New and Dynamic Sources of Industrial Growth

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Abstract

An attempt is made in this paper to analyse the sources of industrial growth then and now, focussing largely on new sources which rekindle dynamic growth across manufacturing subsectors. While the past academic exercises on the sources of industrial growth were demand-centric, decomposing the sources of industrial growth into domestic demand, external demand and import substitution, current research on the sources of industrial growth concentrates on knowledge, skills, information, technology, innovation and networking as new and dynamic sources of industrial growth. Those new sources trigger dramatic shift in industrial production from resource-based and labour-intensive products to medium-, high-tech and sophisticated products which account for major share of global manufacturing value added and manufactured exports. While many resource-rich least developed countries struggle to convert their resource-based comparative advantages into competitiveness for want of domestic capacity and capability building in terms of R & D and innovation, several resource-poor countries enhance their global competitiveness using human ingenuity as the infinite source of wealth creation. Thus, today the process of industrialization is not driven by resource-based comparative advantage alone, but by a number of non-resource-based factors, serving as new and dynamic sources of industrial growth.

Keywords: *Growth, Manufacturing, Resources, Exports, R & D, Innovation, Competitiveness, Networking, Linking, Leveraging, Learning*

Introduction

In the past, the sources of industrial growth were decomposed into domestic demand, external demand, and import substitution, based largely on the demand-centric perceptions (Chenery, 1960). It was realised that the incidence of technical progress could have been added as a source of growth in addition to the demand-based approach. For want of valid, authentic and reliable data, it could not be included in the past analytical interpretations of the sources of growth (Vinanchiarachi, 1990). The analysis of the extent of internal demand and external demand as sources

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of industrial growth bears testimony to external demand serving as a major source of growth in export-oriented countries, such as the Republic of Korea and Taiwan Province of China, and domestic demand contributing to over 90 per cent of industrial growth in India. Despite the waves of liberalization and deregulation sweeping across all subsectors of manufacturing in India, domestic demand continues to contribute to lion's share of the sources of industrial growth in India. The new and dynamic sources of growth today stem largely from knowledge, skills, technology, innovation, and networking and not from resource-based comparative advantages alone.

The key sources of the 18th century industrial revolution were industrious response from the household sector to meet the growing demand for goods and services and small changes which took place in small workshops to turn out value added products. Fundamental changes took place in the patterns of production during the 19th century industrial revolution which transformed great agrarian economies into might industrial power houses, the US in particular. The 20th century industrial revolution was underpinned by rapid, revolutionary and complete changes in processing, design and marketing, triggered largely by dramatically enhanced functional literacy rates of industrially more advanced countries. Functional literacy rate entails enhanced capabilities and skills to use modern technology and to commercialise new knowledge.

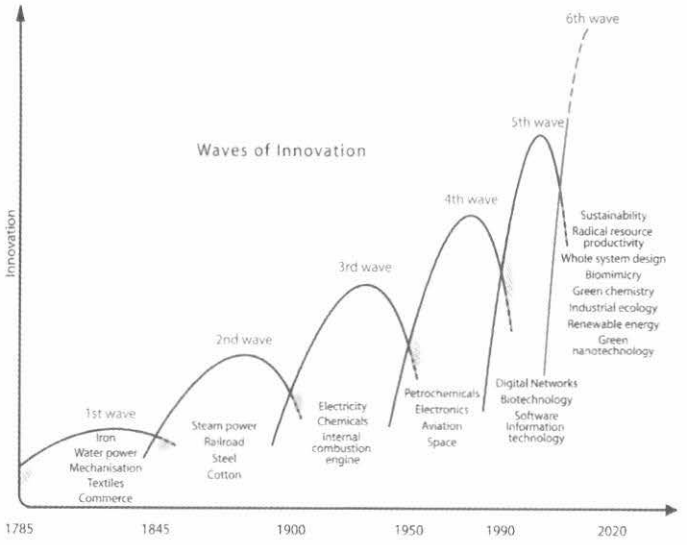
The new and dynamic sources of growth are different from demand-based sources of growth. Today, new knowledge is generated by institutions, exploited by laboratories and commercialised by dynamic firms. Supply is a source of growth as it is increasingly bearing testimony to the famous Say's law "supply creates demand." The supply of products produced complying with international standards and quality control norms with a high degree of precision create demand for those products. In this respect, what the father of Economics Smith (1776) said is proven to be wrong. In his famous classic "*The Wealth of Nations*" he said: The end of production is consumption. But today, it is being increasingly proved that the end of production is learning, and learning is continuous. Linking, leveraging and learning emerge as new and dynamic source of growth. A dynamic entrepreneur establishes links with dynamic sources of growth, which are often across the border, leverages his skills and resources with those dynamic sources of growth and in that process learns to invent something new which suits the given market specific context. The Ricardian theory of comparative advantage (Ricardo, 1817) is dead today. Now, countries are enhancing competitiveness not through resource-based comparative advantages alone but also by using human ingenuity as the infinite source of wealth creation.

