

SI 2 - TRAJECTORY OF CHANGE: REMODELLING INDIA'S NATIONAL INNOVATION SYSTEM FOR SUSTAINABLE DEVELOPMENT & INCLUSIVE GROWTH

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ABSTRACT

India has been pursuing a unique developmental path. Initially it followed a mixed economy concept and now attempting to bypass manufacturing stage and leapfrog from predominantly agrarian to service oriented economy. Along the course of liberalisation since 1991, India has registered an accelerated rate of growth with GDP reaching up to 8% per annum. While the growth may have helped in poverty reduction at some level it has not been without attendant problems such as increasing uneven economic growth, disparities in income individually and regionally and pressure on environment. Innovative industrial development is the focus of policy measures in order to ensure a continued success of India's unusual development path and to mitigate attendant problems risen out of recent economic growth. In this paper we follow the framework of Innovation presented by the National Innovation System paradigm. National Innovation System approach has been found to be an effective methodology of studying the economic development of nations particularly those that fall in the category of developing economies.

NIS approach is particularly significant in the context India's recent attempts to restructure its Innovation System. We examine changes occurring in the innovation paradigm and India's trajectory as evidenced from the emerging organizational architecture and institutional arrangements through a survey of studies. In order to set down the nature of the emerging system, the paper focuses on few interrelated issues:

- To understand and define the conceptual framework of the Innovation
- System prevailing since 1950s until the 1980s.
- understanding the transition and the nature of the emerging NIS and
- to understand the nature of challenges and analyse the impact of policy measures to restructure the NIS
- to explain the need, the nature and relevance of SI 2 innovations.
- Delineate the features of emerging NIS

For most part of the data the reliance is put on India's Innovation Portal, various studies by international organisations such as the World Bank, IMF, OECD, UN agencies etc. writings and speeches by planners involved in creating this system. Mental models that define the conceptual framework are inexorably determined by the culture and civilisation of the place. Indian policy perspectives strongly reflect this impact. In order to delineate the characteristic features of the new paradigm we make a comparative analysis of the old and the new paradigm. For the final part of this analysis we make use of the recent data and statistics proffered by the public and international

agencies. In the final analysis an attempt is made to consolidate the evolution of all institutional structure and to present an integrated view of the emerging NIS of India.

Keywords: Innovation System, sustainability, Inclusive Growth,

INTRODUCTION

Economic growth is an essential part of development process conventionally measured in terms of gross domestic product (GDP). In India, growth and development have always been a part of the planning processes that have emphasised equity and inclusive growth leading to improved well being, access to health, education etc. Nevertheless, several areas remain neglected that challenge inclusive growth for sustainable development as reflected by the human development indicators. While the need for economic growth and development is a moral imperative for emerging economies the key concerns that perturb policy initiatives are based around the *nature of this growth and development*.

Concepts of 'green growth' and 'green economy' gained global prominence through the deliberations in the United Nations Conference on Sustainable Development (UNCSD). Member states recognised the necessity to manage natural resources sustainably and with lower negative environmental impacts in a way that the green growth can be one of the strategies to achieve the goal of sustainable development.

India's Thirteenth Finance Commission articulated that "green growth involves rethinking growth strategies with regard to their impact(s) on environmental sustainability and the environmental resources available to poor and vulnerable groups". Thus green inclusiveness entered the policy lexicon and the basis of financing bottom of the pyramid innovations. Strategies around inclusive and sustainable growth would need to incorporate intra-generational and intergenerational equity. India's sustainable economic development is dependent on innovations that accelerate and expand the scope of inclusive and sustainable growth. Innovative solutions must change people's lives with products, services, processes and business models and tackle the twin challenges of the 21st century: poverty and natural resource strain. This requires novel perspectives on innovation and a rethink of innovation processes.

NATIONAL INNOVATION SYSTEM:

Innovation is the key to economic development of a nation but it is found that technological innovations alone are not sufficient. Innovation researchers conclusively suggest that the innovation activity within a nation's economy is dependent upon a complex set of relationships among multitude of factors that enable and facilitate innovation activity across all sectors. Over several decades of studies, innovation research evolved a systems approach that emphasised innovation as an interactive learning process involving different actors in an evolutionary manner. An evolutionary history of the NIS concept (Feinson, 2003; Godin, 2010) reveals that beginning with Freeman (1987) through 1990s National Innovation Systems approach (OECD, 1997) had gained academic ascendancy in the economic literature as an effective tool of studying the level of economic development of a nation.

