Competing in the Electronics Industry: The Experience of Newly Industrialising Economies. Dietr Ernst and David O'Connor. eds. Development Centre of the Organisation for Economic Co-operation and Development (OECD), 2, rue André-Pascal, 75775, Paris. Cedex 16, France, 1992. 303 pp. FF 180.

The Organisation for Economic Co-operation and Development was set up in Paris in 1960. All the European States, United States and Canada were the original members of the Organisation. Japan became a member in 1964, Australia in 1971 and New Zealand in 1973. Economic growth, employment, expansion of world trade on a multilateral non-discriminatory basis in accordance with international obligations were the laid down policy aims. The Development Centre of the Organisation came into being in 1962. The Centre has an autonomous position in the OECD set up and enjoys scientific independence in the execution of its task. Its main purpose is to undertake economic and other studies related to the main policy aims of the OECD and disseminate the findings.

This study directed by Dietr Ernst is the culmination of the Development Centre project on 'Technological Change in the Electronics Sector — Perspectives and Policy Options for Newly Industrialising Economies'. The publication analyses how technological changes and the globalization of competition pose new barriers and make the development of the electronics industry and technology very difficult for the newly industrializing economies (NIEs). Firms as well as governments belonging to the OECD are striving to utilize technology as an instrument — *high-tech neo-mercantilism*—of global competition and are attempting to restrict access to new technologies, products and markets. The globalization of competition has, paradoxically, strengthened rather than weakened the role of governments in international competition. While protecting and promoting national industries, through non-tariff trade barriers, investment regulations, government procurement policies, funding of basic and applied research, and through an increasingly tough intellectual property rights protection, the OECD countries, notably the US, are adopting aggressive measures to open up ('liberalize') foreign markets, in particular telecommunications, semiconductors and computers. The authors note: "In contrast to the widely held belief, it is not just Brazil and India which practised such anti-free market heresies as restrictions on market access and on the establishment of firms. Market access restrictions are widely used in the OECD region, and this applies not only to Japan but also to the United States and Europe. What differentiates most OECD countries from Brazil and India are the much more sophisticated and effective ways in which such market restrictions are implemented."

It must be remembered that the first-tier newly industrializing economies — ANIEs (S. Korea, Taiwan, Singapore and Hong Kong) — are all client states of the United States. American military presence in S. Korea and Philippines, and the dependence of the regime in Taiwan on the US for military support, reassured US businesses that they could invest in these countries for their offshore operations. Hong Kong (a British colony) and Singapore, both open economies, also served the US firms in their quest for cheap, efficient and disciplined labour for assembly kind of operations. Japan and other EC countries also rushed to the ANIE countries for similar projects. The entry of the US, EC, and Japanese firms, though based on self-interest, catalysed the growth and primed the start of entrepreneurial ventures in these ANIEs. The regimes in these ANIE countries were totalitarian in many respects but had outward, export-oriented progressive macroeconomic policies. Their economic and industrial growth became spectacular.

By 1988, S. Korea and Taiwan had moved forward to the sixth and eighth in world ranking in the value of their total electronic production. Singapore ranked ninth, followed by Brazil, tenth, and Hong Kong, twelfth. India had a production smaller than that of Malaysia, a country one-fortieth its size.

While Japan is the leading electronics exporter ($72 billion in 1988), the next top spot goes to the group of four first-tier East Asian newly industrializing countries (EANIEs) comprising S. Korea, Taiwan, Hong Kong and Singapore. The total exports in 1988 of these four 'tigers' (as they are usually labelled), came close to $52 billion exceeding that of the United States ($46 billion). The exports of Germany, UK, and France were $26, $18, and $12 billion respectively. Malaysia, Thailand and Philippines exported $4.5, $1.4 and $1.4 billion respectively. India had a poor showing of $80 million in 1988 and figures for China are missing in the book.

The ANIEs also registered large trade surpluses in the electronic goods export (1988). Korea — US $7.9 billion; Taiwan — US $5.5 billion; Singapore — US $5.35 billion; Hong Kong — US $2.5 billion; Malaysia — US $2.5 billion. It may be useful to note that in contrast to the huge trade surpluses registered by these countries, the US and the EC countries all had negative trade balances in the electronics segment. India and Brazil also registered negative trade balances; figures for China are, unfortunately, not available.

In respect of India and China, the authors note that the electronics industry has been heavily inward-oriented and that isolation from international technology trends has resulted in technological backwardness. The concepts of 'self-reliance' have enabled the local scientists and engineers to acquire a certain proficiency in a broad range of technological capabilities — including product and process adaptation but this process has left them far behind and the industries are not in a position to compete in world markets.

