

INNOVATION AND INDUSTRIALIZATION: THE WAY AHEAD FOR DEVELOPING COUNTRIES

Ph. D. Jovo Ateljević*, Ph. D. Peter Rosa**

Abstract

Although most countries in the world have had a long tradition of craft based manufacturing or cottage industries, which arose from the „grass roots”, large-scale industrialization did not happen through natural forces except in the case of Britain (the first to industrialise). Other countries observed Britain’s success, took stock, and planned their industrialization. This was especially true in the 20th century, where the Soviet Union, China and India carefully planned their industrial development, with a heavy emphasis on planned state control, regulation, protectionism and subsidies. Nehru’s famous dictum that „It is better to have a second rate thing made in one’s own country than a first rate thing one has to import” has served as a role model for most developing countries seeking to industrialise.¹ This paper provides a critical account on the industrialisation and its effects on economic development and growth. We argue that the most fundamental assumption underpinning modern industrial policy is that the environment, driven by accelerating social, political and technological change, is constantly producing new fundamental economic opportunities. The paper is based on a number of selected references complemented with an extensive additional reading.

Keywords: Innovation, industrialization, economic development, lessons for developing countries

* University of Stirling

** University of Edinburgh

¹ Quoted from the Economist (US) June 5th 2001

Introduction

Industrialization based on manufacturing is commonly seen as the most important route to modernization and economic prosperity. It is easy to see why. The Finniston Report² in 1979, appointed to investigate the changing role of engineers in Britain following industrial decline, made a strong case for a strong manufacturing sector:

- Manufacturing accounts for a significant proportion of every nation's economy, and generates a very important proportion of jobs
- Every sector of the economy has close links with manufacturing either through sourcing raw materials, the distribution, marketing and sales of goods, or by supplying services, which add value to manufacturing processes and products.
- Employment in non-manufacturing sectors is often dependent on its links with manufacturing. In effect manufacturing sustains far more jobs than are directly employed by it.

We could add further points:

- Much of what we eat and most of what we use is „manufactured”. Manufacturing apparently underpins all aspects of life.
- The world's most powerful countries owe their success to manufacturing and industrialization. Britain, a small second rate European power until 1700, was transformed by being the first country to industrialise. The USA was a backwater until its industry „took off” in the 1860s; France, Germany and Japan did not reach the status of modern world powers until they industrialised in the later 19th Century. In the 20th Century the Soviet Union (1920s/30s); India, China and Hong Kong (1950s/60s) achieved considerable world influence and power following industrialization. Since the war the revival of Germany and Japan into world economic powers is commonly ascribed to the modernisation of the manufacturing industrial base.
- Manufacturing is still central to the economies of the world's wealthiest countries.
- The rate of productivity is higher in manufacturing than services. It thus contributes disproportionately to economic growth.
- Manufactured goods are much more „tradable” than services. Having a strong manufacturing „base” is thus important to the balance of payments, as manufactured goods are much more exportable and also reduce the needs for imports.

² Sir Montague Finniston (1980), *Engineering our Future*, Report of the Committee of Inquiry into the Engineering Profession: HMSO Cmnd 7794

Implicit in these types of discussion is the view that industrialization is linked to large scale manufacturing, in which products can be produced in volume to meet mass consumer demand. Large manufacturing organizations in turn produce multiplier effects supporting a large sub-structure of dependent suppliers, distributors and service providers. Despite major differences in how modes of productions were controlled, regulated and distributed, both communist and capitalist countries ended up with large „Fordist” types of industrial production units. As Kerr, Dunlop, Harbison and Myers (1960:p.39)³ put it in their seminal book *„Industrialism and Industrial man”*, *„the technology and specialisation of the industrial society are necessarily and distinctly associated with large scale organizations, which require extensive coordination of managers and managed”*.