The approach is considered particularly significant in the context of developing economies as most of such countries are weighed down by the legacy of long history, traditions, diversity of cultures and

colonialism that affect the collective mind-set of a nation's workforce. Arocena & Sutzwhere (2005) make a forceful case of its relevance to developing countries. Firstly this approach takes a broader definition of 'innovation'. Innovation is defined as a continuous cumulative process involving not only radical and incremental innovation but also the diffusion, absorption and use of innovation. Secondly, this approach recognises multiple sources of innovation than science, more importantly the users. A broader approach to NIS takes into account social institutions, macroeconomic regulations, financial systems, education and communication infrastructure, and market conditions as they impact on learning, innovation, and competence building systems and processes. This approach is eminently appropriate for India which is attempting to build a national innovation system based on broader understanding of innovation and its processes. .

DEFINING THE NATIONAL INNOVATION SYSTEMS

In order to understand the intellectual underpinnings of the NIS approach, OECD study compiled a set of definitions suggesting that National Systems of Innovation may be defined in evolutionary terms for the strategic role it gives to knowledge and learning. The analysis of innovation systems may be seen as an analysis of how knowledge evolves through processes of learning and innovation (Lundvall, 2005).

BOX – 1

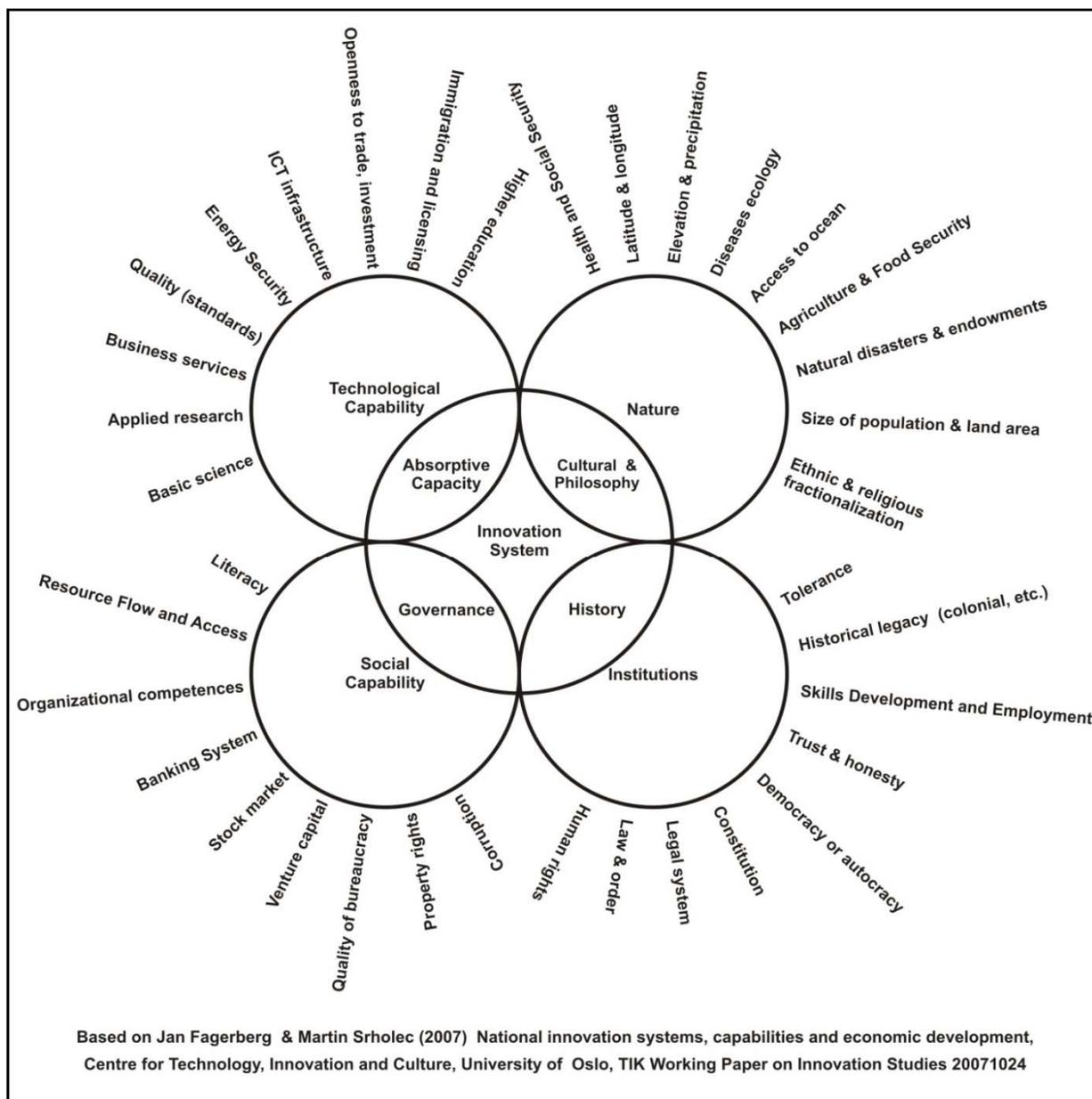
- "... The network of institutions in the public- and private-sectors whose activities and interactions initiate, import, modify and diffuse new technologies" (Freeman, 1987)
- "... The elements and relationships which interact in the production, diffusion and use of new, and economically useful knowledge... and are either located within or rooted inside the borders of nation state" (Lundvall, 1992)
- "... The set of institutions whose interactions determine the innovative performance of national firms" (Nelson and Rosenberg, 1993)
- "... The national system of innovation is constituted by the institutions and economic structures affecting the rate and direction of technological change in the society" (Edquist and Lundvall, 1993)
- "... A national system of innovation is the system of interacting private and public firms (either large or small), universities, and government agencies aiming at the production of science and technology within national borders. Interaction among these units may be technical, commercial, legal, social, and financial, in as much as the goal of the interaction is the development, protection, financing or regulation of new science and technology" (Niosi et al., 1993)
- "... The national institutions, their incentive structures and their competencies, that determine the rate and direction of technological learning (or the volume and composition of

