A stratagem for responsible business in India and the US: Government innovation or constraint?

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Abstract

The India and US manufacturing industry is in urgent need of innovation. Globally competitive societies require a robust manufacturing industry. The contribution of government innovation and approaches is vital to increase the competitive advantage in manufacturing sector. Priority must be given to assess the role of government to provide technological innovation and advance economic growth in manufacturing industry. The purpose of writing this paper is to examine India and US government new initiatives and approaches in the manufacturing sector. This paper is based on secondary research. Existing reports related to various initiatives taken by the government of both countries and recommendations of planners/NGOs/consultants/government accountability agencies/key industry experts/ for improving the system in both countries are studied. The paper provides in-depth knowledge about India and US government’s new initiatives and approaches in the manufacturing sectors and the scope for further improvement. The present paper attempts to understand the important role of the government to engage in designing and implementing manufacturing sector initiatives in both countries. This work is original and could be further extended.

Keywords: Competitive advantage; India; Manufacturing; Technology; US

1. Introduction

In today’s complex and rapidly changing business environment there are numbers of business models, government strategies and policy approaches advocated for reaching zenith. Some of the organizations...
are using self-assessment techniques and employing other positive approaches for achieving success in the world market. As the business world moves towards globalization, shorter product life cycles, diminishing first-mover advantage, commoditization of goods, etc., the ultimate objective for companies requires newer products and services in the market. Henceforth, there is no room for error and this has put a great emphasis on getting government policies and manufacturing products right in a fast changing world. As manufacturing industries compete in a changing global environment, it raises questions as to a company’s weaknesses and strengths on how to implement lean manufacturing techniques. Business and government leaders may find change disorienting, creating anxiety similar to culture shock, the uneasy feelings of visitors to an alien land because of the absence of the familiar cues they took for granted back home. With an established routine, people do not have to think and work hard. But when a company is currently undergoing major changes that will affect the lives of all of its employees and shareholders, people tend to respond to change with constraint. The central question is: why do some manufacturing companies thrive and make extravagant profits, while others scrape by or perish in a changing environment? What is the secret to manufacturing success and survival? Is it implementation of the right strategy or the development of innovative products by manufacturing companies? Or, is it the various initiatives taken by government? This manuscript focuses on these issues and is based on secondary research. Overall, the manuscript provides in-depth knowledge about India and US government new initiatives and approaches in the manufacturing sectors.

2. Indian manufacturing industries at a glance

India is one of the oldest civilizations in the world. Its rich traditions embedded in the very core of the common Indian person, and its large cultural diversity is well known worldwide. India is among the fastest growing economies in the world and has registered growth in GDP. India’s quest for industrial development began after independence in 1947. The Industrial Policy Resolution of 1948 marked the beginning of evolution of the Indian Industrial Policy. The Resolution not only defined the broad contours of the policy, it also delineated the role of the states in industrial development both as an entrepreneur and as an authority. Successive policy resolutions also reiterated this basic tilt in favor of the public sector. While the agricultural economy was largely characterized by private ownership, manufacturing was predominantly in the public sector until the 1980s. The nationalization of banks and the financial sector was dominated by state-owned institutions. The 1990s witnessed dramatic changes in policy and the unleashing of the Indian enterprise. However, it is only since 2000 that the private Indian enterprise has come into its own. As a recent report of CII(FICCI, June, 2010) showed, in the decade 2000-2010, the private corporate sector overtook the public sector both in terms of net sales and net profits. The private sector’s share in the net sales of manufacturing and services sector output increased from 48.83 per cent in 2000-01 to 68.55 per cent in 2009-10, with the public sector’s share consequently falling from 51.17 per cent to 31.45 per cent. Similarly, the private sector’s share of net profit in the non-agricultural economy increased from 39.17 per cent to 63.86 per cent for the same period, with a decline in the public sector share from 60.83 per cent to 36.14 percent (FICCI, June 2010). The sharp increase in foreign direct investment during this decade has also contributed to the increase in the share of the private sector in national income, sales and profits.