Although most countries in the world have had a long tradition of craft based manufacturing or cottage industries, which arose from the „grass roots”, large-scale industrialization did not happen through natural forces except in the case of Britain (the first to industrialise). Other countries observed Britain’s success, took stock, and planned their industrialization. This was especially true in the 20th century, where the Soviet Union, China and India carefully planned their industrial development, with a heavy emphasis on planned state control, regulation, protectionism and subsidies. Nehru’s famous dictum that „It is better to have a second rate thing made in one’s own country than a first rate thing one has to import” has served as a role model for most developing countries seeking to industrialise.⁴ Restrictions of imports into Kenya, and import substitution policies, for example, were a keystone in the partial industrialization of Kenya in the 1960s and 1970s. By the 1980s, however, India gained a reputation as a country where everything ALMOST works, and Kenya produced many items that were available but not always willingly consumed. I can still clearly visualise the sickly taste and garish Technicolor red of the Kenya tomato ketchup import substitute of the 1960s. Clearly this model has its disadvantages.

Industrialization in the new Millennium.

The limitations and weaknesses of the traditional model of industrialization have been evident since the 1970s. The following factors have necessitated a radical reappraisal of the role of manufacturing in the modern world:

³ Kerr et al. (1960s), *Industrialization and Industrial Man: The Problems of Labour and Management in Economic Growth*. Cambridge MA: Harvard University Press

⁴ The Economist (US) June 5th 2001

- Increases in productivity made possible by the advent new technology. Most modern factories have become so efficient as a result of mechanisation that they require only a fraction of people to work in them.
- The exponential rate of increase of the rate of innovations⁵. For example in the world of computing alone, processing power has been doubling every two years since the 1980s, and the added commercial value of the internet has been exponential since 1993⁶. If you think about it most luxury consumer goods we take for granted did not exist commercially before 1940 (television, tape and video recorders, CDs, DVDs, mobile phones, food processors, PCs, laptops, coffee making machines).
- Globalisation: thanks to rapid communications and transport, global competition becomes normal rather than exceptional.
- Differentiation of consumer tastes: The increasing sophistication of people has led to demand for more choice and customisation. Demand is much more volatile and unpredictable. Mass markets have been transformed into segmented niche markets.⁷

These factors have led to a revolution in the nature of industrial organizations:

- The large complex hierarchical Fordist organization is increasingly obsolete. Technological efficiency and differentiation of consumer tastes have made short runs more economical and have eroded the advantages of gains in productivity linked to economies of scale. This has tended to favour smaller production units. There has been a large growth in small businesses throughout the world in the last thirty years servicing „niche” markets, and a downsizing of large traditional manufacturing plants.
- The need for choice has led to frequent innovative variations on core products, making them „socially” redundant well before they become functionally redundant. (Although my Sony Laptop is less than 9 months old, for example, and still works perfectly, I am already hankering for the latest one with new advanced features).
- There is less advantage in geographical concentration. Sub units can be spread widely without incurring penal costs.
- Innovation and automation has led to less need for labour, especially traditional skilled labour. The unpredictability of the nature and size of new

⁵ P. Drucker, *Managing in a Time of Great Change*, Butterworth, 1999-

⁶ A fuller discussioin of these phenomena known as Moore’s Law and Metcalfes’ Law can be found in Papows, J. (1999) *Enterprise.com*. Nicholas Brearley

⁷ G. Loveman; W. Sengenberger, *Economic and social reorganisation in the small and medium-sized enterprise sector*” in Sengenberger et al. (1990) *The Re-emergence of Small Enterprises: Industrial Restructuring in Industrialised Countries*, Geneva:ILO, 1990.

markets and the decreasing lifetime of products has generated a new need for a flexible and adaptable labour force. There is an increasing trend for expertise to be bought in when needed, burgeoning a growth in sub-contracted self-employed service providers.

The industrialization paradox:

Modern industrial economies, particularly the most prosperous ones, have experienced a considerable trauma since the 1960s as the forces of change swept over them. There has been an enormous shake out of large traditional „smoke stack” manufacturing industries. Britain, for example, has suffered many famous casualties. The motorcycle industry disappeared in 1960s; commercial shipbuilding is now virtually extinct; a few small designer car firms still manufacture in Britain, but British owned mass car production is virtually dead. Textiles have mostly gone too. In my village of Alva in Scotland only one Woollen Mill remains out of over a dozen operating in the 1960s. This is only viable because it services passing tourists.