Though the four first-tier ANIEs have jointly outperformed the US in total electronic exports, there are weaknesses in their industrial set-ups to warrant careful evaluation of the future in the context of the present global technological and competitive environment.

Citing the case of the development of Application Specific Integrated Circuits (ASICS), the authors note that Taiwan has over 50 ASIC design centres with revenues of over $100 million. The revenue is expected to increase to $200 million. A silicon foundry has also been established — Taiwan Semiconductor Manufacturing Corporation (TSMC) — established in 1986. TSMC is a joint venture between the Taiwanese government, Philips and local investors. This silicon foundry fabricates for Philips and for outside customers. Philips has agreed to transfer 2 micron technology

as well as advanced ASIC technology. The presence of a local silicon foundry has helped local ASIC designers. Can design of ASICs be separated from manufacturing the ASICs in a remote silicon foundry? After arguing the pros and cons, the authors conclude that while this may be theoretically possible, continuous interaction between designer and the fabricator would be missing. This will lead to delays and production and yield problems. In any case, ASICS-making plants have to deal with over 50 process flows and over 100 circuit types at one time. Such production lines have very low utilization rates—less than 30%. Latecomers will therefore face higher unit costs and longer development times leading to difficulties in competing in the world market. The costs for establishing latest wafer fabrication lines have also increased and technologies may not be easily made available for plants incorporating the latest features necessary for current state-of-art devices.

Also thresholds for investments and consequently for volumes have risen—another barrier. The first-generation production lines for flat panel LCDs are estimated to cost between $100 million and 300 million. Japanese LCD producers may spend over $2.4 billion on LCD plants (1989 estimate).

The other NIEs have also to address the very same issues affecting the ANIEs, though, in their cases, the hurdles will be far more difficult to overcome.

There is US and European concern with the rapid industrial development and export thrust of the ANIEs. Domestic manufacturers in the US and Europe have not been able to face competition, and imports from the ANIEs are flooding their markets upsetting their domestic industries and causing foreign exchange outflow. S. Korean exporters were forced to accept voluntary export restrictions on colour TVs, VCRs and microwave ovens rather than face anti-dumping countervailing duties threatened by the US administration. The same is happening in the European market. The threats also loom over semiconductor exports.

Under these conditions it is natural for the OECD countries to evaluate the future threats that the ANIE and other NIE electronic industries may pose to their own industries. Japan is, however, cause for more serious concern but the US industry has become enmeshed with the Japanese firms in various co-operative technology development activities and also has become very dependent on the import of core components like DRAMS, active-matrix LCD displays, laser engines for their laser printers and other opto-electronic devices from Japan that they dare not greatly displease Japan without hurting their own interests, though, they do impose import quotas, anti-dumping duties and take other protectionist measures from time to time.

In view of the spectacular successes of the ANIEs, Malaysia and Thailand in the field of electronic production and exports, why should there be concern over the future of the electronics and information technology (IT) industries in these countries?

The authors fear that barriers are already being raised higher for most sectors of the electronics industry and technology. The access to growth markets in the OECD region faces increasing restrictions, and this applies to both exports and to the outward bound foreign direct investments.

Firms as much as states are striving to utilize technology as an instrument of global competition and are attempting to restrict access to new technologies, product standards and markets. Politicalization of global competition has arisen because of the strategic importance of industries such as computers and semiconductors. Also availability of core components, market intelligence and access will pose problems. Identifying customer requirements in advance is the key to design and economic manufacture. This, the authors argue, is likely to be a big growth barrier for the NIEs.

The epicentre of competition has shifted beyond the sphere of production to R&D and other forms of intangible investments. Trans-national arrangements for co-operative R&D, cross-licensing agreements, and special core component sourcing are now very prevalent in the industry. In addition, competition increasingly centres on the capacity to define the rules of the game through standards and other forms of regulatory barriers.

Globalization of the economies has a lot to do with international investment flows. The earlier trade-led internationalization is giving way to investment-driven patterns. The international investment flows are more concentrated than international trade flows. The investment in the five leading OECD countries (so-called G-5) accounted for over 75% of the foreign direct investment (FDI). There has been a direct fall in the FDI flowing to the developing countries: from 24% in 1983 to 17% in 1988. And the ANIEs are trying to invest in the EC countries to locally produce the very same products they were exporting to offset import quotas whereas the investment should have been in their own countries to upgrade technology and products.