India’s strong economic growth over the last decade has been primarily driven by the services sector, closely followed by the manufacturing sector. The manufacturing industry is the backbone of any economy as it helps in the overall growth of productivity, employment, and it also strengthens the agriculture and service sectors. The astronomical growth in worldwide distribution systems and information technology, coupled with the opening of trade barriers, has led to stupendous growth of global manufacturing networks, designed to take advantage of a low-waged yet efficient Indian work
force. Many believe the next wave of growth in India will focus on manufacturing. The manufacturing sector is expected to drive India’s economy into the next decade and beyond. India’s manufactured products are gaining wide acceptance within the global market, while strong domestic demand continues to drive manufacturing expansion. A study by the Confederation of Indian Industries (CII) and McKinsey & Co. on the manufacturing sector in India estimates that Indian manufacturing exports have the potential to reach US $300 billion by 2015, growing at an annual rate of seventeen percent (Raju Bhinge, 2009)

Fig. 1 depicts the trends of industrial growth and evolution of Indian manufacturing. The Indian manufacturing sector has now been on a high growth trajectory for some time. India is emerging as an efficient manufacturing hub and not as a mass-production hub. Nevertheless, mass production does not necessarily mean that it's employment-heavy. All manufacturing today has an information technology backup. Definitely this kind of manufacturing requires different types of infrastructure: transportation, energy and telecommunications, etc. However India's physical infrastructure is running behind its potential to grow.

There are several key factors contributing to India’s competitive advantage in the manufacturing sector. Multinationals are increasingly setting up manufacturing operations in India. The introduction and the subsequent development of globalization of the Indian manufacturing sector respectively helped India to shed its age old tag of being 'an agriculture based country' (ParanBalakrishnan, 2010) India is slowly shedding its image from being an agriculture based country to a manufacturing based country. The effect of globalization of Indian manufacturing industry is reflected in the GDP’s share of Indian manufacturing sector that has grown considerably over the years. Further, the contribution of the Indian manufacturing sector to the Indian export sector has also increased.

Fig. 1. Evolution of Indian Manufacturing (Source: RajuBhinge, CEO, Tata Strategic Management Group, “India’s manufacturing Sector – Is the best still to come?” 2009)

Since India is quite a long way behind in the development game, it still has further to go. All this elation does need a large bucket of cold water. As our GDP hits the $1-trillion mark, we still have illiteracy rates of about 40 per cent (FICCI, June 2010). This means a sizeable chunk of the population will still be watching from the outside as India Inc. zooms into the stratosphere. And when we look at literacy levels, India stops being compared with fast-growth China and the lens suddenly turns towards sub-Saharan Africa.
But India’s dark side doesn’t take away from the fact that the other side of the picture is bright. It may sound far off but 2015 is only four years away - and, for the time being, the future looks rosy and people will feel proud in purchasing those best quality products that have a “Made in India” tag. In the early 1990s apart from the problems as a result of the foreign exchange crisis, India was also battling image issues: the “Made in India” tag was not exactly a sought after tag. Today, 20 years later India boasts of 15 companies that have won the Deming Award from the Union of Japanese Scientists and Engineers. Furthermore, 92 companies have been awarded the TPM award from the Japan Institute of Plant Maintenance and more than 21,313 ISO certified companies. In the auto components industry, amongst China, India and Thailand, India is number one on the quality of products supplied. Multinational companies have begun to see the benefits of sourcing from India. General Motors (GM) and Caterpillar source radiator caps from Sundram Fasteners – the company has won GM’s best-supplier award for three years. GM sources light equipment from Lumax. Mitsubishi of Japan sources front-axle beams from Bharat Forge and Federal Mogul of the US sources components from India through a tie-up with the Anand group.

3. India’s quality journey

The current euphoric growth of the Indian economy was preceded by long years of gloomy growth until our industry took it upon itself to take a lead in the quality movement. Today, the Indian manufacturing sector is globally recognized amongst the most competent for “global contract manufacturing” with many companies making India their manufacturing hub. These achievements are a result of the “Total Quality Movement” (TQM) and “Total Productivity Maintenance” (TPM) launched by the CII and gained momentum as many small and medium enterprises too bought into the concept. TQM and TPM are now extremely popular models amongst the Indian companies (CII, 2008). India started its quality journey in the early 1985’s. One of the first Japanese gurus who took the lead at that time was the late “Professor K Ishikawa” who visited India in 1986. Professor Ishikawa, then heading JUSE (Union of Japanese Scientists and Engineers) during his visit to India recommended starting a national drive for quality by setting up an institutional arrangement. Confederation of Indian Industry (CII) took the lead in this. CII has led sixteen missions of Indian top management to JUSE since 1989, one each year. Through this arrangement, more than 350 top managers have been trained in Japan on the practice of Total Quality Management through lectures, case studies and plant visits. Several professors have also visited India in these years. Today, it has a membership of more than 300 companies and in the last few years, Indian Oil has become the first public sector to embark on this journey (CII 2008). Today Total Quality Management (TQM) and Total Productive Maintenance (TPM) have become the foundation for manufacturing excellence in India. A lot of credit goes to Japanese institutions like JIPM and JUSE. CII has also invited quality gurus such as Prof.Tsuda, Prof. S Yamaguchi, Prof. H Hirano, Prof. Takawo Kasahara, and more recently Prof. Shoji Shiba to train the Indian industry in the implementation of these quality initiatives. Furthermore, CII has taken several engineers, managers, supervisors, and operators to Japan for short and long-term courses over the years. A lot of human resource development has happened in India through this partnership. Professor Y Tsuda is one of gurus who taught Total Quality Management to Indian companies (CII, 2008).