Yet, paradoxically, manufacturing still survives and is, if anything, richer than ever. The profits generated by modern food processing and pharmaceutical companies, for example, is still enormous. Manufacturing industries are still vital in the economies of nations such as Japan and Germany, the USA and Britain. What is going on?

- Firstly there have been huge gains in productivity as a result of new technology and mechanization. Fewer people are being employed, but output and profits are much greater. IMF figures show that the share of manufacturing in total employment in the rich economies fell from 28% in 1970 to 18% in 1994. Even in Japan, one of the strongest manufacturing economies, less than a third of employment is in manufacturing. Productivity in manufacturing has risen twice as fast as in services, making it more profitable but less labour intensive.
- Globalisation, coupled with the growing liberalisation of trade, has realigned global competitiveness. One commonly held view is that this favours developing countries, as they have advantages of low labour costs and can take advantage of „migrating” companies. Closer scrutiny, however, reveals that the gains are not high in terms of quality of jobs and life, and that even these gains are relatively short lived. Even India and the Asian Tigers have been experiencing rapid reductions in manufacturing employment as productivity through innovation displaces gains from cheapness of labour.

Porter states in a number of papers in the Harvard Business Review, that national prosperity is created, not inherited. It does not grow out of a country's

natural endowments, its labour pool, its interest rate, and its currency value as classical economists insist. Globalisation has wiped out these traditional advantages. The key factors of production today – technology, intellectual and financial capital, managerial skill – are not rooted in a nation's soil but are eminently transportable across borders. The advent of the Internet has accelerated this process of freedom from national boundaries.

Why then are there still regional industrial „clusters” of manufacturing excellence (high performance autos in Germany and Northern Italy; cameras in Germany and Japan; play stations in Japan; internet search engines in California and so on)? Porter argues that theoretically these clusters ought to be dispersing under globalisation. However what appears to be happening is that when businesses of the same type are clustered together, they generate local rivalries, which stimulates innovation and excellence. Research on Silicon Valley⁸ has also demonstrated that whilst at one level firms compete with each other in the global market place (Yahoo versus Lycos, for example, or BMW and Mercedes), they also share common networks and frequently interchange specialised talent. (For example in the UK Premier League, all the teams compete, but players, coaches and managers rotate often between clubs). Innovation, managerial expertise and knowledge drive modern companies, not traditional and simplistic notions of comparative advantage.

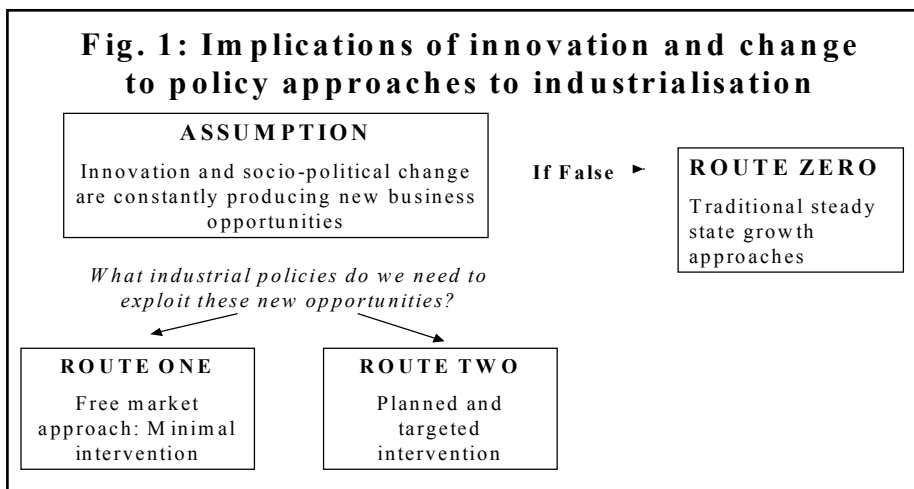
Unravelling the assumptions of industrialisation and economic growth

Modern industrial economies in the rich countries are much more sophisticated than the economies of the traditional industrial era pre-dating 1980. What options do developing countries have in trying to match these sophisticated trends? In order to discuss this question, it is necessary first to understand that the basic assumptions underlying economic growth have fundamentally shifted in the last forty years.

