Tata's internationalization. Since the opening-up of the Indian economy in 1991, Tata has been subjected to global competition, making it imperative for the group to become competitive in India against the new entrants. To gain scale, to reduce their exposure to the cyclicality of India's economy and to achieve a sustainable competitive position in industries that are globalizing, most Tata companies then looked overseas, primarily through acquisitions. Three companies have been at the forefront of this process – Tata Steel, Tata Motors, and TCS. As it pertains to challengers from formerly peripheral areas that internationalize in order to access resources (Mathews 2002), multiple factors have been at play, including the need to access new markets (*i.e.*, in BPO services), the opportunity to integrate the value chain and increase vertical integration (*i.e.*, in steel), and the quest for brand control and resource leverage strategies (*i.e.*, in tea and cars).

[34] "Corus workers are nervous. The boys were asking if we would have to wear safety turbans now" ("A passage to India for Corus", *The Sunday Times*, 22 October 2006). The general secretary of the steel industry trade unions, Community, later praised publicly Tata Steel for their "first class, modern and progressive operations" and its "modern, clean and extremely well-maintained" mills (Leahy, 2007).

[35] "Making It Work", *Businessworld*, 9 October 2006.

[36] "Tata parent seeks to head off barriers to bid for Corus", *Financial Times*, 7 October 2006. In the run-off to the 2008 Presidential campaign, TCS and other Indian BPO firms have also invested in lobbying services, to fight any allegation that outsourcing to their country destroys jobs in the United States. "Lobbying in U.S., Indian Firms Present an American Face", *The New York Times*, 4 September 2007.

The process of growth has consequences for the nature of corporations, their internal characteristics, and their relationship with stakeholders. Such dynamics is likely to be more complex in the case of a business group that is undergoing a rapid transformation. This strategy has proved feasible because Tata as a group possesses strong leadership. It successfully exploited the increasingly developed financial markets in India, a large domestic market and the surplus of global liquidity. Tata has not blindly embraced ready-made recipes to face the challenges of multinational management, preferring instead organizational solutions aimed at fostering mutual recognition and knowledge exchange within the multinational conglomerate. Standard & Poor's praised this way of managing the group in December 2006, writing that the "policy [of Tata] to support its companies and the improved financial profile of its entities also enhances the overall financial flexibility of Tata Motors." In the case of VSNL, a strategic link with TCS has given the advantage of offering customers a single partner option that can deliver a combined IT and telecom solution. Jaguar and Land Rover envisage to make use of Tata's extensive IT resources, including TCS.

Operating across borders and time zones and integrating diverse management teams and corporate governance practices do not seem to have modified the Tata imprinting. Tata, with its strong corporate culture (as defined in Hirota et al. 2007) and unique business model, is a good example of a company that has turned good corporate citizenship into good business. Ratan Tata has also said that the Tata group is not in favour of any hostile takeovers. This gentle approach and the credibility that Tata has managed to build and maintain may distinguish Tata from competitors. For instance, in 2007, the auto workers' union in the United Kingdom, Unite, said that Tata would be its preferred buyer for Jaguar and Land Rover.[37] In this context, another Tata advantage is the fact of being run by a very successful minority, the Parsees, without stirring anger amid the majority of the population (as is tragically common in other countries, see Chua 2002).

The questions addressed in this paper are of more than just academic interest. In today's world, employers have responsibilities not just to their own shareholders and employees, but also to the citizens in the communities in which they are located, wherever in the world that might be (e.g., Locke, 2003). Corporations eager to pursue

[37] Jaguar and Land Rover's new permanent chief executive considers Tata "a very principled organisation" and expects integration to be faster than with Ford, "where financial constraints made life much more difficult" ("Tata gives Jaguar Land Rover the freedom to cruise", *Financial Times*, 4 August 2008).

international opportunities have to take a hard look at the short- and long-term impact of their presence in a wider world where stakeholders are diverse, globally distributed, and no agreed-upon rules exist. Future research needs to analyze a broad variety of issues, from management practices and industrial relations, to the organization of R&D function and innovation.

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Table A.1. Major international acquisitions by Tata companies

Tata company	Acquired company	Location	Stake acquired (per cent)	Value	Date
Indian Hotels	Starwood Group (W Hotel)	Sydney, Australia	100	$29 million	December 2005
	The Pierre	New York, United States	Lease of property	$9 million	July 2005
	Ritz-Carlton	Boston, United States	100	$170 million	January 2007
	The Campton Place	San Francisco, United States	100	$58 million	April 2007
	Orient-Express Hotels	United States	10	$211 million	September 2007
Tata Autocomp Systems	Wündsch Weidinger	Germany	100	$9 million	September 2005
Tata Chemicals	Brunner Mond	United Kingdom	63.5	$111 million	December 2005
			36.5	$64 million	March 2006
	Indo Maroc Phosphore (IMACID)	Morocco	50	$38 million	March 2005
	General Chemical	United States	100	$1,005 million	March 2008
Tata Coffee	Eight ' O Clock Coffee Company	United States	100	$220 million	June 2006
Tata Communications	Neotel	South Africa	30	Not disclosed	June 2008
Tata Consulting Services	Comicrom	Chile	100	$23 million	November 2005
	Pearl Group	United Kingdom	75	$96 million	October 2005
	Financial Network Services	Australia	100	$26 million	October 2005
Tata Industries	Indigene Pharmaceuticals	United States	26<x< 30	Not disclosed	July 2005
Tata Interactive	Tertia Edusoft Gmbh	Germany	90	Not disclosed	January 2006
	Tertia Edusoft AG	Switzerland	90.38		
Tata Metaliks	Usha Ispat, Redi Unit	India	100	$25 million	January 2006
Tata Motors	Hispano Carrocera	Spain	21	$16 million	February 2005
	Daewoo Commercial Vehicle Company	Korea	100	$102 million	March 2004
	Jaguar Land Rover business from the Ford Motor Company	United Kingdom	100	$2.3 billion	

/...

Table A.1. Major international acquisitions by Tata companies (concluded)

Tata company	Acquired company	Location	Stake acquired (per cent)	Value	Date
Tata Steel	Millenium Steel	Thailand	67.11	$167 million	April 2006
	NatSteel Asia	Singapore	100	$286 million	February 2005
	Corus	United Kingdom/Netherlands	22.84	$12 billion	April 2007
Tata Sons through Tata Ltd and Tata Tea through TTGB Investments	Energy Brands Inc	United States	30	$677 million	October 2006
Tata Tea and Tata Sons	Tetley Group	United Kingdom	100	$434 million	February 2000
Tata Tea through Tata Tea (GB)	Good Earth Corporation & FMali Herb Inc	United States	100	$31 million	October 2005
	JEMCA	Czech Republic	100	$22 million	May 2006
	Joekels Tea Packers	South Africa	33.3	$2 million	September 2006
Tata Tech	INCAT International	United Kingdom	100	$90 million	August 2005
VSNL	Gemplex	United States	Assets and network	Not disclosed	July 2003
	Tyco Global Network	United States	100	$130 million	November 2004
	Teleglobe International	United States	100	$239 million	July 2005

Source: companies

World Investment Report 2008

Transnational Corporations and the Infrastructure Challenge

OVERVIEW

RECORD FLOWS IN 2007, BUT SET TO DECLINE

Global FDI flows surpassed the peak of 2000…

After four consecutive years of growth, global FDI inflows rose in 2007 by 30% to reach $1,833 billion, well above the previous all-time high set in 2000. Despite the financial and credit crises, which began in the second half of 2007, all the three major economic groupings – developed countries, developing countries and the transition economies of South-East Europe and the Commonwealth of Independent States (CIS) – saw continued growth in their inflows (table 1). The increase in FDI largely reflected relatively high economic growth and strong corporate performance in many parts of the world. Reinvested earnings accounted for about 30% of total FDI inflows as a result of increased profits of foreign affiliates, notably in developing countries. To some extent, the record FDI levels in dollar terms also reflected the significant depreciation of the dollar against other major currencies. However, even measured in local currencies, the average growth rate of global FDI flows was still 23% in 2007.

FDI inflows into developed countries reached $1,248 billion. The United States maintained its position as the largest recipient country, followed by the United Kingdom, France, Canada and the Netherlands (figure 1). The European Union (EU) was the largest host region, attracting almost two thirds of total FDI inflows into developed countries.

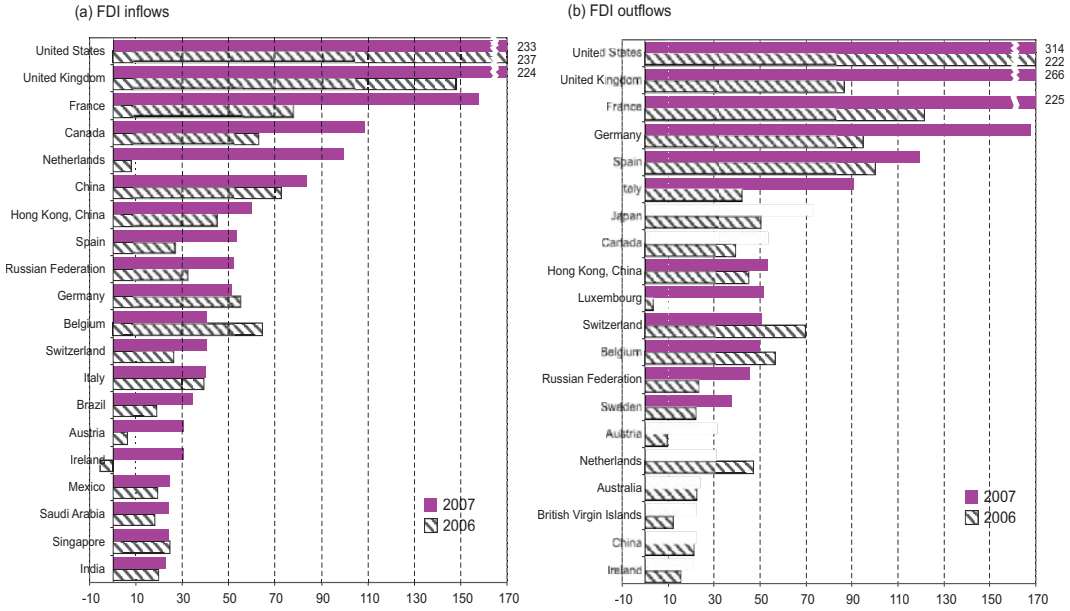
In developing countries, FDI inflows reached their highest level ever ($500 billion) – a 21% increase over 2006. The least developed countries (LDCs) attracted $13 billion worth of FDI in 2007 – also a record high. At the same time, developing countries continued to gain in importance as sources of FDI, with outflows rising to a new record level of $253 billion, mainly as a result of outward expansion by Asian TNCs. FDI inflows into South-East Europe and the CIS also surged, increasing by 50%, to reach $86 billion in 2007. The region has thus seen seven years of uninterrupted growth. Outflows from this region similarly soared, to $51 billion, more than twice the 2006 level. Among developing and transition economies, the three largest recipients were China, Hong Kong (China) and the Russian Federation.