Prof. S. Yamaguchi has been a pioneer for mobilizing Total Productive Maintenance (TPM) in India. Professor Hirano from the Just In Time Institute has helped Indian companies introduce “Just in Time”. Prof Hirano has been a champion of JIT, which is one of the key elements of “Toyota Production System”. Prof.TakawoKasahara is an expert of flow manufacturing, which also forms the basis of the Toyota Production System that he calls as “Modern Manufacturing System”. Prof.Kasahara has assisted many Indian companies in the last few years. Prof.Kasahara has been visiting India since 1996 and has
worked with many Indian groups like the TVS, Godrej and others to help in their productivity and quality journey. Prof. Shoji Shiba needs no introduction that introduces Indian companies with the “Breakthrough Management concept”. The most important thing today for an organization to succeed is to anticipate the future and work from strong basics. Bringing breakthrough would mean nothing if there are loose interests and minds that we are banking on [6]. The researchers agree that a shared vision that has visible success will bring lot of excitement in a company, but that vision cannot be limited to a product or service innovation. It can be just an innovative idea towards improvement of a process, an important customer insight, not necessarily driving an entire SBU. This resulted in 15 Indian companies winning the Deming Application Award from the Union of Japanese Scientists and Engineers (JUSE) and is a reflection of the increasing quality consciousness of India Inc.

![Fig. 1.2. CII's Quality Journey](Source: CII Institute of Quality, Annual Report, 2008)

Now there must be aim to quadruple the number of such award winning companies over the next two to three years. To take India to the next leap of manufacturing revolution, individual organizations need to build abilities to acquire, assimilate and develop new technologies, reduce production costs, cut down delivery time, practice Total Quality Management and enhance productivity and customer service. Achieving high levels of competitiveness and quality standards is really not rocket science. A large number of tools and techniques for problem solving are available. What is required fundamentally is management’s willingness to adopt good manufacturing practices. Figure 1.2 summarized the major quality initiatives taken by CII during last decade. However, sustaining this quality and growth or taking it to the next level will require a focused effort, especially on innovation. It is widely recognized that innovation plays a critical role. As our economy becomes more open to global competition, future growth will depend on our ability to innovate. There is a huge potential for India to follow the same path. Now the question is, can India realize this potential and actually become an innovation powerhouse? To answer this question requires starting with an analysis of the strengths and weaknesses of the Indian innovation system. This is followed by a summary of recent events that will have a significant impact on the innovation system and predictions for the short and long term evolution of the Indian innovation system.
4. Strengths and weaknesses of the Indian innovation system

The Indian innovation system appears to have many features that would enable dynamic innovative output. These include a broad-based network of government-supported research and development laboratories with multi-disciplinary expertise, a large education capacity with several high-quality institutions, a large and growing private sector industrial base, etc. Yet, deeper examination suggests that within these apparent strengths are embedded a number of limitations (Innovate India, CII, 2007). India’s most significant achievements have been in the broad realm of human resource development. But translation of these capabilities into products and services that can capture international markets, or into continuous improvements in shop floor productivity that could drive industrial competitiveness has been sketchy. Table 1 depicts the some strengths and weakness of the Indian innovation system.

Table 1. The Indian innovation system

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<tr>
<th>Strengths</th>
<th>Weaknesses</th>
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<tr>
<td>A Network of Government-supported R&amp;D Laboratories with</td>
<td>Lack of Dynamism of the Government R&amp;D System</td>
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<td>Expertise in a Variety of Disciplines</td>
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<td>Large Education Capacity with Several World-class Institutions</td>
<td>Quality of the Higher Education System</td>
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<td>Large Private Sector Industrial Base</td>
<td>Absence of a Vibrant High-technology Sector</td>
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<td>Government Recognition of the Importance of Industrial R&amp;D</td>
<td>Limited Impact of Government Support Programmes</td>
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<td>Influence of Scientists in Policy-making</td>
<td>The Science-Technology Divide</td>
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<td>Changes to Patent Laws &amp; Increased Foreign Direct Investment in R&amp;D</td>
<td>Low Magnitude of Spillovers of Foreign R&amp;D Investment</td>
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<td>“We can do it” Approach</td>
<td>Other Barriers to Innovation</td>
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Source: Rishikesha T. Krishnan, “Can India become an Innovation Powerhouse?” Indian Institute of Management Bangalore