As Figure 1 shows, the most fundamental assumption underpinning modern industrial policy is that the environment, driven by accelerating social, political and (primarily) technological change, is constantly producing new fundamental business opportunities. The pace of new technologies and business opportunities takes little imagination to verify. The gramophone, for example, was invented in the late 19th century, a huge head with a needle playing a vinyl groove. Fifty years later this basic model was replaced by an electrical record player still based on a needle running along a groove, but now linked electronically to loudspeakers. By 1965 reel-to-reel tapes had begun to

⁸ A. Saxenian, (1996) *Regional Advantage, Culture and Competition in Silicon Valley and Route 128*, Cambridge MA: Harvard University Press

challenge this model of producing music. By 1970 portable cassettes had become the vogue. They were superseded by CDs in the late 1970s, and we now have digital media. The lead-time between fundamental changes, as Drucker observes,⁹ is getting shorter and shorter. Each one of these fundamental changes had significant multiplier effects.



What if the assumption is false, that new opportunities are few and slow to materialise? We would then have a steady state economy, similar to the one before the war, where the „world cake” was finite and slow to expand. Such expansion would mostly have occurred as a result of population growth, rather than increased demand through changing consumer tastes. Figure 2 illustrates the implications of this. With a relatively static „zero growth” „cake” with slow changing mass markets, increased profits can only come by displacing the profits of others. Left to market forces those companies that are best able to compete would get bigger and more dominant at the expense of less successful companies. The role of innovation of production would be to accelerate this process. As a company becomes more efficient through modernization and innovation, its capacity to displace other companies is even greater. It is a recipe for the growth of monopolistic giant companies.

In this kind of economic climate, nations with few competitive advantages for their companies would have little choice but to either survive on the „crumbs” left by the cake when it is cut up, or to generate some kind of competitive advantage artificially. Developing countries like India and China through government planning, protectionism, subsidies and incentives were able to build up in the post war period internal industries by isolating their

⁹ P. Drucker, (1985) *Innovation and Entrepreneurship*, London: Butterworth/Heineman

Fig. 2: ROUTE ZERO IMPLICATIONS

IF THERE FEW NEW OPPORTUNITIES BEING GENERATED

- There is slow predictable growth in demand- mainly from increases in population
- New profits mainly come from exploiting existing markets more efficiently
- Favours growth of large and established firms with increasingly competitive resources and managerial expertise
- Increased profits are largely at the expense of other less competitive businesses

Leaving the economy to market forces will favour success for those with genuine competitive advantage – and will drive less competitive companies to extinction. Policy has favoured maximising the genuine competitive advantages of companies. (Making the environment more competitive, free trade).

If genuine competitive advantage is lacking or in short supply, policy has favoured manufacturing advantage (protectionism, subsidies etc.). This is a very tempting route for developing countries with few perceived competitive advantages.

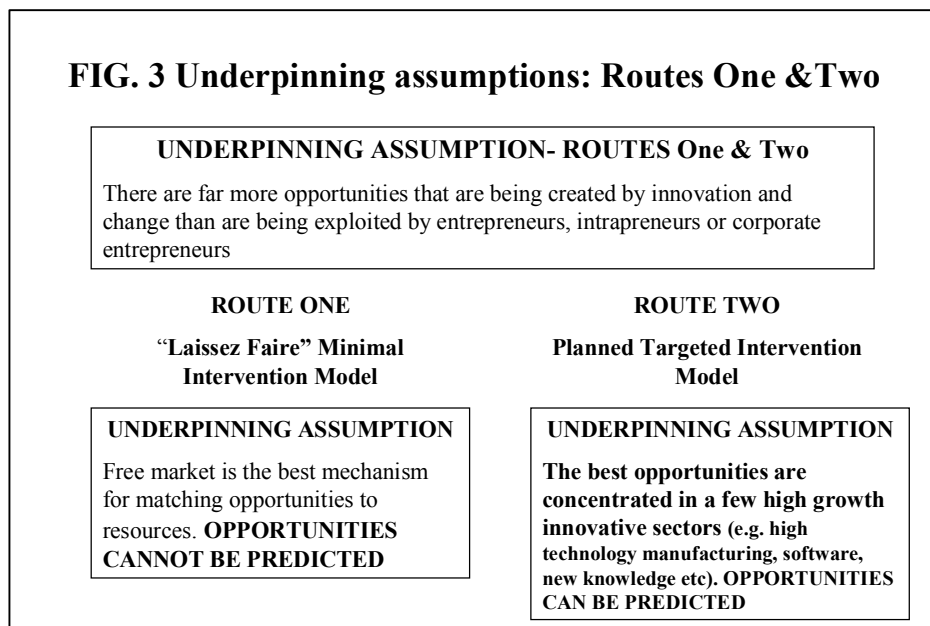
country from the winds of market forces. When India finally rejoined the main economy in 1990, it had to endure as radical a transformation as that experienced by any of the developed economies.