Source: National Innovation Systems (OECD, 1997)

It is dynamic due to the "financial flows between government and private organizations... human flows between universities, firms, and government laboratories, regulation flows emanating from

government agencies towards innovation organizations, and knowledge flows (spillovers) among these institutions” (Niosi, 2002).

Figure 1: A Suggested Integrated Framework of National Innovation System



EVOLUTION OF INDIA'S NATIONAL INNOVATION SYSTEM

In order to better understand the transformation now under way it is useful to briefly recapitulate in chronological terms the evolution of India's NIS that has passed through mainly three major phases since independence. (i) Planned or controlled period from 1950s till the end of 1970s, (ii) the limited liberalisation period of 1980s; (iii) period of reforms beginning in early 1990s till 2010. As corollary of reforms the current transformation is under way following the declaration of "Innovation Decade" 2010-2020.

From 1950s to 1980s

Period of Self Reliance, emphasis on local production, local consumption.

Outstanding Policy Instruments of Emerging National Innovation System

Industrial Policy Resolution 1948

Industrial Policy Resolution 1956

Scientific Policy resolution 1958

An approach to the Science and Technology Plan (NCST) 1973

Predominantly agrarian economy notwithstanding, India adopted the *Industrial Policy Resolution 1948* (IPR 1948) which set the tone for India's future industrial development. Significant political and economic changes such as the declaration of Indian Republic and the launch of planned economy forced changes in industrial policy as well. The development philosophy influenced by Nehruvian view endorsed the need for rapid development led by state economic activity and planning. The New Economic Policy adopted in 1954 called for commanding heights of public sector enterprises which was followed by a New Industrial Policy in April 1956. The Industrial Policy 1956 (IPR 1956) provided a comprehensive framework for industrial development in India with import substitution as a stimulant for manufacturing industries. Basically, these formative years after independence were focused on establishing institutions.

The Second Five Year plan (1957-1962) articulated a development philosophy that laid down the strategy of public sector dominated industrialisation through heavy industries on the one hand and emphasising education, infrastructure, and health on the other. While the plan was in progress India adopted the *Scientific Policy Resolution 1958* (SPR 1958) which called for cultivation of Scientific Temper to "ensure that the creative talent of men and women is encouraged and finds full scope in scientific activity; and, in general, to secure for the people of the country all the benefits that can accrue from the acquisition and application of scientific knowledge." SPR 1958 was clearly aimed at taking advantage of India's rich human resources by creating supportive institutional infrastructure.