5. The future of the Indian innovation system: near-term perspective

The recent developments listed above suggest a growing realization that while India may have been able to benefit from the opportunities thrown up by the knowledge economy so far largely due to the large stock of qualified people, further growth will depend on the creation of a supportive policy framework. However, it is an open question as to what extent the government’s initiatives will deliver results. This skepticism is prompted by the absence of a systems approach to government’s thinking such as the government’s poor implementation record, and a lack of clarity in government’s philosophy. In the absence of a clear philosophy, and a set of coordinated policies across ministries dealing with different subjects, the likelihood of a major transformation of the innovation system in the short run is small. However, new opportunities will arise if very serious steps will be taken by the government for removal of deficiencies.

6. The future of the Indian innovation system: long-term perspective

If economic growth continues at the present rate, the long-term prognosis of the innovation system is bright. However, the full potential will be realized only if some key constraints are tackled. There is no doubt that India has the opportunity for creating new business models, products and services for the poor not just at home, but also for countries in Africa and Latin America. The winner in the current scenario could be disruptive innovation: developing low-cost products for the bottom of the pyramid. These products could be taken to the other developing economies of the world in stage two. The innovator could
then bring in higher-end features in the product to enter the higher level of the domestic market and, subsequently launch the product in global markets. But most people understand innovation as product innovation and confuse it with invention. Few understand it in terms of business processes, organization’s issues or new businesses. A company is perceived to be innovative only if it can develop a product that is saleable and replaces an existing product. However, innovation also includes services, manufacturing processes, customer facing and back-end processes in services. Bharti Airtel is one of the most innovative companies of India for the way it has created a successful business model. The company has outsourced everything but its customers, thus being able to offer mobile telephony at 10 paise a minute; nowhere in the world can we get such rates. Maruti Udyog Limited (MUL) is another great marketing innovator to widen its market base. Manufacturing companies can also innovate in marketing and customer services. For instance, Toyota and Lexus innovated in customer services by building their showrooms such that the salesperson could read the license plate of the car while driving the car. The salesperson could feed the number into his laptop and obtain information about the customer. By the time the customer walked into the showroom, the salesperson was able to ask the customer about the performance of the car with reference to the last time it was at the showroom.

The generation of ideas is the critical aspect. There are those who get ideas, are able to build on them and implement them. There are others who look for customer pain points and come up with solutions. To get others to ideate, there are well-defined ideation processes defined by experts such as synectics and brainstorming. Synectics, developed by William Gordon, stimulates thought processes in which the subject is generally unaware. The central principle of the process is “Trust things that are alien, and alienate things that are trusted.” It encourages fundamental problem analysis and alienation of the original problem through a creation of analogies, which sometimes lead to new solutions. The brainstorming approach to innovation requires groups of people to ideate together and arrive at solutions. The process of brainstorming could lead to new solutions for existing or unknown problems. CII’s Manufacturing Innovation Mission has been working with innovation and breakthrough management experts such as Prof. Shoji Shiba, Prof. Clayton Christensen, Prof. Whitney and the Blue Ocean Strategy Network to help companies follow the process of ideation (Dr. Surinder Kapur, 2007). In India, the Manufacturing Industry has seen three eras of change and management - Process Control, Incremental Improvement (Kaizen), and Breakthrough Management. A few years ago Indian manufacturing companies focused only on production - the small ‘m’ concept. However, to compete globally Indian manufacturing companies are now focusing on the BIG ‘M’ concept. The BIG ‘M’ concept is related to enlarging our perspective and developing an integrated thinking capability to improve quality in every field. Indian Manufacturing started its quality journey in the early 1985’s. The Confederation of Indian Industry took the initiatives to lead the Indian Manufacturing Sector. ISI, Indian Quality Council, NIQR, NASSCOM, QAI, TQMI, KPMG, etc. also played an important role in this journey. By adopting different quality improvement techniques, many Indian companies received various prestigious quality awards from world class quality institutions. Another very prestigious award, received by more than fifteen Indian companies is the “Deming Prize” from The Japanese Union of Scientists and Engineers (JUSE), Japan.