This „Route Zero” option, however, is increasingly out of step with modern conditions, chiefly because new opportunities are developing frequently and rapidly in the modern economy. The assumption that opportunities are out stepping the ability of entrepreneurs in industry to take advantage of them is widely accepted, by governments of all political persuasions. The main area of debate today is not so much whether such opportunities exist, but HOW best to exploit and optimise them. In Figure 1 modern governments have commonly adopted two routes to success. ROUTE ONE is the „Laissez Faire” or market forces route, championed particularly by Margaret Thatcher and Ronald Reagan in the 1980s. ROUTE TWO is the planned interventionist route, which has been favoured particularly by more socialist governments (of which the current UK government is a typical example).

An important difference between these two approaches lies in their belief on whether wealth and job creating opportunities can be predicted. In ROUTE ONE it is assumed that governments cannot predict the best money making opportunities. Market forces are the most efficient way of matching resources to opportunities, and they should be given free reign to operate. It does not

matter in the end which industrial sector a job comes from, as long as the job is generated by a genuinely profitable business. Entrepreneurs are thus the best people to find and pursue new opportunities.

FIG. 3 Underpinning assumptions: Routes One & Two



In ROUTE TWO, however, there is an underlying suspicion about uncontrolled entrepreneurship. The best jobs and market opportunities, it is believed, can be predicted in advance, and can be planned and controlled. In particular there are „jobs and jobs”, quality of jobs matter as much as quantity of jobs. The sources for quality jobs can also be predicted and planned for. The approach relies on „picking winners” and „picking sectors”. At present the current UK government, and most European governments, agree that the most promising sectors are high technology „knowledge based „ sectors.”¹⁰

¹⁰ The OECD definition of knowledge based industries is given below as quoted by the UK 1998 White Paper „Our Competitive Future: Building the Knowledge Driven Economy: Analytical Report 3.2.3: (CM1250).” www.dti.gov.uk/comp/competitive/

- **Knowledge based industries:** knowledge based services and high tech industry.
- **Knowledge based services:** telecommunications; computer and information services; finance; insurance; royalties; other business services.
- **High technology industries:** aerospace; computers and office equipment; radio, TV and communications equipment; pharmaceuticals. **Medium - high technology industries:** professional goods; motor vehicles; electrical machines excluding

Fig. 4: Optimising the potential of each route

ROUTE ONE: Metaphor

“Survival of the fittest”

To maximise unpredictable opportunities, as many entrepreneurs as possible should experiment with new diversifications. Hence policy should:

- Encourage high rates of new firm formation
- Tolerate high rates of business failure and “churn”
- Ensure a fair and uninhibited competitive business environment

OUTCOME: Vigorous, entrepreneurial tough competitive new companies. WEEDS?

ROUTE TWO: Metaphor

“Gardening”

To maximise predictable opportunities in high growth innovative sectors businesses have to be nurtured, as they are difficult to start and need a great deal of investment (*they are resource and knowledge intensive*). Hence Policy needs to :

- Persuade entrepreneurs to start businesses in these difficult sectors
- Train entrepreneurs and staff to operate effectively in such knowledge intensive industries
- Encourage preferential LONG-TERM investment in these sectors. Government has a vital role to play in underpinning risk as the free market will be wary.