Table 1. FDI flows, by region and selected countries, 1995–2007
(Billions of dollars and per cent)

Region/economy	FDI inflows							FDI outflows						
	1995–2000 (Annual average)	2002	2003	2004	2005	2006	2007	1995-2000 (Annual average)	2002	2003	2004	2005	2006	2007
Developed economies	539.3	442.9	361.1	403.7	611.3	940.9	1 247.6	631.0	483.2	507.0	786.0	748.9	1 087.2	1 692.1
Europe	327.9	316.6	279.8	218.7	505.5	599.3	848.5	450.9	279.9	307.1	402.2	689.8	736.9	1 216.5
European Union	314.6	309.4	259.4	214.3	498.4	562.4	804.3	421.6	265.6	285.2	368.0	609.3	640.5	1 142.2
Japan	4.6	9.2	6.3	7.8	2.8	- 6.5	22.5	25.1	32.3	28.8	31.0	45.8	50.3	73.5
United States	169.7	74.5	53.1	135.8	104.8	236.7	232.8	125.9	134.9	129.4	294.9	15.4	221.7	313.8
Other developed countries	37.1	42.6	21.8	41.3	- 1.7	111.3	143.7	29.2	36.0	41.8	58.0	- 2.1	78.4	88.3
Developing economies	188.3	171.0	180.1	283.6	316.4	413.0	499.7	74.4	49.6	45.0	120.0	117.6	212.3	253.1
Africa	9.0	14.6	18.7	18.0	29.5	45.8	53.0	2.4	0.3	1.2	2.0	2.3	7.8	6.1
Latin America and the Caribbean	72.9	57.8	45.9	94.4	76.4	92.9	126.3	21.1	12.1	21.3	28.0	35.8	63.3	52.3
Asia and Oceania	106.4	98.6	115.5	171.2	210.6	274.3	320.5	51.0	37.3	22.5	89.9	79.5	141.1	194.8
Asia	105.9	98.5	115.1	170.3	210.0	272.9	319.3	51.0	37.2	22.5	89.9	79.4	141.1	194.7
West Asia	3.3	5.5	12.0	20.6	42.6	64.0	71.5	0.9	3.2	- 1.9	7.7	12.3	23.2	44.2
East Asia	70.7	67.7	72.7	106.3	116.2	131.9	156.7	39.6	27.6	17.4	62.9	49.8	82.3	102.9
China	41.8	52.7	53.5	60.6	72.4	72.7	83.5	2.0	2.5	2.9	5.5	12.3	21.2	22.5
South Asia	3.9	7.1	5.9	8.1	12.1	25.8	30.6	0.3	1.8	1.6	2.3	3.5	13.4	14.2
South-East Asia	28.0	18.1	24.6	35.2	39.1	51.2	60.5	10.2	4.7	5.3	17.0	13.8	22.2	33.5
Oceania	0.5	0.1	0.4	0.9	0.5	1.4	1.2	- 0.0	0.0	0.0	0.1	0.1	0.0	0.1
South-East Europe and CIS transition economies)	7.3	11.3	19.9	30.4	31.0	57.2	85.9	2.0	4.6	10.7	14.1	14.3	23.7	51.2
South-East Europe	1.2	2.2	4.1	3.5	4.8	10.0	11.9	0.1	0.5	0.1	0.4	0.3	0.4	1.4
CIS	6.1	9.1	15.8	26.9	26.1	47.2	74.0	1.9	4.1	10.6	13.8	14.0	23.3	49.9
World	734.9	625.2	561.1	717.7	958.7	1 411.0	1 833.3	707.4	537.4	562.8	920.2	880.8	1 323.2	1 996.5
Memorandum: percentage share in world FDI flows														
Developed economies	73.4	70.8	64.4	56.2	63.8	66.7	68.1	89.2	89.9	90.1	85.4	85.0	82.2	84.8
Developing economies	25.6	27.4	32.1	39.5	33.0	29.3	27.3	10.5	9.2	8.0	13.0	13.3	16.0	12.7
South-East Europe and CIS (transition economies)	1.0	1.8	3.5	4.2	3.2	4.1	4.7	0.3	0.9	1.9	1.5	1.6	1.8	2.6

Source: UNCTAD, *World Investment Report 2008: Transnational Corporations and the Infrastructure Challenge,* annex table B.1 and .FDI database (www.unctad.org/fdistatistics).

Figure 1. Global FDI flows, top 20 economies, 2006, 2007[a]
(Billions of dollars)



Source: UNCTAD, *World Investment Report 2008: Transnational Corporations and the Infrastructure Challenge*, annex table B.1 and based on FDI/TNC database (www.unctad.org/fdistatistics).

[a] Ranked by the magnitude of 2007 FDI flows.

...driven by record values of cross-border M&As.

Continued consolidation through cross-border mergers and acquisitions (M&As) contributed substantially to the global surge in FDI. In 2007, the value of such transactions amounted to $1,637 billion, 21% higher than the previous record in 2000. Thus, overall, the financial crisis, starting with the sub-prime mortgage crisis in the United States, did not have a visible dampening effect on global cross-border M&As in 2007. On the contrary, in the latter half of 2007 some very large deals took place, including the $98 billion acquisition of ABN-AMRO Holding NV by the consortium of Royal Bank of Scotland, Fortis and Santander – the largest deal in banking history – and the acquisition of Alcan (Canada) by Rio Tinto (United Kingdom).

The largest TNCs pursued further expansion abroad…

The production of goods and services by an estimated 79,000 TNCs and their 790,000 foreign affiliates continues to expand, and their FDI stock exceeded $15 trillion in 2007. UNCTAD estimates that total sales of TNCs amounted to $31 trillion – a 21% increase over 2006. The value added (gross product) of foreign affiliates worldwide represented an estimated 11% of global GDP in 2007, and the number of employees rose to some 82 million (table 2).

The universe of TNCs is expanding. Manufacturing and petroleum companies, such as General Electric, British Petroleum, Shell, Toyota and Ford Motor, retain some of the top positions in UNCTAD's ranking of the 25 largest non-financial TNCs in the world (table 3). However, TNCs in services, including in

Table 2. Selected indicators of FDI and international production, 1982–2007

Item	Value at current prices ($ billion)				Annual growth rate (Per cent)						
	1982	1990	2006	2007	1986–1990	1991–1995	1996–2000	2004	2005	2006	2007
FDI inflows	58	207	1 411	1 833	23.6	22.1	39.9	27.9	33.6	47.2	29.9
FDI outflows	27	239	1 323	1 997	25.9	16.5	36.1	63.5	-4.3	50.2	50.9
FDI inward stock	789	1 941	12 470	15 211	15.1	8.6	16.1	17.3	6.2	22.5	22.0
FDI outward stock	579	1 785	12 756	15 602	18.1	10.6	17.2	16.4	3.9	20.4	22.3
Income on inward FDI	44	74	950	1 128	10.2	35.3	13.1	31.3	31.1	24.3	18.7
Income on outward FDI	46	120	1 038	1 220	18.7	20.2	10.2	42.4	27.4	17.1	17.5
Cross-border M&As	..	200	1 118	1 637	26.6	19.5	51.5	37.6	64.2	20.3	46.4
Sales of foreign affiliates	2 741	6 126	25 844	31 197	19.3	8.8	8.4	15.0	1.8	22.2	20.7
Gross product of foreign affiliates	676	1 501	5 049	6 029	17.0	6.7	7.3	15.9	5.9	21.2	19.4
Total assets of foreign affiliates	2 206	6 036	55 818	68 716	17.7	13.7	19.3	-1.0	20.6	18.6	23.1
Exports of foreign affiliates	688	1 523	4 950	5 714	21.7	8.4	3.9	21.2	12.8	15.2	15.4
Employment of foreign affiliates (thousands)	21 524	25 103	70 003	81 615	5.3	5.5	11.5	3.7	4.9	21.6	16.6
Memorandum											
GDP (in current prices)	12 083	22 163	48 925	54 568	9.4	5.9	1.3	12.6	8.3	8.3	11.5
Gross fixed capital formation	2 798	5 102	10 922	12 356	10.0	5.4	1.1	15.2	12.5	10.9	13.1
Royalties and licence fee receipts	9	29	142	164	21.1	14.6	8.1	23.7	10.6	10.5	15.4
Exports of goods and non-factor services	2 395	4 417	14 848	17 138	11.6	7.9	3.8	21.2	12.8	15.2	15.4

Source: UNCTAD, *World Investment Report 2008: Transnational Corporations and the Infrastructure Challenge*, table I.4.

infrastructure, have become increasingly prominent during the past decade: 20 of them featured among the top 100 in 2006, compared with only 7 in 1997.

The activities of the 100 largest TNCs increased significantly in 2006, with foreign sales and foreign employment almost 9% and 7% higher respectively, than in 2005. Growth was particularly high for the 100 largest TNCs from developing countries: in 2006, their foreign assets were estimated at $570 billion – a 21% increase over 2005. Their countries of origin have changed little over the past 10 years, with companies from East and South-East Asia dominating the list of the top 25 such TNCs (table 4).

….while sovereign wealth funds are emerging as new actors on the FDI scene.

A new feature of global FDI is the emergence of sovereign wealth funds (SWFs) as direct investors. Benefiting from a rapid accumulation of reserves in recent years, these funds (with $5 trillion assets under management) tend to have a higher risk tolerance and higher expected returns than traditional official reserves managed by monetary authorities. Although the history of SWFs dates back to the 1950s, they have attracted global attention only in recent years following their involvement in some large-scale cross-border M&A activities and their major capital injections into some troubled financial institutions in developed countries.