Significant achievements during the first phase of Indian national innovation systems included: (i) creation of S&T infrastructure and the expansion of higher education with great emphasis on basic research; (ii) development of indigenous capability to produce a range of goods; (iii) implementation of the Green Revolution to achieve food security and (iv) creation of the scientific and industrial innovative potential to compete in international market. India's success in software sector was mainly due to intensive R&D effort by the companies and the presence of strong basic research capability in the country. The liberalisation of policy regimes in the 1990s has demonstrated the potential of Indian innovation system in achieving a higher rate of growth despite persistent weaknesses in the innovation system such as continuing problems in forging closer linkages between R&D institutions and firms.

By the beginning of 1980s, it became clear that the pervasive regulatory mechanism over private economic activity had had effects opposite to those intended and now adversely affecting economic efficiency and growth. Policy measures were initiated to "rationalize" controls. The intent was clearly to reduce the number of overlapping and sometimes even inconsistent regulations.

From 1980s to 1990: Period of transition

Outstanding Policy Instruments of Emerging National Innovation System

New Industrial Policy Statement 1980

Technology Policy Statement of 1983

Technology Missions 1985

The decade of 1980s was a period of transition and experimentation in economic liberalisation and expansion. A New Industrial Policy was announced in January 1980 that sought to relax regulatory mechanism and financial deregulation to expand the space for private enterprise and foreign capital. Pressing need for technology modernisation led to Technology Policy Statement, 1983 to attain technology self-reliance by making maximum use of indigenous resources, traditional skills and knowledge. As an offshoot of Seventh Plan the new government introduced Technology Missions in 1985 in the fields of literacy, immunization, oilseeds, drinking water, dairy products and telecommunication with a clear objective to provide distribute justice to the underprivileged masses. Strategy proved fairly successful in raising social capital with rising per capita incomes, falling infant mortality, rising life expectancy etc. The Government's expansionary fiscal stance led to accelerated growth accompanied with current account deficit. Other structural problems became acute: infrastructure became increasingly stretched; declining value added activity in public sector became a drain on public resources. Overall real rate of return on investment in state owned manufacturing enterprises is estimated to have been no more than two percent.

The industrialization strategy pursued under various policy regimes did generate a diversified industrial base, and a capability for designing and fabricating industrial plants and machinery. But the strategy virtually ignored considerations of scale economies, vastly restricted domestic and import competition, constrained technological up gradation, encouraged capital-intensive production and discouraged employment generation thereby sharpening the imbalances.

One of the puzzling aspects of Indian growth in 1980s was that it was not driven by manufactured exports and there was no industrial policy targeting the development of specific industries. The growth was largely driven by the service sector.

Liberalisation Phase From 1990 to 2010

Open Markets, liberalization of financial system

Period of critical self assessment, course correction and evolving contours of a new NIS

Outstanding Policy Instruments of Emerging National Innovation System

New Industrial Policy 1991

Draft Technology Policy 1993

Science & Technology Policy (2003) and

Science, Technology & Innovation Policy (2013)

No sooner did the new government came to power in June 1991 than did it announce a New Industrial Policy in July 1991 in clear recognition of severity of structural problems ailing Indian economy that required urgent solutions.

Major Objectives of India's New Industrial Policy 1991 were:

New IPR 1991 was a land mark event in shaping the future economic development of India. The stated objectives of the New IPR 1991 was to liberate the industry from the shackles of licensing system; drastically reduce the role of public sector and encourage foreign participation in India's industrial development. The New IPR 1991 made very significant changes in four main areas viz., industrial licensing, role of public sector, foreign investment and technology and the MRTP act. The major provisions of this policy are:

1. Abolition of Industrial Licensing;
2. De-reservation of Industries for Public Sector
3. Liberalised Policy Towards Foreign Capital and Technology:
4. Changes in the Monopolies and Restrictive Trade Practices (MRTP) Act
5. Greater Support to Small-Scale Industries

Besides, the IPR 1991 also announced some more steps to promote rapid industrial development.