This is a reflection of the increasing quality consciousness of Indian Manufacturing Industries. To take India to the next leap of manufacturing revolution, some Indian manufacturing companies decided to adopt some innovative techniques. Breakthrough Management is one example of an innovative technique that was introduced in 2004 in India by Prof. Shoji Shiba from Japan. Professor Shiba initiated the first CII Learning Community with six Indian companies in July 2004 for learning about Breakthrough Management and applied this in the Indian context. Sona Koyo Steering Systems Ltd, TechNova Imaging Systems Ltd, UCAL Fuel Systems Ltd, Godrej & Boyce Manufacturing Co Ltd, TVS Motor Co. Ltd, Lucas TVS, Brakes India Ltd - Foundry Division, Bharti, etc. are the member companies of this community. Breakthrough Management theory rests on the premise that every organization goes through
a lifecycle and there comes a tipping point when the business starts waning. This is when businesses must reinvent themselves and necessarily kill old businesses to find new avenues. Overall, Breakthrough Management is all about creating new markets in the fast changing environment. The idea is to create a consumer segment that did not previously exist. The first CII Learning Community has achieved many breakthroughs over the past seven years. After the success of the first CII-LC, Prof. Shiba set up the second Learning Community with another five companies. All those companies who adopted breakthrough practice, experienced both tangible and intangible benefits. Having realized the current need of the Indian manufacturing sector, Prof. Shiba along with CII decided that it is time to take the successful Learning Communities concept to a National Level. Thus, the first steps were taken towards the creation of a National Level Learning Community through Visionary Leaders for the Manufacturing Programme (VLFM 2007). The initial objective of this program was to create a critical mass of Visionary Leaders to lead India’s manufacturing sector into future growth. Today, the program is focusing on building a shared dream for India’s manufacturing sector that fuels the growth of the individual, the organization, the industry and the economy.

In sum, the past decade has seen India’s “mixed economy” become an essentially private enterprise economy. Thousands of entrepreneurs led by some inspiring leaders who have acquired a global footprint are driving the growth process in India. It is necessary to foster a culture of innovation, enhance the competitiveness of the Indian manufacturing sector, and it has to be looked at as the next wave for Indian industry to adopt. Only once this happens can Indians say that Indian manufacturing has arrived on the world stage. Truly, the best is still to come.

7. US manufacturing sector overview

The manufacturing sector in the US is critical to a prosperous US economy because it cascades economies of scale and improves economic competitiveness domestically and internationally. However, the US manufacturing sector is not keeping pace with other advanced countries. There is a steady decline in manufacturing employment, leadership, R&D, investment and innovation. Furthermore, US manufacturers compete with other manufacturers that produce low cost and high cost commodity products. Therefore, how can US manufacturers implement lean manufacturing techniques that increase quality production in the US? Is the government promoting fluid policies to increase manufacturing employment and innovation? “Currently US factories competitively produce about 75 percent of the products that the nation consumes. A series of identifiable smart actions and choices by business leaders, educators, and policymakers could lead to a robust, manufacturing-driven economic future and push that figure up to 95 percent. Alternatively, if the U.S. manufacturing sector remains neglected, its output could fall by half, meeting less than 40 percent of the nation’s demand, and U.S. manufacturing capabilities could then erode past the point of no return” (Kaushal, et al. 2011). A viable solution is effective government policies coupled with innovation and research and development (R&D) to increase US manufacturing competitiveness in a changing global environment. The US manufacturing sector is an essential component of US economic productivity. At present, the manufacturing sector contributes 12 percent of the GDP while manufacturing organizations involved in the private sector R&D manage 70 percent (Bureau of Economic Analysis 2011). New advanced technologies that combine IT, the physical and biological sciences (nanotechnology, chemistry and biology) may lead to increased economic growth and competitiveness in the manufacturing sector. Likewise, new advanced manufacturing technologies offer promise to foster competitiveness and economic growth in the overall US economy. The FY 2012 Budget includes the Advanced Manufacturing Technology/Consortia Program and the Technology Innovation Program through public-private partnerships to encourage innovation in the manufacturing sector. However, advanced manufacturing leadership is lacking in the US (NEC, CEA, and OSTP 2011).
8. US manufacturing R&D

Key US revitalization of the US manufacturing sector is dependent upon manufacturing production to create economic activity within the sector and outside the sector. Innovation is the vital driver to increase the manufacturing sector’s R&D. Thus, US R&D is critical for sustainable growth. However, R&D is only one critical component to increase productivity in the manufacturing sector. Because manufacturing industries have greater capital, the manufacturing sector is vital to overall US competitiveness and economic growth. Thus, government initiatives can provide a framework to determine where R&D may be beneficial to create new industries and remain globally competitive.