Table 3. The world's top 25 non-financial TNCs, ranked by foreign assets, 2006 [a]
(Millions of dollars and number of employees)

Ranking by:						Assets		Sales		Employment		TNI [b] (Per cent)	No. of affiliates		
Foreign assets	TNI [b]	II	Corporation	Home economy	Industry	Foreign	Total	Foreign	Total	Foreign	Total		Foreign	Total	II
1	71	54	General Electric	United States	Electrical & electronic equipment	442 278	697 239	74 285	163 391	164 000	319 000	53	785	1 117	70
2	14	68	British Petroleum Company Plc	United Kingdom	Petroleum expl./ref./distr.	170 326	217 601	215 879	270 602	80 300	97 100	80	337	529	64
3	87	93	Toyota Motor Corporation	Japan	Motor vehicles	164 627	273 853	78 529	205 918	113 967	299 394	45	169	419	40
4	34	79	Royal Dutch/Shell Group	United Kingdom, Netherlands	Petroleum expl./ref./distr.	161 122	235 276	182 538	318 845	90 000	108 000	70	518	926	56
5	40	35	Exxonmobil Corporation	United States	Petroleum expl./ref./distr.	154 993	219 015	252 680	365 467	51 723	82 100	68	278	346	80
6	78	64	Ford Motor Company	United States	Motor vehicles	131 062	278 554	78 968	160 123	155 000	283 000	50	162	247	66
7	7	99	Vodafone Group Plc	United Kingdom	Telecommunications	126 190	144 366	32 641	39 021	53 138	63 394	85	30	130	23
8	26	51	Total	France	Petroleum expl./ref./distr.	120 645	138 579	146 672	192 952	57 239	95 070	74	429	598	72
9	96	36	Electricite De France	France	Electricity, gas and water	111 916	235 857	33 879	73 933	17 185	155 968	35	199	249	80
10	92	18	Wal-Mart Stores	United States	Retail	110 199	151 193	77 116	344 992	540 000	1 910 000	41	146	163	90
11	37	34	Telefonica SA	Spain	Telecommunications	101 891	143 530	41 093	66 367	167 881	224 939	69	165	205	80
12	77	88	E.On	Germany	Electricity, gas and water	94 304	167 565	32 154	85 007	46 598	80 612	51	279	590	47
13	86	82	Deutsche Telekom AG	Germany	Telecommunications	93 488	171 421	36 240	76 963	88 808	248 800	46	143	263	54
14	58	65	Volkswagen Group	Germany	Motor vehicles	91 823	179 906	95 761	131 571	155 935	324 875	57	178	272	65
15	73	57	France Telecom	France	Telecommunications	90 871	135 876	30 448	64 863	82 148	191 036	52	145	211	69
16	90	63	ConocoPhillips	United States	Petroleum expl./ref./distr.	89 528	164 781	55 781	183 650	17 188	38 400	43	118	179	66
17	56	89	Chevron Corporation	United States	Petroleum expl./ref./distr.	85 735	132 628	111 608	204 892	33 700	62 500	58	97	226	43
18	11	75	Honda Motor Co Ltd	Japan	Motor vehicles	76 264	101 190	77 605	95 333	148 544	167 231	82	141	243	58
19	36	62	Suez	France	Electricity, gas and water	75 151	96 714	42 002	55 563	76 943	139 814	69	586	884	66
20	45	48	Siemens AG	Germany	Electrical & electronic equipment	74 585	119 812	74 858	109 553	314 000	475 000	66	919	1 224	75
21	10	11	Hutchison Whampoa Limited	Hong Kong, China	Diversified	70 679	87 146	28 619	34 428	182 149	220 000	82	115	125	92
22	84	85	RWE Group	Germany	Electricity, gas and water	68 202	123 080	22 142	55 521	30 752	68 534	47	221	430	51
23	9	7	Nestlé SA	Switzerland	Food & beverages	66 677	83 426	57 234	78 528	257 434	265 000	83	467	502	93
24	62	38	BMW AG	Germany	Motor vehicles	66 053	104 118	48 172	61 472	26 575	106 575	56	138	174	79
25	51	33	Procter & Gamble	United States	Diversified	64 487	138 014	44 530	76 476	101 220	138 000	59	369	458	81

Source: UNCTAD, *World Investment Report 2008: Transnational Corporations and the Infrastructure Challenge*, annex table A.I.15.

[a] All data are based on the companies' annual reports unless otherwise stated. Data on affiliates are based on Dun and Bradstreet's Who owns Whom database.

[b] TNI, the Transnationlity Index, is calculated as the average of the following three ratios: foreign assets to total assets, foreign sales to total sales, and foreign employment to total employment.

Table 4. The top 25 non-financial TNCs from developing countries, ranked by foreign assets, 2006 [a]
(Millions of dollars and number of employees)

Ranking by:						Assets		Sales		Employment		TNI [b] (Per cent)	No. of affiliates		
Foreign assets	TNI [b]	II	Corporation	Home economy	Industry	Foreign	Total	Foreign	Total	Foreign	Total		Foreign	Total	II
1	18	9	Hutchison Whampoa Limited	Hong Kong, China	Diversified	70 679	87 146	28 619	34 428	182 149	220 000	82.3	115	125	92.0
2	88	94	Petronas - Petroliam Nasional Bhd	Malaysia	Petroleum expl./ref./distr.	30 668	85 201	14 937	50 984	3 965	33 439	25.7	4	78	5.1
3	53	11	Samsung Electronics Co., Ltd.	Republic of Korea	Electrical & electronic equipment	27 011	87 111	71 590	91 856	29 472	85 813	47.8	78	87	89.7
4	21	4	Cemex S.A.	Mexico	Non-metalic mineral products	24 411	29 749	14 595	18 114	39 505	54 635	78.3	493	519	95.0
5	86	32	Hyundai Motor Company	Republic of Korea	Motor vehicles	19 581	76 064	30 596	68 468	5 093	54 711	26.6	19	28	67.9
6	33	3	Singtel Ltd.	Singapore	Telecommunications	18 678	21 288	5 977	8 575	8 606	19 000	67.6	103	108	95.4
7	92	86	CITIC Group	China	Diversified	17 623	117 355	2 482	10 113	18 305	107 340	18.9	12	112	10.7
8	65	10	Formosa Plastic Group	Taiwan Province of China	Chemicals	16 754	75 760	13 002	50 445	67 129	89 736	40.9	11	12	91.7
9	28	18	Jardine Matheson Holdings Ltd	Hong Kong, China	Diversified	16 704	20 378	12 527	16 281	58 203	110 125	70.6	108	126	85.7
10	57	74	LG Corp.	Republic of Korea	Electrical & electronic equipment	15 016	53 915	43 902	70 613	36 053	70 000	47.2	3	12	25.0
11	73	66	Companhia Vale do Rio Doce	Brazil	Mining & quarrying	14 974	60 954	37 063	46 746	3 982	52 646	37.1	17	52	32.7
12	94	88	Petroleo Brasileiro S.A. - Petrobras	Brazil	Petroleum expl./ref./distr.	10 454	98 680	17 845	72 347	7 414	62 266	15.7	7	74	9.5
13	69	73	China Ocean Shipping (Group) Company	China	Transport and storage	10 397	18 711	8 777	15 737	4 432	69 549	39.2	245	947	25.9
14	54	54	América Móvil	Mexico	Telecommunications	8 701	29 473	9 617	21 526	27 506	39 876	47.7	16	33	48.5
15	89	56	Petróleos De Venezuela	Venezuela, Bol. Rep. Of	Petroleum expl./ref./distr.	8 534	60 305	32 773	63 736	5 373	49 180	25.5	30	65	46.2
16	50	8	Mobile Telecommunications Company	Kuwait	Telecommunications	7 968	12 027	3 373	4 185	975	12 700	51.5	37	40	92.5
17	41	85	Capitaland Limited	Singapore	Real Estate	7 781	13 463	1 461	2 053	16 261	32 876	59.5	25	233	10.7
18	45	15	Hon Hai Precision Industries	Taiwan Province of China	Electrical & electronic equipment	7 606	19 223	16 801	40 507	322 372	382 000	55.1	82	94	87.2
19	80	65	China State Construction Engineering Corporation	China	Construction	6 998	15 986	4 483	18 544	25 000	119 000	29.7	23	70	32.9
20	67	5	Kia Motors	Republic of Korea	Motor vehicles	6 767	18 655	11 525	21 316	10 377	33 005	40.6	15	16	93.8
21	100	90	China National Petroleum Corporation	China	Petroleum expl./ref./distr.	6 374	178 843	3 036	114 443	22 000	1 167 129	2.7	5	65	7.7
22	72	82	New World Development Co., Ltd.	Hong Kong, China	Diversified	6 147	18 535	1 430	2 995	16 949	54 000	37.4	8	63	12.7
23	77	68	CLP Holdings	Hong Kong, China	Electricity, gas and water	6 096	15 965	1 283	4 951	1 827	6 087	31.4	3	10	30.0
24	90	40	Telefonos De Mexico S.A. De C.V.	Mexico	Telecommunications	5 790	24 265	4 295	16 084	16 704	76 394	24.1	44	73	60.3
25	87	47	Sasol Limited	South Africa	Industrial chemicals	5 709	14 749	2 920	8 875	2 205	27 933	26.5	14	26	53.8

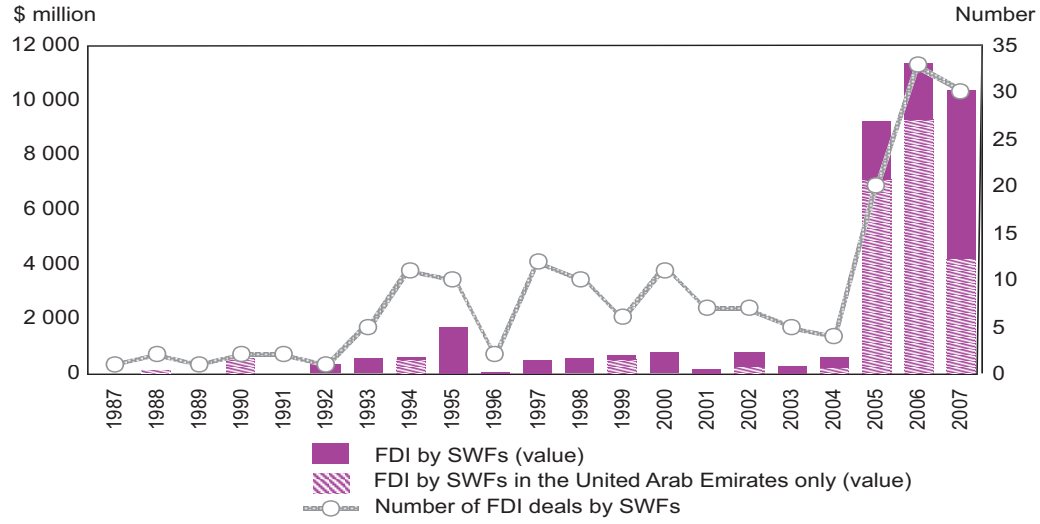
Source: UNCTAD, *World Investment Report 2008: Transnational Corporations and the Infrastructure Challenge, annex table A.I.16.*

[a] All data are based on the companies' annual reports unless otherwise stated. Data of affiliates are from Dun and Bradstreet's *Who Owns Whom* database.