Knowledge as a Source and Innovation as a Force

The 21st century businessman may not be part of the frontiers of best practice in whatever he does. But the minimum he should know is to understand his distance to the frontiers of best practice. His personal and business response to identify viable avenues of reducing the distance to the frontiers of best practice is a discovery process. The successful businessman discovers the process. Knowledge as a source triggers innovation and innovation as a force triggers the transformative shift from quantitative increase to qualitative improvements to turn products, with an accent on a high degree of economic efficiency and ecological compliance.

Figure 1 shows five long-term business cycles that occurred since the onset of the First Industrial Revolution in Western Europe in the late 18th century. The figure makes it clear that each of the successive growth cycles was driven by the waves of innovation. Rapid changes in production processes made England the pioneer of the industrial revolution in the 18th century. During the 19th century industrial revolution, Germany and the United States of America emerged as mighty industrial powers due largely to much faster changes which transformed the productive process.

Figure 1. Waves of Industrial Revolution and Innovation



Source: UNIDO, *Making IT: Industry for Development*, 2009.

In the later part of the 20th century came the first and second generations of the newly industrializing countries, mainly in Asia, China and India surfaced as the emerging economies of the world. With $5.8 trillion gross domestic product (GDP), China overtook Japan ($5.5 trillion) in 2010 as the second largest economy in the world. Indications are that within the next 10 years, the economy of China will be roughly the same as the US economy. By 2020 India is likely to be a superpower in terms of economic growth and performance. A report on mapping the global future by 2020 (NIC, 2004) said: The emergence of China and India as new global players is similar to that of the rise of Germany in 19th century and United States in the 20th century. The rising powers will be great catalytic factors for the transformation of the geopolitical landscape with impacts as powerful as in the previous two centuries. Large population, expanding capabilities, promotion of high technologies and sustained high economic growth will be the foremost reasons for the rapid rise in economic power for both countries. The rate at which developing countries are growing today is faster than the rate at which developed countries grew during the pre-industrial revolution due largely to the incidence of technical progress that enable developing countries to foster higher rate of economic expansion.

The Energy Perspective

Rifkin (2011) argues that in the next few decades everything will be triggered by renewable sources of energy, namely, wind, water, waste, solar, etc., almost in all spheres of economic activity. He also contends that the current centralized distribution of power will collapse and that decentralized distribution of power will be the new reality. The possibility of each building becoming a power house to generate its own energy to meet the energy needs is in the offing. Rifkin's five pillars of energy point to:

1. Shifting to renewable energy;
2. Transforming the building stock of every continent into micro-power plants to collect renewable energies on site;
3. Deploying hydrogen and other storage technologies in every building and throughout the infrastructure to store intermittent energies;
4. Using Internet technology to transform the power grid of every continent into energy-sharing inter-grid that acts just like the Internet (when millions of buildings are generating a small amount of energy locally, on site, they can sell surplus back to the grid and share electricity with the continental neighbours); and

5. Transforming the transport fleet to electric plug-in and fuel cell vehicles that can buy and sell electricity on a smart, continental, interactive power grid.

The above emerging trends seem to play a major role in triggering new and dynamic sources of growth, with a priority focus on clean and efficient energy.

Technological Marvels and Enhanced Adaptive Capabilities and Skills

Marsh (2012) talks a great deal about the incidence of technical progress making deep inroads into the productive processes. Technology is certainly the key to unlock the development potential of countries. However, innovation is not necessarily the outcome of R&D. Improvements to existing products and processes through enhanced skills to use borrowed technology could lead to incremental innovations (Lall, 1992). Most of the innovations that take place in developing countries are incremental in nature. Thus, there are a number of non-R&D routes to innovation. Those routes are efforts to adapt and modify products and processes aimed at reducing energy consumption and material intensity and wastage. Engineers and operatives, who are normally the major forces behind these changes, need to be trained and motivated in order to enhance the benefits of incremental innovation through linking, leveraging and learning and through effective transfer of technology, which is determined by capabilities to acquire the right technology, assimilate it, adopt, adapt and learn; learn to invent something new and thereby be innovative.

The waves of globalization sweeping across countries and continents generate plenty of opportunities: with adaptive capabilities, technology can be upgraded to increase competitiveness in all countries and industries and at all technological levels; technological upgrading can be achieved by pursuing a strategy of innovation based on connecting, complying and competing; and technological upgrading is facilitated by entering into high-tech global value chains, even at the assembly level for export-oriented operations (UNIDO, 2003).

Given the determinants of industrial transformation in terms of infrastructure, utility services, knowledge, technology, networking and adaptive capabilities, late-comers may bypass several stages of development and edge into a high degree of industrialization through incremental innovation. However, R&D is critical in developing countries in order to improve upon imported technology effectively. Thus, the purpose of R&D in developing

countries is not necessarily to invent but to use effectively what has been already invented and to learn to adopt, adapt, modify and improve existing technology to suit local needs and conditions.