Current emerging manufacturing industries include nanotechnology and sustainable development to increase energy efficiency. Popkin and Kobe suggest “government partnerships with business in applied research and development activities at a level at which business risk exposure is sufficient to insure adequate market tests of project viability, a new government initiative to identify basic research direction should be explored further to see if it produces useful metrics, and can be a guide for expanding private sector basic R&D and assure businesses that the R&D tax credit availability can be relied on so projects with long gestation periods and riskier outcomes can be considered more frequently” (Popkin and Kobe 2010). However, can markets alone provide adequate manufacturing sector initiatives? What is the role of government to enforce appropriate rules in the manufacturing sector? Manufacturing industries perform almost two-thirds of private sector R&D and have the highest R&D intensity, as a percent of sales, of any major industrial sector and have contributed significantly to overall US productivity (Popkin and Kobe 2010). The US federal government is the most extensive contributor of basic R&D rendering 61% in comparison to private industry at 16% of total national investment (IWG 2008). In addition, the federal government continues to incorporate the American Competitiveness Initiative (ACI) with basic R&D to foster economic and national security.

9. US technological innovation

The Interagency Working Group (IWG) on Manufacturing R&D recommends Hydrogen, Nanomanufacturing and Intelligent and Integrated Manufacturing technologies to foster US economic and national security (IWG 2008). Due to the interdependency of these technologies’ capabilities greater competitive advantage can be realized in practical applications that transform product development and new products and services. Outsourcing within the manufacturing sector has led to the decline of US made high-tech products and services, knowledge and highly skilled workforce. Furthermore, manufacturing companies located in countries with greater new market opportunities have contributed towards the decline of the manufacturing sector in the US (Pisano and Shih 2009). Accelerating leadership in the manufacturing sector demands new and advanced technologies to advance manufacturing innovation, increase US national security and create high-quality skilled workers and wages. How can the US government create and compete with other countries to increase innovation and R&D in the US? The US government should focus on the tax and regulatory environment, infrastructure and new technologies to build a sustainable innovative policy.

One example of a promising innovative technological initiative is Advanced Manufacturing. Advanced manufacturing “often involve innovative new ideas generated by smaller companies” that cascade increased competition production and merit (EOP, PCAST 2011). Promotion of US leadership in Advanced Manufacturing requires innovation and investment of new technologies that result in a “coherent policy” not an industrial policy (EOP 2011). Advanced Manufacturing is also a powerful tool to promote national security. Successful implementation to launch the Advanced Manufacturing Initiative (AMI) requires the “whole-of-government effort to complement parallel initiatives in the industry and
academia. AMI should develop mechanisms to involve these sectors and to draw on their expertise in identifying technological opportunities. An external advisory board that has access to advanced manufacturing expertise should help guide this work. Funds to implement the programs recommended by AMI should be appropriated to the Departments of Commerce, Defense, and Energy to support the most promising opportunities, at the level of $500 million rising to $1 billion over four years. Some of these funds may be drawn from existing programs as appropriate” (EOP PCA ST 2011). Another example is the Nanoeletriconics Research Initiative (NRI), a pilot public-private partnership to foster research to replace the semiconductor chip by 2020. The NRI was created in 2005 and has created regional research centers with 35 universities in 20 states resulting in 600 technical publications and 19 patent disclosures.

10. US manufacturing innovation

The US manufacturing sector requires innovative government policies to increase manufacturing production and competitiveness in a rapidly changing global environment. The Executive Office of the President, President’s Council of Advisors on Science and Technology (2011) recommends “the US should replace the industrial policy (selecting particular firms and industries) with an innovation policy to foster and support innovation in advanced manufacturing. “President Obama’s Strategy for American Innovation seeks to harness the inherent ingenuity of the American people to ensure that our economic growth is rapid, broad-based, and sustained” (National Economic Council, Council of Economic Advisers, and Office of Science and Technology Policy 2011). Therefore, US innovation requires a world-class workforce, fundamental research, advanced physical infrastructure and IT, advanced manufacturing, market-based innovation, clean energy revolution, space capabilities, advanced biotechnology, nanotechnology, health care and educational technology (Ibid 2011). Most innovation does not stand alone but complements other innovations to provide jobs in manufacturing. Therefore, the manufacturing sector is dependent upon innovative initiatives within the sector and outside the sector. Furthermore, the manufacturing sector is contingent upon government policies that nurture innovation or diffusion of new ideas among the US people. For example, The United States Agricultural Research Service (ARS) created the Agricultural Technology Innovation Partnership Program (ATIP) with the manufacturing sector and other sectors for USDA innovations, and President Obama’s FY 2011 National Nanotechnology Initiative focuses on Sustainable Nanomanufacturing as an industry of the future.