[b] TNI is calculated as the average of the following three ratios: foreign assets to total assets, foreign sales to total sales, and foreign employment to total employment.

While the amounts invested by SWFs in the form of FDI remain relatively small, they have been growing in recent years (figure 2). Only 0.2% of their total assets in 2007 were related to FDI. However, of the $39 billion investments abroad by SWFs over the past two decades, as much as $31 billion was committed in the past three years. Their recent activities have been driven by the rapid build-up of reserves generated by export surpluses, changes in global economic fundamentals and new investment opportunities in structurally weakened financial firms.

Figure 2. FDI flows[a] by sovereign wealth funds, 1987–2007



Source: UNCTAD, *World Investment Report 2008: Transnational Corporations and the Infrastructure Challenge*.

[a] Cross-border M&As only; greenfield investments by SWFs are assumed to be extremely limited.

Almost 75% of the FDI by SWFs has been in developed countries, with investments in Africa and Latin America very limited so far. Their investments have been concentrated in services, mainly business services.

Investments by SWFs in the banking industry in 2006-2007 were generally welcomed, owing to their stabilizing effect on financial markets. However, they also prompted some negative public sentiment, with calls to impose regulatory restrictions on investments by these funds, notably on national security grounds. International institutions, such as the International Monetary Fund (IMF) and the Organisation for Economic Co-operation and Development (OECD), are in the process of establishing principles and guidelines relating to FDI by SWFs.

Most national policy changes continued to encourage FDI, though less favourable measures became more frequent.

Despite growing concerns and political debate over rising protectionism, the overall policy trend remains one of greater openness to FDI. UNCTAD's annual survey of changes in national laws and regulations that may influence the entry and operations of TNCs suggests that policymakers are continuing in their efforts to make the investment climate more attractive. In 2007, of the almost 100 policy changes identified by UNCTAD as having a potential bearing on FDI, 74 aimed at

making the host country environment more favourable to FDI (table 5). However, the proportion of changes that were less favourable to FDI has been increasing over the past few years.

Table 5. National regulatory changes, 1992–2007

Item	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Number of countries that introduced change	43	56	49	63	66	76	60	65	70	71	72	82	103	92	91	58
Number of regulatory changes	77	100	110	112	114	150	145	139	150	207	246	242	270	203	177	98
More favourable	77	99	108	106	98	134	136	130	147	193	234	218	234	162	142	74
Less favourable	0	1	2	6	16	16	9	9	3	14	12	24	36	41	35	24

Source: UNCTAD database on national laws and regulations.

As in 2006, most of the new restrictions introduced were concentrated in the extractive industries, particularly in Latin America (e.g. Bolivia, Ecuador and the Bolivarian Republic of Venezuela), but they were also apparent in other countries as well. Several governments, including those of the United States and the Russian Federation, adopted stricter regulations with regard to investments in projects that have potential implications for national security. Government concerns also appear to be directed towards investments in certain infrastructure areas and those undertaken by State-owned entities.

The number of international investment agreements (IIAs) continued to grow, reaching a total of almost 5,600 at the end of 2007. There were 2,608 bilateral investment treaties (BITs), 2,730 double taxation treaties (DTTs) and 254 free trade agreements (FTAs) and economic cooperation arrangements containing investment provisions. The shift in treaty-making activity from BITs towards FTAs continued, as did the trend towards renegotiation of existing BITs.

The global financial crisis had a limited impact on FDI flows in 2007, but will begin to bite in 2008.

The sub-prime mortgage crisis that erupted in the United States in 2007 has affected financial markets and created liquidity problems in many countries, leading to higher costs of credit. However, both micro- and macroeconomic impacts affecting the capacity of firms to invest abroad appear to have been relatively limited so far. As TNCs in most industries had ample liquidity to finance their investments, reflected in high corporate profits, the impact was smaller than expected. At the macroeconomic level, developed-country economies could be affected both by the slowdown of the United States economy and the impact of the turmoil in the financial markets on liquidity. As a result, both inflows to and outflows from these countries may decline. On the other hand, relatively resilient economic growth in developing economies may counteract this risk.

In addition to the credit crunch in the United States, the global economy was also affected by the significant depreciation of the dollar. While it is difficult to isolate the effects of exchange rate changes from other determinants of FDI flows, the sharp weakening of the dollar helped to stimulate FDI to the United States. European FDI to the United States was spurred by the increased relative wealth of

European investors and reduced investment costs in the United States. Moreover, companies exporting to the United States have suffered from the exchange rate changes, which have induced them to expand local production in the United States. This is illustrated by changes in the strategy of several European TNCs, particularly carmakers, that plan to build new or expand existing production facilities in that country.

The slowdown in the world economy and the financial turmoil have led to a liquidity crisis in money and debt markets in many developed countries. As a result, M&A activity has decelerated markedly. In the first half of 2008, the value of such transactions was 29% lower than that in the second half of 2007. Corporate profits and syndicated bank loans are also declining. Based on available data, estimated annualized FDI flows for the whole of 2008 are expected to be about $1,600 billion, representing a 10% decline from 2007. Meanwhile, FDI flows to developing countries are likely to be less affected. UNCTAD's *World Investment Prospects Survey, 2008–2010,* while also suggesting a rising trend in the medium term, points to a lower level of optimism than was expressed in the previous survey, and to more caution in TNCs' investment expenditure plans than in 2007.

In Africa, high commodity prices and rising profitability attracted FDI.

In Africa, FDI inflows grew to $53 billion in 2007 – a new record. Booming commodity markets, rising profitability of investments – the highest among developing regions in 2006-2007 – and improved policy environments fuelled inflows. LDCs in Africa also registered another year of growth in their FDI inflows. A large proportion of the FDI projects launched in the region in 2007 were linked to the extraction of natural resources. The commodity price boom also helped Africa to maintain a relatively high level of outward FDI, which amounted to $6 billion in 2007.

Despite higher inflows, Africa's share in global FDI remained at about 3%. TNCs from the United States and Europe were the main investors in the region, followed by African investors, particularly from South Africa. TNCs from Asia concentrated mainly on oil and gas extraction and infrastructure. Prospects for increased FDI inflows in 2008 are promising in light of the continuing high prices of commodities, large projects already announced for that year and forthcoming payments from previously concluded cross-border M&As. This will signify a fourth consecutive year of FDI growth. The UNCTAD survey shows that almost all TNCs have maintained or even increased their current levels of investment in Africa.

In South, East and South-East Asia and Oceania, both inward and outward FDI flows rose to their highest levels ever.

FDI flows to South, East and South-East Asia and Oceania were also higher than ever before, reaching $249 billion in 2007. Most subregions and economies, except Oceania, received higher inflows. A combination of favourable business perceptions, progress towards further regional economic integration, improved investment environments and country-specific factors contributed to the region's

performance. China and Hong Kong (China) remained the two top destinations within the region as well as among all developing economies. Meanwhile, India – the largest recipient in South Asia – and most member countries of the Association of Southeast Asian Nations (ASEAN) also attracted larger inflows, as did post-conflict countries and Asian LDCs, such as Afghanistan, Cambodia, Sri Lanka and Timor-Leste.

Overall, prospects for new FDI to the region remain very promising. Sustained economic growth, demographic changes, favourable business sentiments and new investment opportunities were among the main factors contributing to the region's good performance in 2007, and they should continue to attract FDI in the near future.

FDI outflows from South, East and South-East Asia also reached a new high, amounting to $150 billion, reflecting the growing importance of developing countries as outward investors. Intra- and inter-regional flows are a particularly important feature. But firms are investing in developed countries as well, not least through cross-border M&As. SWFs from the region have emerged as significant investors, contributing to the region's rapidly growing outward FDI stock: this jumped from $1.1 trillion in 2006 to $1.6 trillion in 2007.

West Asia also saw record flows in both directions…

FDI in West Asia rose by 12% to $71 billion, marking a new record and a fifth consecutive year of growth. More than four fifths of the inflows were concentrated in three countries: Saudi Arabia, Turkey and the United Arab Emirates, in that order. A growing number of energy and construction projects, as well as a notable improvement in the business environment in 2007, attracted FDI into members of the Gulf Cooperation Council (GCC). For example, Qatar experienced a significant rise in inflows – more than seven times higher than in 2006**.**

FDI outflows from the region in 2007 increased for the fourth consecutive year, to $44 billion – nearly six times its level in 2004. The GCC countries (Kuwait, Saudi Arabia, the United Arab Emirates, Qatar, Bahrain and Oman, in that order) accounted for 94% of these outflows, reflecting in part their desire to diversify away from oil and gas production through investments by SWFs. Intraregional FDI was significant, particularly from oil-rich countries, as confirmed by a growing number of greenfield projects and the increasing value of cross-border M&As.

FDI inflows into West Asia are expected to rise in 2008, as countries in the region have remained largely unaffected by the sub-prime mortgage crisis, and a significant number of intraregional investment projects are in the pipeline.