Digitalized Manufacturing and Marketing

The current transformative shift of the post-carbon energy development strategy would reinvent the way we do business, facilitating a digital-manufacturing based New Industrial Revolution, replacing mass production by mass customization and a shift from mass production to production by the mass, implying anybody imbued with the required skills could participate in the global value chain as evidenced by people living in remote villages producing tiny components of highly sophisticated products. These developments in manufacturing industry seem to have wide ranging impacts on other sectors. The related concepts are further elaborated by The Economist (2012), Marsh (2012), Rifkin (2011) and Teigland (2012) in terms of: i) Technological upgrading; ii) Science, knowledge, skills and capabilities; iii) Product innovation: iv) Value chain dynamics and market orientation; v) Productivity growth: vi) Employment impact; vii) Industrial relocation: viii) Industrial reorganization; ix) Policy, and x) Global outlook.

Digitized manufacturing is yet another dimension of the New Industrial Revolution (The Economist, 2012). The era of mass production of standardized products may soon end, and the assembly lines will usher in a new era of industrial production marked by short run of differentiated products, leading to mass customization. Digitized production would facilitate the process. In this sphere a number of technological marvels are converging: clever software, novel materials, more dexterous robots, new processes (notably three-dimensional printing) and a range of web-based services. Now a product can be designed on a computer and "printed" on a 3D printer, which creates a solid object by building up successive layers of material (*The Economist*, 2012). Indications are that the digital design can be at one's finger tips, with a few mouse-clicks. These amazing technological marvels and devices can make almost anything, anywhere. Carbon was a dirty word yesterday. Today carbon is a dynamic source of sustainable wealth creation, e.g., carbon fiber is replacing steel and aluminum in products ranging from aero planes to mountain bikes. Nanotechnology is giving products enhanced novel features in a range of products. The internet seems to dismantle the barriers to entry. The trend is further facilitated by robots performing numerous functions with a high degree of precision.

In the wake of these developments, cheap wage cost is no longer the key determinant of competitiveness, and offshore production is increasingly

moving back to rich countries (The Economist, 2013). The trend is further triggered by companies in developed countries wanting to be closer to their customers in order to respond more quickly to changes in demand, possibly triggering a new era of back sourcing.

Collaborative Networking

Collaborate to compete is the new industrial theology. Knowledge sharing and networking for collaborative enterprise development is a matter of harnessing knowledge on a global scale for withstanding competitive pressures for efficiency gains. As the techniques of knowledge sharing are global, enterprises will also go global as long as they are part of the global network to enhance collective response to enhance competitiveness. The word "co-optition" signifies cooperation among firms to compete in an internationally competitive environment. Coordination failures are bound to occur in collaborative networking. The dissemination of knowledge is often proven to be an effective means to correct coordination failures among collaborating and the same time competing firms.

The creation and diffusion of knowledge in social networks and the impact on competitive advantage is yet another dimension of knowledge sharing (Teigland, 2013). Recent evidence shows how virtual worlds and social media enable the co-creation of value in online communities outside of a firm's traditional boundaries. Social network is facilitated by mobile phones and internet. Sub-Saharan Africa is now home for millions of mobile phone subscribers. According to rough estimate, the number surpasses that of the United States and European Union, and represents an explosion of new communication technologies that are being tailored to the developing world. Given the context, the participation of the least developed countries in the virtual world to turn out sophisticated products will not be a utopian aspiration. Those countries also be the beneficiaries of new and dynamic sources of growth.

Conclusion

The traditional approach to compute the sources of industrial growth based on different types of demand fails to capture the incidence of technical progress as one of the sources of industrial growth. The new and dynamic sources of growth include, among other things, information, knowledge, skills, R & D, innovation, technological marvels, new sources of energy and collaborative networking for withstanding competitive pressures for efficiency gains. An enabling environment for facilitating the effectiveness of the new and dynamic sources of growth entails right policy space and

institutional direction and support. With the preconditions in place to reduce the distance to the frontiers of best practice, the latecomers in the sphere of industrialization can leapfrog and edge into a high degree of industrialization and use manufacturing as a dynamic force to foster economic transformation.

Measuring the extent and effectiveness of the new and dynamic sources of growth is a simple exercise. Those sources of dynamic growth will result in enhanced share of medium-, high-tech and sophisticated products in domestic manufacturing value added and in a given country's manufactured exports. If the share of medium-, high-tech and sophisticated products in domestic manufacturing value added is relatively high and that of manufactured exports is relatively low, it necessarily implies that the country's pattern of production is not akin to the global reality and that the country's manufacturing sector fails at the export front. Industrialization is an ongoing process, with constant injection of restructuring led by the new and dynamic sources of industrial growth, which enable countries to be part of today's global industrial reality.

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