Developing new R&D in manufacturing technologies is a tool to foster economic growth and competitiveness in the manufacturing sector. Likewise, evolving technologies can help create new manufacturing processes. “Advanced manufacturing can be defined as manufacturing activities that bring substantial intellectual capital, in the form of new technologies, into the manufacturing process, resulting in a combination of lower cost, rapid customization, improved time-to-market, reduced waste, and increased quality (National Economic Council, Council of Economic Advisors, and Office of Science and Technology Policy). The Obama administration’s FY 2012 Budget includes an “Advanced Manufacturing Technology Consortia program and a public-private partnership that will improve manufacturing R&D investments and accelerate innovations’ time to market” (Ibid 2011). The Materials Genome Initiative for Global Competitiveness is one example. This initiative has established a set of objectives to “serve a more competitive domestic manufacturing presence-one in which the United States will develop, manufacture, and deploy advanced materials at least two times faster than is possible today, at a fraction of the cost” (National Science and Technology Council 2011). In an effort to revitalize innovation in the manufacturing industry, the Obama Administration created the Advanced Manufacturing Partnership (AMP) initiative that provides approximately 500 million of investments in advanced technologies. The AMP is a R&D innovation focused on manufacturing activities and fosters collaboration with the private sector, universities and the government to create high paying jobs and quality manufacturing products.
Three hundred million will be invested into the department of Defense, Homeland Security, Energy, Agriculture, Commerce and other agencies for R&D in energy-efficient manufacturing processes, seventy million in robotics, and one-hundred million in materials genome initiative. Due to consumer and investor demands for environmentally friendly products, packaging, EU and international regulations, large global packaging firms and supply chains are increasingly integrating sustainability into their manufacturing processes (Sweeney 2010). The OECD Project on Sustainable Manufacturing and Eco-innovation was created under the Committee on Industry, Innovation and Entrepreneurship (CIIE) in 2008 to diffuse mechanisms and impacts of eco-innovation and new technologies in sustainable industrial production. It is a mechanism to examine the changing nature of eco-innovation’s socio-technical environment and the impact on the effect of the lifecycle.

The conceptual relationships between sustainable manufacturing and eco-innovation begin with pollution control, cleaner production, eco-efficiency, life-cycle thinking, closed-loop production and industrial ecology. Current eco-innovation in the manufacturing sector generates greater emphasis upon technological advances, products and processes. However, technology is not enough to make a sustainable impact in the manufacturing sector. It also requires non-technological processes within organizational and social structures that include human nature and cultural values. Overall, this project aims to “provide guidance on indicators for sustainable manufacturing, identify promising policies for eco-innovation, build a common vision for eco-innovation and develop a common definition and a scoreboard” (OECD 2009).

11. US government manufacturing acts, initiatives and strategies

- **America COMPETES Act** was passed by Congress in 2010 and signed into law by President Obama in January 2011. It increases funding for the National Science Foundation (NSF) from approximately $5.6 billion in Fiscal Year 2006 to $11.2 billion in Fiscal Year 2011 and the Department of Energy’s Office of Science to increase funding over ten years, from $3.6 billion in Fiscal Year 2006 to over $5.2 billion in Fiscal Year 2011. The Act includes the Innovation Acceleration Research Program to direct federal agencies funding research in science and technology to budget toward high-risk frontier research. It provides assistance to state-wide schools that specialize in math and science, expands teaching programs and graduate research fellowship and trainee programs in math, science and foreign language, develops a President’s Council on Innovation and Competitiveness in the public and private sectors, and requires the National Academy of Sciences to identify barriers to innovation (Source: America COMPETES Act 2010).

- **The National Manufacturing Strategy Act of 2010** was introduced by Congressman Dan Lipinski (D-Ill.) to increase competitiveness of the US manufacturing sector in the 21st Century.

- **The Obama Innovation Strategy** builds on over $100 billion of Recovery Act funds that support innovation, additional support for education, infrastructure and others in the Recovery Act and provides a foundation for innovation that leads to quality jobs and shared prosperity.

- The U.S. Department of Commerce (DOC) **Commerce Connect** initiative was introduced by Secretary Gary Locke in October 2009 to make businesses more competitive and create jobs by incorporating all of the Department of Commerce’s services together.

- **The American Recovery and Reinvestment Act of 2009** is an economic stimulus package developed by the 111th United States Congress in February 2009 to provide funding in the event of an economic downturn.

- In order to offer effective and continued support to U.S. companies in their sustainable manufacturing efforts, Commerce’s Manufacturing & Services unit has created a **Sustainable Manufacturing Initiative (SMI)** and **Public-Private Dialogue** to identify and coordinate US sustainable
manufacturing challenges.