… while the surge of FDI into Latin America and the Caribbean was mainly driven by the demand for natural resources.

Latin America and the Caribbean saw inflows rise by 36% to a historic high of $126 billion. The increase was the highest in South America (66%), where most of the $72 billion worth of inflows targeted the extractive industries and natural-resource-based manufacturing. Inflows to countries in Central America and the Caribbean (excluding offshore financial centres) increased by 30% to $34 billion,

despite the economic slowdown in the United States. This resilience was partly explained by the dynamism of FDI in mining, steel and banking, which are not oriented primarily towards the United States market.

FDI outflows from the region fell by 17% to $52 billion, mainly reflecting a return to more "normal" levels of outward investment from Brazil. Latin American TNCs, mainly from Mexico and Brazil, continued to internationalize, competing for leadership in such industries as oil and gas, metal mining, cement, steel, and food and beverages. In addition, many new Latin American companies began emerging in new sectors such as software, petrochemicals and biofuels.

In the extractive industries, in which FDI increased as a result of the high commodity prices, the picture differed between oil and gas and metal mining. In metal mining, the scope for inward FDI is greater, as there are no major State-owned companies in the region, except Codelco in Chile. In oil and gas, by contrast, the dominant position, or even exclusive presence, of State-owned oil and gas companies limits the opportunities for foreign investors. This situation was accentuated in 2007, as a number of countries, including Bolivia, the Bolivarian Republic of Venezuela and Ecuador, adopted policy changes to increase taxation and further restrict or prohibit foreign investment in oil and gas.

FDI to and from Latin America and the Caribbean is expected to increase further in 2008. Inflows would be driven mainly by South America, where high commodity prices and strong subregional economic growth should continue to boost TNCs' profits. However, the level of future inflows into Central America and the Caribbean is uncertain, as the slowdown of the United States economy and a weak dollar could adversely affect their export-oriented manufacturing activities. Outflows are expected to be boosted by TNCs in Brazil and Mexico, which have already announced ambitious investment plans for 2008.

FDI to and from South-East Europe and the Commonwealth of Independent States maintained an upward trend and set new records.

As in most other regions, FDI flows to and from South-East Europe and the CIS reached unprecedentedly high levels. Inward FDI rose for a seventh consecutive year, to reach $86 billion – 50% more than in 2006. In the CIS, these inflows were mainly attracted to fast growing consumer markets and natural resources, while those to South-East Europe were associated with privatizations. Inward FDI in the Russian Federation increased by 62%, to $52 billion.

Outward FDI from South-East Europe and the CIS amounted to $51 billion, more than double its 2006 level. FDI from the Russian Federation – the main source country in the region – soared to $46 billion in 2007. Russian TNCs have extended their reach to Africa with the aim of increasing their raw material supplies and their access to strategic commodities. These are needed to support their efforts to increase their downstream presence in the energy industry and their value-added production activities in the metals industry of developed countries.

Whereas most of the national policy changes of the transition economies in 2007 were in the direction of greater openness to FDI, some CIS countries continued to introduce restrictions in the extractive industries and some other

strategic industries. The Russian Federation approved the long-discussed Strategic Sector Law, which specifies industries in which foreign investors are allowed only minority participation. In Kazakhstan, a newly approved natural resources law allows the Government to change existing contracts unilaterally if they adversely affect the country's economic interests in the oil, metal and mineral industries. Nevertheless, FDI flows are expected to be buoyant in these two countries as well as Ukraine.

In developed countries FDI inflows and outflows appear to have peaked.

Despite concerns over the economic uncertainty faced by some developed economies, FDI inflows to developed countries as a whole surged by 33% in 2007, to reach $1,248 – yet another record. The rise was mainly driven by cross-border M&As, but also by reinvested earnings as a result of high profitability of foreign affiliates. The United States retained its position as the world's largest FDI recipient country. The restructuring and concentration process in the enlarged common market of the EU countries led to a renewed wave of cross-border acquisitions. Large FDI flows to the United Kingdom, France, the Netherlands and Spain drove overall FDI inflows to the EU to $804 billion – a 43% increase. Japan's FDI inflows grew strongly for the first time since the end of the 1990s.

Developed countries maintained their position as the largest net outward investors, as outflows soared to a record $1,692 billion – $445 billion. The largest outward investors – the United States, the United Kingdom, France, Germany and Spain (in that order) – accounted for 64% of the total outward FDI of the group.

The policy environment for FDI in a number of developed countries continues to be one of greater openness, with some exceptions. There are, however, growing concerns over the possible negative effects of cross-border investments by SWFs, as well as private equity and hedge funds.

FDI to and from developed countries is expected to fall because of the dampening effects of the financial market crisis, combined with weaker economic growth in these economies. The value of cross-border M&As in developed countries fell considerably in the first half of 2008, compared with the second half of 2007. In UNCTAD's *World Investment Prospects Survey 2008–2010,* 39% of the responding TNCs anticipated an increase in FDI inflows into developed countries compared with more than 50% in last year's survey.

TRANSNATIONAL CORPORATIONS AND THE INFRASTRUCTURE CHALLENGE

There are huge unmet investment needs for infrastructure in developing countries.

The provision of good quality infrastructure is a prerequisite for economic and social development. Indeed, it is considered one of the main preconditions for enabling developing countries to accelerate or sustain the pace of their development and achieve the Millennium Development Goals (MDGs) set by the United Nations.

Moreover, the future investment needs of developing countries in infrastructure far exceed the amounts being invested by governments, the private sector and other stakeholders, resulting in a significant financing gap. On average, according to World Bank estimates, developing countries currently invest annually 3–4% of their GDP in infrastructure; yet they would need to invest an estimated 7–9% to achieve broader economic growth and poverty reduction goals.

Partly because of the scale of investment required in infrastructure, there has been a fundamental change in the role of the State around the world. Governments have opened infrastructure industries and services up to much greater involvement by the private sector – including TNCs. After the Second World War, and until the 1980s, infrastructure industries were by and large the purview of the State, sometimes through corporatized forms, such as State-owned enterprises (SOEs). Since then they have been gradually liberalized, though the pace and degree have varied by industry and country. As a result, the relationship between the State and the private sector has evolved, with the State increasingly assuming the role of regulator of activities performed by private, and often foreign, companies. This new relationship will continue to change in response to technological progress, growing experience with private sector involvement and shifting political priorities.

In addition to developing-country TNCs in infrastructure (mentioned below), "new players" in infrastructure have emerged, including a heterogeneous set of institutions belonging to two broad groups: private equity investors, and State-owned or government-linked entities such as sovereign wealth funds.

WIR08 focuses on economic infrastructure, including electricity, telecommunications, water and sewage, airports, roads, railways and seaports (the last four collectively referred to as transport). Analyses of TNC activities, development effects and policy recommendations need to take into account the main features of these industries. First, infrastructure investments are typically very capital-intensive and complex. Second, infrastructure services often involve (physical) networks, and are frequently oligopolistic or monopolistic in nature. Third, many societies regard access to infrastructure services as a social and political issue. Such services may be considered public goods, in the sense that they should be available to all users, and some, such as water supply, are considered a human right. Fourth, infrastructure industries are a major determinant of the competitiveness of an economy as a whole, and the quality of infrastructure is an important determinant of FDI. Fifth, infrastructure is key to economic development and integration into the world economy.

TNC participation in infrastructure has increased substantially, including in developing and transition economies.

Infrastructure industries account for a rapidly expanding share of the stock of inward FDI. Over the period 1990–2006, the value of FDI in infrastructure worldwide increased 31-fold, to $786 billion, and that in developing countries increased 29-fold, to an estimated $199 billion. Throughout the period it continued to grow in most infrastructure industries: the most significantly in electricity and telecommunications, and much less in transport and water. As a whole, the share of infrastructure in total FDI stock globally currently hovers at close to 10%, compared to only 2% in 1990.

Another measure, foreign investment commitments in private participation in infrastructure (PPI) projects (which include FDI, but also other investments that are an element of concessions), also indicates that TNCs have invested significantly in developing countries. During the period 1996–2006, such commitments amounted to about $246 billion, with a concentration in Latin America and the Caribbean between 1996 and 2000 (the region accounted for 67% of commitments); but since the turn of the century TNCs' share participation in PPI projects has grown relatively faster in Africa and Asia.

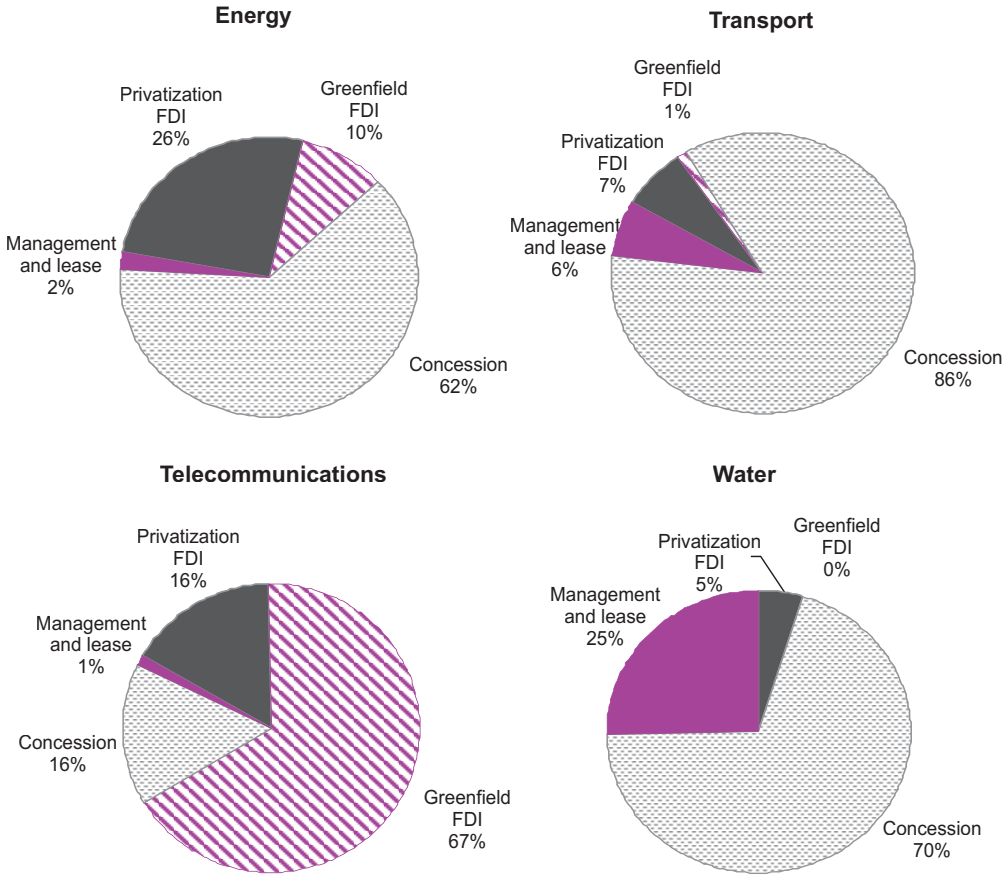
The *group of LDCs* has remained by and large marginalized in the process of globalization of infrastructure investment, accounting for about 2% of the stock of infrastructure FDI in developing countries in 2006. Their share in the foreign investment commitments in infrastructure industries of developing economies in the period 1996–2006 (of $246 billion) was a little over 5%.