OUTCOME: Fragile specialist innovative companies: FRUIT?

The consequences of these assumptions to government policy are outlined in Figure 4. In ROUTE ONE, to maximise the take-up of opportunities, it is necessary to have as many entrepreneurs, intrapreneurs or corporate entrepreneurs as possible trying out new business ideas. As the source of the next great business is not very predictable, the economy needs a diversity of entrepreneurs (from different backgrounds, expertise and experiences) to try their luck. As entrepreneurs experiment with opportunities, a natural selection process occurs. From the „churn” of entrepreneurial activity, the fittest survive, and send up strong innovative and vigorous new businesses. This means that a competitive business environment is essential, and that the government must tolerate (and control the social consequences) of high rates of business failure. Reynolds and Maki (1990)¹¹ in a regional study of US

communications equipment; chemical excluding drugs; other transport; non-electrical machinery.

- **Medium - low technology industries:** *rubber and plastic products; ship-building and repairing; other manufacturing; non-ferrous metals; non-metallic mineral products; metal products; petroleum refineries and products; ferrous metals.*
- **Low technology industries:** *paper, products and printing; textiles, apparel and leather; food, beverages and tobacco; wood products and furniture.*

¹¹ Reynolds P.; W.R. Maki, ‘*Business Volatility and Growth*’ Report to the US Small Business Administration, Regional Economic Development Associates, Minneapolis, 1990.

businesses showed that the most prosperous regions of the USA were associated not only with high rates of business births, but also high rates of business „deaths”. This implies a Darwinian evolutionary process where the fittest survive, and where competitive forces match opportunities through entrepreneurial experimentation.

Reynolds and Maki (1990:90-91) stated:

“The most important finding for public policy was the importance of high establishment and job birth and death rates to economic growth. This was so pervasive that the analysis proceeded by combining both death and birth measures as indications of business establishment and job volatility. This was strong evidence that the process of economic change requires a substantial transfer of resources (capital, facilities, entrepreneurial and managerial talent) from one firm to another and from one industry to another. Public policies that attempt to prevent such shifts by subsidising organisations and industries in decline may not only support non-competitive activities, they may retard the development of more promising activities. An adaptive economic system seems to require a substantial degree of volatility – business births and deaths, jobs created and destroyed. The most suitable role for governments may be to facilitate adaptation of the economic system through changes in businesses entities and jobs whilst minimising the social costs – interim unemployment, redeployment of capital and physical assets – associated with such transactions”

Contrast this with the planned interventionist approach of ROUTE TWO in Figure 4. The emphasis is on „picking winners”. Having targeted high growth sectors, new businesses in these sectors have to be „nurtured”. Entrepreneurs with the right skills (a scarce resource) have to be tempted to commercialise, and start businesses within these sectors. A great deal of investment has to be spent on the fledgling business, as the pay-off may not materialise for several years. Investment is long-term, and hence risky. Unlike in the competitive approach, moreover, the interventionists see little merit in business failure. Having spent so much investment in getting these businesses off the ground, failure is costly.

Fig 5: Remedies for supply imperfections

ROUTE ONE

- Promote a plentiful supply of entrepreneurs to test out new unpredictable opportunities. Encourage diversity of skills and background and an enterprise culture to persuade people to have a go.
- Fair access to resources (capital, labour, advice, support). Advice and support should be made available (at a fee) but not “forced”.
- Promote a flexible and mobile labour force capable of adapting quickly to changing conditions. (Discourage permanent employment, make retraining available, abolish restrictive working practices)

ROUTE TWO

- Promote a specialist supply of high technology entrepreneurs (especially by targeting science departments of research universities). Train them to commercialise innovation.
- Encourage partnerships between innovators, government, business, banks and venture capital funders to provide resources.
- Investment in education and training to provide the high growth sectors with a skilled labour force.
- Instil progressive attitudes in people

In terms of process and outcome, each approach can be viewed metaphorically in terms of gardening. The free market ROUTE ONE approach requires no intervention by the gardener, and generates through competition and survival of the fittest, strong vigorous plants (Weeds?). The interventionist ROUTE TWO approach in contrast requires significant gardening as the „young shoots” would be swamped, left to their own devices. After careful nurturing and gardening, however, they produce high value and productive fruit.