- The **American Competitiveness Initiative (ACI)** is a federal assistance program intended to help America maintain its competitiveness through investment in research and development (R&D) and education. The ACI was a part of President George W. Bush’s State of the Union Address given on January 31, 2006. The Initiative commits $5.9 billion ($1.3 billion in new Federal funding, and an additional $4.6 billion in R&D tax incentives) in FY 2007 to increase investments in R&D, strengthen education, and encourage entrepreneurship. Over ten years, the Initiative plans to commit $50 billion to increase funding for research and $86 billion for R&D tax incentives.

- The **Asia-Pacific Partnership on Development (APP)** reduces carbon and other greenhouse gases with partner countries: Australia, China, India, Japan, Republic of Korea, and the United States. The APP develops cleaner, more efficient energy technologies to meet national pollution reduction, energy security, and climate change concerns that aim to reduce poverty and promote economic development.

- The **Sustainable Development Partnerships (SDP)** focuses on U.S. sustainable development partnership efforts to help countries create and implement their own development strategies for poverty reduction, universal primary education, access to clean water and sanitation services, access to energy services, reducing the spread of infectious diseases, reducing hunger and promoting agricultural and rural development, conservation and environmental stewardship and protecting marine and freshwater resources.

- The **3Rs (Reduce, Reuse, and Recycle) Initiative** was enacted at a Ministerial Conference in Tokyo of April 2005. Its primary goals are to reduce waste, reuse and recycle resources, and to reduce barriers to trade in recycled and remanufactured products and clean energy technologies.

12. US manufacturing sector recommendations

Stronger coordination and mechanisms within the federal, state and local governments to foster greater investment in US manufacturing is long overdue. The US government should monitor regulatory compliance costs to prevent loss of cost competitiveness and intellectual property. Furthermore, government intervention is necessary due to how rising energy costs can decrease profit margins and the ability to purchase new equipment and new manufacturing operations. The US government should increase R&D technologies with environmental considerations into innovation policies that can result in developing environmental manufacturing industries. Moreover, the government can continue to play the facilitator role through public-private partnerships and cross-sector and knowledge transfer platforms for sustainable manufacturing and eco-innovation. The US has lost many highly skilled jobs in the manufacturing sector. For example, the transfer of specialized knowledge, inventions and manufacturing capacity in consumer electronics products has shifted to Asia (Pisano and Shih 2009) and R&D in manufacturing is moving abroad as other countries are strengthening their R&D (EOP, PCAST 2011). To address the decline in manufacturing employment, President Obama’s advisors recommend that an innovation policy for the manufacturing sector should include business and tax settings, workforce development and new technologies to sustain advanced manufacturing in the US. However, Kaushal, et al argues the future of manufacturing “will largely be regional. This type of region-oriented footprint is a clear way to provide adequate scale and volume, minimize transportation and logistics costs, increase market responsiveness and innovation, and customize products for the unique preferences of different regions and cultures”.

The US public opinion is neutral regarding stronger leadership of US manufacturing competitiveness. However, the US manufacturing industry “ranks second to last as a career choice” (Giffi and DeRocco 2011). Therefore, higher-level education skills in science, engineering and other disciplines are necessary for increasing innovation, productivity and competitiveness within the US manufacturing sector.
According to the 2010 Global Manufacturing Competitiveness Index, highly skilled workers rise in importance above labor and materials to determine a country’s competitiveness to attract manufacturing companies. Thus, workforce development is crucial due to how companies decide where to locate manufacturing operations. Lastly, another recommendation is to increase global awareness of US technical standards. This can assist SMEs to link with global supply chains and compete immediately in a changing global marketplace (Dept. of Commerce 2004).

13. Conclusion

The manufacturing sector plays a critical role in stimulating a more robust India and US economy. Henceforth, an open economy is vital to securing economic growth in the manufacturing sector. However, there has been little progress for increasing the competitiveness of the manufacturing sector within the last several years. Is the measurement of US and India product totals across manufacturing sectors complimentary for manufacturing competitiveness? A more systematic and analytical framework that contains an array of characteristics within modifications, products, processes, organizations and institutions is warranted. Furthermore, a lack of policy co-ordination among various government agencies is a barrier to increasing innovation and competitiveness in the manufacturing sector in the US and India. Rather, the manufacturing sector’s policies should be internalized by other industry policymakers and government agencies to increase innovation and competitiveness. Government policies in trade, investment and R&D must coordinate together to obtain manufacturing leadership worldwide.

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