The form of TNC involvement varies considerably by industry. Telecommunications is the only infrastructure industry in which FDI has been the dominant form of TNC entry in developing and transition economies (figure 3). In electricity, concessions were the most frequent modes of entry (62% of the cases), followed by privatizations and greenfield projects (36%) (figure 3). Concessions were also the predominant form of foreign participation in transport infrastructure (more than 80%), and in water (70% of the projects). In addition, the water industry used management and lease contracts relatively frequently (25%) (figure 3).

Developing countries have significant infrastructure TNCs and are becoming prominent investors in other developing countries.

Although developed-country TNCs still dominate in infrastructure industries internationally, there has been a marked rise in involvement by developing-country TNCs. In some industries, such as telecommunications, they have emerged as major players, and in others, such as transport, they have even become world leaders (table 6). Of the top 100 infrastructure TNCs in the world in 2006, 14 were from the United States, 10 from Spain, and 8 each from France and the United Kingdom. However, of the top 100 infrastructure TNCs, no less than 22 were headquartered in a developing or transition economy. The largest number of such firms was from Hong Kong (China) with 5 firms, and Malaysia and Singapore with 3 each.

Figure 3. Main legal forms of foreign commitments in the infrastructure industries of developing and transition economies, by industry, 1996–2006
(Based on the number of projects; in per cent)



Source: UNCTAD, *World Investment Report 2008: Transnational Corporations and the Infrastructure Challenge*, figure III.6.

Note: Data refer to investment commitments only in projects with private sector participation. Some of these projects include investment commitments from the public sector. Projects that are solely public sector funded are excluded.

To varying degrees, TNCs from the South are playing a more prominent role in the infrastructure industries of developing countries, though they do not invest as much as their developed-country counterparts. In *Asia and Oceania*, TNC involvement from other developing economies, especially intraregional investment, is particularly pronounced. In 1996–2006 almost half of foreign investment commitments in infrastructure in Asia and Oceania originated in developing countries, and in two industries (telecommunications and transport), TNCs from the South accounted for the largest share of foreign commitments. In *Africa*, developing-country investors have been dominant in telecommunications (58% of all commitments), but are less important in other infrastructure industries. On average, developing-country firms account for 40% of all commitments in Africa. Finally, in *Latin America and the Caribbean* the role of developing-country investors has been more limited (16% of all commitments). (Note that "all commitments"

Table 6. Largest TNCs in infrastructure industries, ranked by foreign assets, 2006
(Companies highlighted are based in developing or transition economies)

Rank	Electricity	Telecommu-nications	Transport	Water and sewage	Natural gas	More than one infrastructure industry
1	Electricité de France	Vodafone Group	Grupo Ferrovial	Veolia Environnement	Gaz de France	Suez
2	E.ON	Telefónica	Abertis	Grupo Agbar	Spectra Energy Corp.	**Hutchison Whampoa**
3	Endesa	Deutsche Telekom	AP Moller-Maersk	Waste Management Inc	Centrica	RWE Group
4	Vattenfall	France Télécom	**DP World**	Shanks Group	Gas Natural	Bouygues
5	National Grid	Vivendi Inc	**China Ocean Shipping**	Waste Services Inc	Transcanada Corp.	**YTL Power**
6	AES Corp.	Liberty Global Inc	Canadian National Railways Co.	Stericycle Inc	Enbridge Inc	Babcock & Brown Infrastructure
7	Fortum	TeliaSonera	Skanska	**Hyflux Limited**	Sempra Energy	**Enka Insaat ve Sanayi**
8	Duke Energy Corp.	**SingTel**	**PSA International**	Clean Harbors Inc	El Paso Corp.	**NWS Holdings**
9	EDP Energias de Portugal	Telenor	Hochtief	..	Hunting Plc	..
10	International Power Plc	Nortel Networks	Vinci	..	Williams Companies	..
11	**CLP Holdings**	KPN	Macquarie Airports	..	**Hong Kong & China Gas Co.**	..
12	Iberdrola	BT Group	Deutsche Bahn	..	Distrigaz 'D'	..
13	Unión Fenosa	Verizon Communications	**Orient Overseas International**	..	Canadian Utilities Ltd.	..
14	PPL Corp.	SES	Grupo ACS	..	Iwatani International Corp.	..
15	Atel - Aare Tessin	Telecom Italia	Obrascon Huarte Lain	..	..	..
16	Public Service Enterprise Group	**América Móvil**	Kansas City Southern	..	..	..
17	**Keppel Corp.**	**Mobile Telecommuni-cations Co.**	Canadian Pacific Railway	..	..	..
18	Cofide-CIR Group	TDC A/S	First Group	..	..	..
19	Edison International	Portugal Telecom	BBA Aviation	..	..	..
20	Enel	Tele2	**China Communications Construction Co.**	..	..	..

Source: UNCTAD, *World Investment Report 2008: Transnational Corporations and the Infrastructure Challenge*, table III.11.

cover those made by the private sector and by the State or SOEs where they have a share in PPI projects. However, investments in infrastructure made *solely* by the State or SOEs are excluded.)

TNCs in infrastructure derive their competitive advantages from a variety of sources and invest abroad mostly to access markets.

Competitive or ownership advantages of infrastructure TNCs are primarily related to specialist expertise or capabilities, such as network design and operation, engineering skills, environmental know-how, project management capabilities and tacit, hands-on skills. Specialized business models and financial prowess are important in some industries and segments, such as telecommunications.

The majority of infrastructure TNCs invest abroad in order to access the markets of host economies. They aim at benefiting from market opportunities arising from a number of measures, including liberalization and deregulation in host economies, invitations to tender for infrastructure projects, and the opening up of host countries to foreign acquisition of local firms (including privatization and acquisition of private firms). Additional motivations for investment can include following clients in the infrastructure business, searching for economies of scale and taking advantage of regional growth opportunities. The primacy of the host country market as a motive for infrastructure TNC involvement in developing economies places LDCs at a disadvantage in attracting their investment, as they have small markets in general and in infrastructure industries more specifically.

Mobilization of financial resources for infrastructure investment by TNCs is rising, but a vast gap remains.

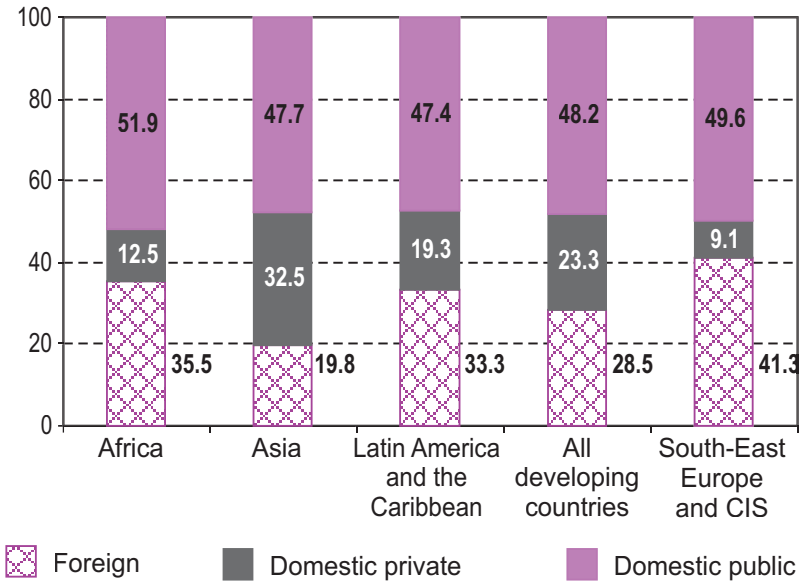
Financial constraints faced by governments were a major reason for an increasing number of developing countries to open up to FDI and TNC participation in infrastructure industries in the 1990s. Indeed, TNC participation in infrastructure in developing countries has resulted in the inflow of substantial financial resources. As mentioned earlier, the stock of infrastructure FDI in developing countries, an indicator of the extent to which TNC participation mobilizes financial resources, surged after 1990.

In addition, the $246 billion foreign investment commitments in infrastructure in developing countries in the period 1996–2006 represented an average of 29% of all PPI investment commitments. This reflects the importance of TNCs contribution to these industries in developing countries, with the highest share in Africa (36%) (figure 4).

Despite significant levels of TNC investment in developing-country infrastructure, more of it is required to bridge the vast financing gap: there is need for substantial amounts of additional investment, irrespective of source. For instance, in Africa, total TNC investment commitments in infrastructure during the *decade* spanning 1996–2006 were $45 billion – an amount (even if fully realized) that is barely equivalent to the region's current *annual* infrastructure investment needs of $40 billion.

Across much of Latin America, in a similar vein, investment in infrastructure by foreign companies in the 1990s was connected with a decline in public investment in the sector. In expectation of a large-scale increase in private sector investment, many governments in the region cut back on public expenditure in infrastructure, but the increase in investment by TNCs (and the domestic private sector) did not fully compensate for this decline. An important lesson from this experience is that TNC participation should not be expected to meet a country's entire investment needs in infrastructure industries; rather, it should be viewed as an important supplement and complement to domestic investments.