Both routes are critically affected by limitations in the supply of human capital (Figure 5). For ROUTE ONE to work well, a plentiful supply of entrepreneurs is needed. As opportunities could come from many different and unpredictable sources, the economy needs a *diversity* of entrepreneurs, with different skills, backgrounds and experience. To achieve this the Thatcher’s government adopted a number of measures to encourage more entrepreneurs „to have a go”. This was mainly done through the tax system, by which self-employed people were permitted to offset a much greater range of expenses against tax than employed people. They became aware that once in business, they could keep a much greater proportion of earnings. At the same time employment was made less attractive by measures designed to erode permanency in employment. A large proportion of the working population was

in shorter term contracts by the end of the 1980s. Secondly they encouraged an enterprise culture, in which self reliance and making money through business were constantly praised. Finally, the tries to liberate regulations at all levels, to make it easier and cheaper to start businesses.

In contrast, for ROUTE TWO to become effective, entrepreneurs need to be knowledgeable and specialised in the targeted high technology sectors. Such people tend to be in short supply. The current UK government is championing Route Two policies, and since 1998 has targeted Universities for special attention in its drive to find new „knowledge-based” entrepreneurs.¹² Any scientist who wishes to start a business based on the commercialisation of his or her scientific work is guaranteed plenty of support in terms of grants, subsidies, specialist advice and mentoring.

Furthermore as starting new high knowledge businesses is a risky process that requires high initial investment, the complexity and difficulty of this process has been recognised as a crucial barrier. It is now assumed that though the high technology or knowledge specialist entrepreneur is the focus of the business, he or she cannot operate alone. There is thus a focus on fostering „partnerships” between governments, the Universities or other knowledge based institution, the knowledge entrepreneur, other industrial experts and financiers (banks, venture capitalists). In this way different skills are blended lessening the risk and increasing the chances of success.

Both approaches also require the right kind of labour force to work well. In ROUTE ONE the primary requirement for management and employees is the ability to adapt to change and learn new learn new skills quickly, as new types of business opportunities are experimented with. In ROUTE TWO, however, skills can be predicted in advance and planned for. It is assumed that setting up businesses in high technology and other knowledge based sectors requires a labour force with special skills. A shortage of such people would slow down the development of the knowledge based economy. To remedy this requires strategic educational and training planning. The UK governments of the last ten years have tried to remedy these kinds of shortages by changing the higher education system. In the traditional industrial economy when factories dominated, Britain needed an elite professional and managerial class (the best educated 3-6% went to University to become professionals) a large class of skilled industrial workers (trained through apprenticeships, colleges and polytechnics) and a large class of manual workers (learning on the job). In the new knowledge economy most of these traditional skills are now redundant. To instil the new skills needed, Britain now needs a flexible and well educated

¹² UK Government: Department of Trade and Industry (2001), Excellence and Opportunity, A Science and Innovation Policy for the 21st Century, (CM 4814), www.dti.gov.uk/ost/aboutost/dtiwhite

majority of employees. The current Blair government has set a target of 50 per cent of school leavers becoming University educated by 2005. This is a large long term investment in education for what is often referred to as „Britain PLC”.

It should be noted that a ROUTE ONE approach also favours education, but for different reasons. Education in the ROUTE ONE approach is not there to provide skills for knowledge driven companies, but to expand people's skills and minds so that they become better aware of global business opportunities and have the capability and confidence to pursue them.

What are the options for developing countries?