The authors note: The 'catching-up' strategy employed by Korea, Taiwan, Hong Kong and Singapore involved assimilating the rich stock of available technological knowledge enabling them to make and market products and even incrementally upgrade imported technology. They were helped by the design paradigms and market development patterns established by the market leaders and gained rapid market access. The questions are:

a. Can electronics firms in first-tier NIEs which have exhausted the possibilities of 'easy' catching-up continue to rely on a borrowed technology for the future growth? Or do they have to strengthen their own science and technology bases and to improve their product design and market development capabilities?

b. Can second-tier Asian NIEs who are still not very advanced follow the route of borrowed technology to emulate the first-tier NIEs for their growth and so duplicate the first-tier NIEs export miracle of the 1970s and 1980s?

The authors feel that the institutions and policies employed in the catching-up era, while still useful, may be far less effective for ensuring progress once a firm comes close to the technological frontier. They note that there is a widespread consensus in all first-tier NIEs that research and technology development have become essential prerequisite for consolidating earlier competitive successes. It is also widely accepted that public research laboratories and the educational system have to play a crucially important catalytic role in providing the essential building-

blocks of scientific and technological knowledge and in establishing the essential links between the various factors involved in the generation and diffusion of new information technologies.

The authors conclude that in order to compensate for decline in technology inflows and to overcome other new barriers being erected, developing countries need to strengthen their own technological capabilities through research and development efforts and also integrate themselves with the global technology networks. If such strategies are adopted, the first-tier NIEs have a chance to compete with the OECD countries, at least, in some areas.

China and India may have advanced research capabilities in special areas of national priority, but such research has not significantly impacted the commercial segment. New policies are in the anvil and international firms may be attracted to these countries. However, the electronic industries in these two countries are isolated enclaves in still very poor rural societies. Under such conditions, these two countries will face severe constraints in becoming major competitors in the global context.

The other NIEs are stuck with very low levels of industrialization and outdated industrial structures and hence may find entering global electronic markets in a significant way out of reach for the present; they may have to first carry out necessary basic economic and social reforms.

The book provides an unbiased, well-structured, argued analysis of the electronics industry in the newly industrializing economies, their sectoral strengths and weaknesses combined with useful statistics. It also presents the reader with an illuminating account of the character of the newly emerging entry barriers and the global dynamics of industrial development and competition in the electronics industry—a very useful reference publication.

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Biochemical Methods for Agricultural Sciences. S. Sadashivam and A. Manikam eds. Wiley Eastern Ltd., 4835/24, Ansars Road, Doryaganj, New Delhi 110 002. 1992. 246 pp.

This book describes quantitative estimation of plant constituents in a stepwise manner. In this aspect, the book forms a good reference for estimation. However, in most places, the sources of error in estimation and the methods and precautions necessary for obtaining reliable estimates are not discussed. The book would be a good practical guide if these aspects are covered in detail in future editions.

Procedures for the estimation of carbohydrates include a discussion of colour reactions of carbohydrates, determination of amylose, cellulose, hemicellulose, fructose inulin, pectic substances and crude fibre.

Estimation of oils, free fatty acids, saponification, iodine and peroxide values of oils and fats as well as identification and quantification of fatty acids are discussed under lipids of plant materials. The methods described are brief and do not present details of calculation.

Proteins and amino acids are discussed in greater detail. A variety of procedures starting from the identification of proteins to more recent methods of blotting and *in vitro* translation assays are described. The section on estimation of lysine, proline and other essential amino acids is of particular use in evaluating food grains. The principle of these techniques, however, is brief.

The procedure for the assay of 27 of the commonly found plant enzymes is discussed in a separate chapter. The choice of enzymes is appropriate. Methods for analysis of isoenzyme content are also included with specific reference to nine enzymes.

The discussion on nucleic acids begins with procedures for cultivation of λ-phage and extraction of λ-DNA. Methods are also presented for plasmid isolation, restriction digestion, southern blotting and DNA gel electrophoresis. In view of the several excellent monographs available for molecular biological techniques, the chapter could have addressed problems more relevant to agricultural sciences such as detection and estimation of parasite-specific nucleic acid.

Procedures for estimation of vitamins, pigments, phenolics, anti-nutritional factors are described in separate chapters. The chapter on plant hormones is rather short and does not include the more recent methods of estimation using high performance liquid chromatography.

Cell fractionation procedures appear at the end of the book, although, these are the initial steps for most of the biochemical procedures covered in the book.

The lack of illustrative example with experimentally obtained realistic data, lack of coverage of precautions necessary for reliable estimation are partially compensated by extensive reference to literature.

The book is a useful reference material for post-graduate students.

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