Figure 4. Shares of foreign investors, and domestic private and public investors in the investment commitments of the infrastructure industries of developing and transition economies, by region, 1996–2006
(Per cent)



Source: UNCTAD, *World Investment Report 2008: Transnational Corporations and the Infrastructure Challenge,* figure III.1.

Note: Data refer to investment commitments only in projects with private sector participation. Some of these projects include investment commitments from the public sector. Projects that are solely public sector funded are excluded.

TNC investment in developing-country infrastructure affects industry performance …

TNCs in infrastructure bring both hard technology (e.g. specialist equipment for water purification) and soft technology (e.g. organizational and managerial practices) to their operations in host countries. As regards hard technology, in telecommunications for instance, market entry by international operators from both developing and developed countries has contributed to lowering the threshold of access to and use of information and communication technologies in developing countries. TNCs also transfer soft technology to host country operations, for example by re-engineering operational processes, improving procurement and subcontracting practices, and enhancing client records and collection methods. Overall, studies show that in a number of cases the introduction of hard and soft technology by foreign affiliates has helped enhance productivity in services provision, as well as its reliability and quality. However context matters, and performance gains as a consequence of TNC (and more generally private) involvement depend very much on a well-defined regulatory environment.

The industry-wide impact of technology transfer by TNCs also depends on the diffusion of technology to other firms in the industry through a number of routes

of transmission, including joint ventures, mobility of personnel and demonstration effects. For instance, in China's electricity generation industry, TNC participation in large joint-venture projects has involved systematic and comprehensive project management cooperation between foreign investors and their Chinese counterparts. This has enabled the latter to enhance their expertise and efficiency. For the effective diffusion of technology from infrastructure TNCs, the existence of capable domestic enterprises is essential.

The higher the contestability of an infrastructure industry, the more likely it is that TNC participation will contribute to enhanced efficiency through increased competition. For example, in many countries, a competitive market structure has been established in telecommunications as a consequence of technological change and industry reforms. In Uganda, for instance, competition between the national provider and TNCs led to price reductions and a rapid increase in penetration of mobile telephony. Cross-country studies have shown the complementarities between privatization and competition: competition increases the gains from privatization, and vice versa.

On the other hand, in water supply, which is an example of an industry that is still essentially a natural monopoly, the entry of TNCs can result in State monopolies being turned into private, foreign-owned monopolies. This limits competition and thus the scope for efficiency enhancement. In other services, while the entry of TNCs can increase competition and thus efficiency, it may also pre-empt the entry of domestic players or crowd out existing ones. In electricity and telecommunications – both relatively contestable industries – the experience of a number of developing countries indicates that infrastructure TNCs in some cases can be associated with anti-competitive behaviour.

In some developing countries where domestic capabilities exist, local private participants can enhance their competitiveness and efficiency by collaborating with TNCs in a variety of ways. For example, partial privatization with minority ownership by TNCs has been implemented by developing countries such as Morocco in telecommunications, with favourable results for competition. As an alternative to TNC involvement, some developing countries have also been able to improve the performance of public utilities through corporatization reforms, without direct TNC participation. However, successful cases are mainly in relatively high-income or large developing economies.

…with implications for the provision of infrastructure services and universal access.

The participation of TNCs has generally increased the supply and improved the quality of infrastructure services in host countries, but their impact on prices has varied. In some instances this has caused concern over services being priced beyond the reach of the poor. In particular, the *affordability* of services is jointly determined by the price of services and the disposable income of consumers in an economy. The impact of TNC participation on access to services can thus differ among segments of a society: improvements in industry performance do not necessarily translate into increased availability and affordability of services for all members of a society,

especially the poor and people living in rural, remote and economically deprived areas.

Improvements in supply, coverage of services, price and access as a result of TNC participation in developing countries are more pronounced in *telecommunications* than in any other infrastructure industry, especially in mobile telephony. Many developing countries have experienced a "mobile revolution": new business models introduced by TNCs have enabled the expansion of mobile services into low-income segments. TNC entry into the *transport* industry of developing countries is far more varied than in other areas. International terminal operators, for instance, have considerably improved the quality of services in major ports, and thereby increased developing-country connectivity to the global economy.

In contrast to telecommunications, and to a lesser extent transport, the impact in electricity and water has been mixed. The impact of TNC participation on prices, and thus access to electricity and water, depends on political, social and contractual issues, as well as productivity and efficiency gains. In the absence of government subsidies to users, additions to supply capacity, productivity and efficiency improvements may be insufficient to maintain low prices while covering costs. Prices can continue to be subsidized after entry by the private sector, although countries sometimes raise tariffs both to attract companies and to reduce subsidies.

Evidence from a number of developing countries suggests that greater private sector investment – often with TNC involvement – has in many cases led to increased supply capacity and network connections in *electricity,* and thereby to steady improvements in the reliability and quality of service in the industry. Given the many factors involved, electricity prices have sometimes fallen after TNC entry, but overall there has been no definite trend in prices, up or down. The impact of TNC participation on users' access to *water* has been disappointing in many instances, though there is some evidence that well-designed schemes for TNC participation have led to significant service expansion. Partly because TNC participation has sometimes not met expectations of improved access, there have been cancellations of water concessions in countries such as Argentina, Bolivia and the Philippines.

In summary, in the telecommunications and transport industries, the TNCs have contributed substantially to making services more affordable and accessible. For those services that are considered essential, such as drinking water, if the efficiency improvements achieved by TNCs *cannot* allow them to maintain prices at low levels while covering costs, and the government does not provide subsidies to users, access for the poor is affected. Government policies are critical for all infrastructure industries, but, from a social perspective, more so in the case of electricity and water.

Leveraging TNC participation is a complex policy challenge.

Host countries need to consider when it is appropriate to draw TNCs into the development and management of infrastructure. They also need to find ways of ensuring that projects with TNC involvement lead to the expected development effects. This is a complex policy challenge.

As policy priorities and options vary between countries, so too does the optimal mix of public and private (including TNC) investment. Designing and implementing

appropriate policies to harness the potential role of TNCs in infrastructure require adequate skills and capabilities. Governments need to prioritize among competing demands for different projects, establish clear and realistic objectives for the projects chosen, and integrate them into broader development strategies. This means that government agencies have to possess the necessary institutional capacity and skills to guide, negotiate, regulate and monitor the projects. This applies not only at the central level, but also at the provincial and municipal levels.

While many developing countries seek foreign investment to develop their physical infrastructure, convincing foreign companies to invest has become even more challenging. Growing demand in the developed world and in large emerging economies is leading potential investors to expect higher returns for a given level of risk. This poses a particular problem where large-scale capital investments are needed up-front, where cost-recovery is difficult to achieve and where social concerns are considerable. Furthermore, project failures and multiple investment disputes have contributed to a more cautious attitude towards infrastructure projects among overseas investors.

Countries seek greater TNC involvement in infrastructure, but openness varies by industry.

The trend towards opening up has been more widespread among developed countries and the relatively advanced developing and transition economies. While the nature of liberalization has varied, all groups of countries are now more welcoming to TNC activities in infrastructure than they were two decades ago.

However, there are significant variations by industry. Openness is the highest in mobile telecommunications, and the lowest in water. Countries are generally more open to TNC involvement in industry segments that are relatively easy to unbundle and expose to competition. Openness also appears to be greater in countries with more developed institutional and regulatory capabilities. At the same time, some governments are becoming more careful about allowing foreign companies to take control of certain infrastructure, including power generation and distribution, port operations and telecommunications. New restrictions have been proposed based on national security or public interest concerns.

These concerns notwithstanding, many countries have moved beyond the removal of barriers to TNC involvement, and are actively promoting it in some areas of infrastructure. Many investment promotion agencies (IPAs) are targeting infrastructure industries. In a survey conducted by UNCTAD and the World Association of Investment Promotion Agencies, about 70% of the IPA respondents stated that they were actively seeking such investment, while only 24% were not. Almost three quarters of the IPAs stated that infrastructure is a more important priority than it was five years ago.

Confirming the broad patterns of openness to TNC involvement, the infrastructure industries most often targeted by IPAs are electricity generation, Internet services and airports. By contrast, the lowest number of IPAs targeted electricity distribution and transmission (table 7). Judging from the patterns of investment in LDCs, there may be a case for low-income countries to target TNCs from other developing countries, especially in transport infrastructure.

Table 7. Share of IPAs that promote FDI into specific infrastructure industries, by region, 2008
(Percentage of responding IPAs)

Infrastructure industry	All countries	Developed countries	Developing countries	Africa	Asia	Latin America and the Caribbean	SEE and CIS
Transport							
Roads	31	5	42	43	46	38	48
Seaports	37	30	42	50	31	44	29
Airports	41	35	40	57	23	38	71
Railways	24	15	28	50	23	13	29
Electricity							
Generation	49	30	56	79	46	44	57
Transmission	19	0	26	36	23	19	29
Distribution	17	5	23	36	23	13	14
Telecommunications							
Fixed	29	20	30	50	23	19	43
Mobile	40	40	40	57	38	25	43
Internet services	44	45	42	71	31	25	57
Water and sanitation							
Water supply	33	26	33	43	23	31	57
Sanitation	26	15	28	29	23	31	43
Number of responses	*70*	*20*	*43*	*14*	*13*	*16*	*7*

Source: UNCTAD, *World Investment Report 2008: Transnational Corporations and the Infrastructure Challenge*, table V.3.

Securing development gains requires an appropriate governance framework and strong government capabilities.

Without an adequate institutional and regulatory framework, the risk increases that countries will lose out by opening up to TNC participation. Moreover, once a country liberalizes, it is often hard to reverse the process.This is why the sequencing of reforms is important. Ideally, competitive restructuring, the introduction of regulations and the establishment of an independent regulatory agency should precede steps towards opening up. Such a sequence helps clarify the rules of the game for potential investors and makes governments better prepared for engaging in a specific project. However, in reality, opening up to foreign investment has often preceded comprehensive reform, with less positive outcomes as a result. Until credible regulatory bodies can be established, developing countries are likely to be better off keeping their utilities in the public sector.