The modern innovative and knowledge based economy produces:

- a) Highly innovative, productive, flexible and efficient manufacturing which requires less employees
- b) A large number of dependent suppliers and services to these units
- c) A proliferation of small niche producers and service providers to cater for an increasing diversity of consumer tastes and demand
- d) Mechanisms to allow global penetration of even smaller markets (notably through the world wide web)
- e) A proliferation of new and widespread opportunities in a diversity of sectors

All countries have elements of the new economy in them. Even India, whose economy is a product of planned traditional industrialization, has been heavily affected by the new economic order and, having experienced economic liberalisation, has seized opportunities. As a recent article in the Economist puts it:

“[In India] services are growing faster than any other sector. They span a range from banks to tea stalls, but it is the ‘knowledge industries’ that have captured the imagination of India’s entrepreneurs. Of these, information technology is the most successful. It has grown at an average annual rate of over 50% from almost nothing in 1991 to sales of \$8.3 billion in 2000 and employment of around 400,000. It makes up 15% of India’s exports. NASSCOM, the main trade association for the information technology industry, predicts that by 2008 India will export \$50 billion-worth of software and allied services and employ 1.1 million people.” (Economist (US) 2001, June 2).

How can these opportunities be realised in poorer developing countries? The old formula of traditional industrialization (which I called ROUTE ZERO earlier), clearly has a lot of problems if implemented. In the competitive modern economy, only cheap labour provides a true advantage for the poorest

developing countries, but this is of limited value, as modern manufacturing needs cheap skilled labour, not cheap uneducated labour. Moreover if education improves, the cheap competitive advantage soon disappears, as the Asian Tiger countries are now experiencing. If developing countries decide to create artificial competitive advantages for their own industries through protectionism, subsidies and planned traditional industrialization, this would be even more problematic in the long term, as is witnessed by the demise of traditional industries world wide once subjected to the competitive pressures of global market forces. The lesson to be learnt here, perhaps, is that those countries that have not industrialised significantly in a traditional manner (like most African countries, for instance) should „leap frog” this stage. An analogy for this is telephones. In Uganda landlines were not upgraded or modernised during the troubles of the 1970s and early 1980s. In the meantime the new generation of communications (mobile phones) has taken off. We could say that Uganda has „leap frogged” the landline stage.

How then can a modern industrial economy emerge by „leap-frogging” the development of traditional manufacturing? ROUTE ONE (leave it to the market) is highly effective in matching perceived opportunities to resources. It is the basis of all healthy economies. However, it could be argued that in the poorest developing countries, only a small proportion of elite cosmopolitans have the education and wide experience to access the proliferation of global opportunities being thrown up by innovation and change. You have a situation where a limited number of elite entrepreneurs are making a great deal of money and are global in their vision and operation, and provide opportunities for a large number of smaller suppliers and service providers. The bulk of the population, however, though often equally entrepreneurial, operates only at a local level within the informal sector, and fails to reach out to more global opportunities. There is no failure of market forces here. It is rather that market forces are only partially operating in a global environment, and hence only accessing a limited number of possible modern opportunities.

ROUTE TWO provides a possible remedy to increase involvement in the global economy. This requires a strong role by government and industry to develop knowledge that can be commercialised in the Universities and research departments of industry. ROUTE TWO solutions can be locally very effective (for example the French government has been very successful in developing high technology industry clusters through careful intervention. Closer scrutiny, however, reveals that ROUTE TWO solutions are so complex and expensive that they can only be applied to a small number of sectors and only by rich countries. The bulk of the economy BY DEFAULT must remain driven by ROUTE ONE principles. ROUTE TWO also suffers from the fact that trying to guess which sectors will produce the best businesses does not always work.

How can ROUTE ONE solutions be made more effective in developing countries? The long-term answer is to invest in more higher education, and for entrepreneurs or potential entrepreneurs to travel more. Once personal horizons are opened up, entrepreneurial people will be able to spot more global opportunities, and also have more knowledge to enable them to bid for the necessary resources to exploit them. An expansion of higher education, as in the UK, is a vital long-term investment which government must play a major part in engineering. (By this I mean that government must see that it materialises, but does not necessarily imply that government is the best provider). In the short-term the encouragement of our current cohort of elite global entrepreneurs remains one of our major weapons to develop new market opportunities. Making it easier for them to operate is an essential step to establish a new industrial economy.

In this paper we have presented an analysis of how the new industrial economies differ from the traditional one based on large-scale manufacturing. We also discussed the strengths and weakness of two approaches for developing the opportunities presented by the new innovation driven and knowledge based economies. We finally introduced some thoughts on the implications of these approaches to developing countries.

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