Inviting TNCs to deliver infrastructure services tends to place more, rather than less, responsibility on public officials. Infrastructure investments typically require the negotiation of contracts between the host country and the foreign investor(s). Contracts provide for a tailor-made agreement that responds to the particular requirements of each project and to the intentions of the contracting parties. It is therefore important for countries to develop the expertise to determine the desirable level and forms of TNC involvement, to negotiate and monitor the implementation of projects.

Due to asymmetries of information and experience between a TNC and a host country government, it is generally difficult for public sector staff to match the resources of the private sector when engaging in contract negotiations. Major TNCs tend to make use of international law firms and other experts specializing in project financing transactions, but this is not always possible for developing countries.

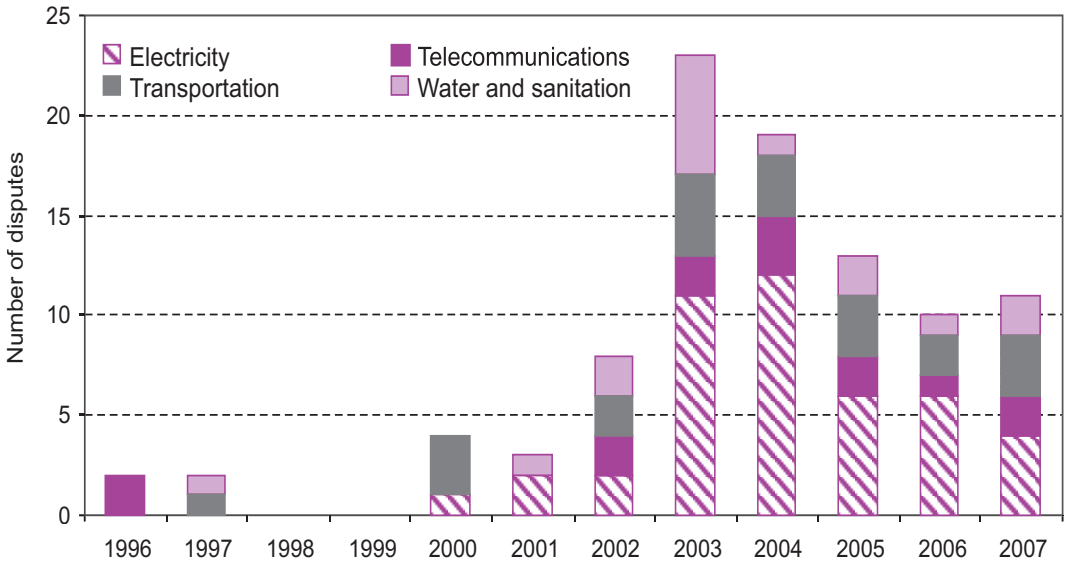
If countries with limited experience decide to involve TNCs in infrastructure projects, it may be advisable for them to start on a small scale rather than adopting a major programme across industries. It may also be useful for them initially to concentrate on less contentious segments of an industry.

Many investment disputes are related to infrastructure.

An issue that has attracted increased attention in recent years is the rise of investment disputes related to infrastructure. At the end of 2007, some 95 disputes (or one third of all known treaty-based investor-State disputes) were related to electricity, transportation, telecommunications and water and sanitation (figure 5). The disputes have provoked debate over the implications of international investment agreements (IIAs), and especially BITs.

Some observers are concerned that improved protection and certainty for foreign investors has come at the cost of too much reduction in the government's regulatory flexibility. They argue that the possibility of investor-State arbitration may have a dampening effect on the ability of the States to adopt public welfare regulations and other regulations in their citizens' interests. Others question whether BITs have been, or ever will be, able to provide the protection they were originally intended to offer investors. TNCs that have seen their cases dismissed or received far

Figure 5. Number of known infrastructure-related investment disputes, 1996–2007
(New cases per year)



Source: UNCTAD, *World Investment Report 2008*: *Transnational Corporations and the Infrastructure Challenge*, figure V.3.

lower compensation than what they had claimed will have found that the protection offered through the BITs was less comprehensive than expected.

A review of arbitration decisions shows that less than half of the awards rendered favoured the claimant, and that damages awarded were considerably smaller than the total claims made by investors. The fact that more than 90 known disputes concerned infrastructure shows that concluding IIAs (and the coexistence of IIAs and State contracts) can have significant implications for host States. At the same time, the number of disputes should be seen in the light of the several thousands of IIAs, and a huge number of investment projects in infrastructure. In addition, if renegotiations of contracts are successful, they do not reach the stage of dispute and arbitration. The complexity of related issues, together with the dynamic evolution of the IIA universe and the international case law, underline the importance of capacity-building to ensure that developing-country governments understand the implications of concluding IIAs. They also need to be better equipped to handle potential investment disputes.

Greater commitments from the international community are needed…

It is important to consider the potential role of home countries and the international community in facilitating more foreign investments into countries that seek such inflows. This is particularly relevant from the perspective of low-income countries, which lack domestic capabilities and have generally failed to attract significant TNC involvement in infrastructure.

Without some form of subsidies, it is difficult to attract TNC investment into economies, communities and industry segments that are characterized by weak purchasing power and poor records of payment. In these cases, development finance institutions can act as catalytic financiers. Especially in such industries as electricity, water and transport, there is significant potential for synergies between foreign investment and overseas development assistance (ODA). By making more funds available, development partners and the home countries of the investing firms could play a major role in helping to "crowd in" foreign investment into infrastructure projects in developing countries.

While development partners have recently scaled up their ODA commitments for infrastructure development, current levels of support have not recovered from the earlier period of declining lending by multilateral banks, and they have not reached the levels promised in various international forums. Moreover, while development partners are yet to provide all the funds pledged to scale up infrastructure investments in low-income countries, existing funds are not being fully used – a situation that can sometimes be referred to as the "infrastructure paradox". Recent assessments show that the liquidity of development finance institutions is very high.

Development partners should honour their commitments related to ODA for infrastructure. Institutions that provide bilateral or multilateral development finance also need to become more willing to take risk and to allocate a greater share of their activities to the needs of low-income countries. In addition, they should keep all options open. While a strong case can often be made for facilitating greater involvement of the private sector, including TNCs, other approaches should not be

ruled out. In some projects, notably in water and some electricity segments, there may be strong arguments for keeping the operation of the services in public hands. But also in other industries, weak institutional capabilities may make private sector involvement too risky. In such situations, international efforts focused on supporting existing public sector producers may be more appropriate. Development partners should therefore give sufficient attention to financing infrastructure projects for which it may not be possible to mobilize private sector involvement.

…including to mitigate risk and build capacity in low-income countries.

Risk-mitigation measures by home countries and international organizations can help in the short term to mobilize private financing of infrastructure projects in developing and transition economies. Special attention may have to be given to measures aimed at mitigating three broad types of risk: political risk (including sub-sovereign and contractual and regulatory risks), credit risk and exchange-rate risks.

Despite the plethora of risk-mitigation instruments available, current programmes are insufficiently tailored to the situation of low-income countries. For example, local currency financing by development finance institutions typically requires a well-established currency swap market. Where such a market exists, intervention by development finance institutions is less likely to be needed. At the same time, risk-mitigation instruments should not be seen as a panacea. Too much risk mitigation may lead to problems of moral hazard and encourage reckless risk-taking on the part of investors and lenders. While risk-mitigation tools can facilitate the mobilization of private debt and equity, they do not make poorly structured projects more viable. This underscores the importance of capacity-building efforts.

Such efforts are especially important in LDCs. Depending on the specific circumstances of each country, assistance may need to be provided for developing legal and regulatory frameworks, assessing different policy and contractual options, preparing project proposals, and monitoring and enforcing laws, regulations and contracts. Considering the nature of the projects, governments at all levels – national, provincial and municipal – are in urgent need of assistance. While positive steps have been taken to meet these needs, current efforts remain vastly insufficient. Disturbingly, funds available for capacity-building are not always fully used.

Advisory services should be geared to providing advice not only on how to encourage investment, but also on how infrastructure can be made to fit into larger development plans and objectives. Most capacity-building support is currently provided by different financing institutions that often have a direct stake in the different projects. It would be worth exploring a more active role for the United Nations in this context. As a neutral party, the organization could complement existing players by, for example, helping developing-country governments in evaluating infrastructure contracts and developing negotiating skills. Improving the ability of governments in these areas should help secure greater development gains from investment inflows.

* * *

The development of physical infrastructure remains one of the most urgent areas for policymakers to address. The needs are huge, and meeting them will require greater use of the private sector, including TNCs. This applies particularly to LDCs, where infrastructure improvements are critical to their attainment of the MDGs. At the same time, low-income countries are often poorly equipped to both attract TNCs into infrastructure and maximize the benefits from TNC involvement. Whatever mix of private and public sector involvement is chosen, adequate institutions and enforcement mechanisms are essential to ensure efficient and equitable delivery of infrastructure services. Meeting the infrastructure challenge requires a concerted effort by all relevant parties. This implies an appropriate combination of improved governance and capabilities in host countries, greater support from the international community and responsible behaviour on the part of the investors.

Geneva, July 2008

Supachai Panitchpakdi
Secretary-General of UNCTAD

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F. **Bibliographical references** in the text should appear as: "John Dunning (1979) reported that ...", or "This finding has been widely supported in the literature (Cantwell, 1991, p. 19)". The author(s) should ensure that there is a strict correspondence between names and years appearing in the text and those appearing in the list of references. All citations in the list of references should be complete. Names of journals should not be abbreviated. The following are examples for most citations:

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Dunning, John H. (1979). "Explaining changing patterns of international production: in defence of the eclectic theory", *Oxford Bulletin of Economics and Statistics*, 41 (November), pp. 269-295.

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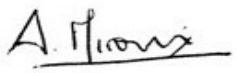

Anne Miroux
Editor
Transnational Corporations

TRANSNATIONAL CORPORATIONS

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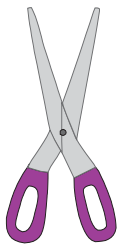

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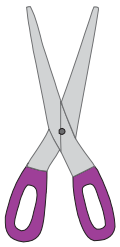

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Printed at United Nations, Geneva
GE.09- – April 2009 – 2,890

United Nations publication

ISBN 978-92-1-112762-1

UNCTAD/DIAE/IA/2008/7 (Vol. 17, No. 3)

ISSN 1014-9562