1. Establishment of Foreign Investments Promotion Board—FIPB) to negotiate with international companies for direct investment in industries in India.
2. Setting up of a National Renewal Fund to provide social security to retrenched workers and provide relief and rehabilitate those workers who have been rendered unemployed due to technological changes.

In concert with the New Industrial Policy a Draft Technology Policy was adopted in 1993. A significant feature of this policy was its emphasis on the need to decentralize science and technology system in response to market and users. Offering incentives and rewards for R & D career the policy brought out the role of industries in enhancing skills.

A decade later a New Science and Technology Policy-2003 was proposed outlining the approach to science and technology governance, optimal utilization of existing physical and knowledge resources, development of innovative technologies for mitigation and management of natural hazards, generation and management of intellectual property and creation of awareness amongst general masses about the use and benefits of science and technology.

From 2010 to Present (Innovation Decade)

Emergence of a complex Innovation System

National Knowledge Commission

National Innovation Council

National Innovation Foundation

The rapid economic growth in the two last decades has accentuated the demand for improved infrastructure, energy and natural resources, skills exposing the paucity of these key drivers of growth. Institutions, public as well as private governance too need to adapt to the inclusive and sustainable development of India and the progressive transformation of its economy.

However, there are challenges that need to be addressed, like:

- Creating equal opportunities of employment for inclusiveness

- Aligning skills to the job requirements - for both current as well as future demands
- Creating avenues of employment for the skilled youth
- Increased viability of agricultural activity and rural development

From the above analysis it is observed that India's NIS has evolved through all these phases keeping centrality of welfare of the masses and poverty alleviation as constant theme. Except the first few years after independence there is also a noticeable recognition and progressive movement toward expanding the role of private sector.

CHALLENGES OF DEVELOPMENT:

India's Unique Growth Path & Knowledge Economy Paradigm

India has begun to attract attention of the world as the potential economic powerhouse (Studies by World Bank, OECD, NESTA, The Economist etc.) Based on PPP GDP, India is now the world's fourth largest economy (EconomyWatch, 2010) and the second most populous. India's recent growth since 1991 has been impressive, with real GDP rising by over 8 percent a year since 2004—accompanied by a jump in innovative activities. Current global slowdown notwithstanding, India is poised to realize an accelerated growth rate in the years to come. Even the most recent economic survey (November 2014) done by OECD confirms that reforms currently under way are poised to put India on a strong, sustainable and inclusive growth path. In pursuit of rapid economic development, which is considered essential for inclusive growth, India is pursuing a unique path of development by attempting to overcome the constraints of so-called Three-Sector (or Fisher-Clark-Kuznets) Hypothesis of demand and productivity shift from low-productivity agriculture to manufacturing and then to service sector. In the period of rapid growth, manufacturing's share of value added has barely risen above last three decades but at the same time trade in services has expanded rapidly (OECD, 2007). In apparent contradiction, the literature on economic development has long argued that production shifts first from agriculture into manufacturing and – only at a later stage of development – from manufacturing into services.

Growth in services sector is driving India's rapid advance into the Knowledge economy. The knowledge economy is often taken to mean only high-technology industries or information and communication technologies (ICTs). But in the Indian context, it would be more appropriate to use the concept rather broadly to cover as to how the economy harnesses and uses new and existing knowledge to improve the productivity of agriculture, industry, and services. The evolving knowledge based economy affords India great opportunity for increasing productivity by shifting labour from low productivity and subsistence activities to more productive modern sectors. By application of technology and knowledge, new ways and processes, products and services can be developed to meet the requirements of all the sections of the Indian society.

While India is gradually transforming itself from predominantly agricultural economy to service driven economy, 70% of its population still lives in villages. In transition it has reduced its dependence on agriculture from 50% of GDP in 1950s to 18% in 2007 (Economic Survey, GOI, 2008), 60% of its population is still dependent on agriculture. Post liberalisation growth may have helped in poverty reduction at some level it has not been without attendant problems such as increasing uneven economic growth, disparities in income individually and regionally and pressure on

environment. Further, this growth is not perceived as being sufficiently inclusive for socially marginalised groups. Gender inequality remains a pervasive problem. The lack of inclusiveness is borne out by data on several dimensions of performance. Various indicators of deprivation suggest that the proportion of the population deprived of a minimum level of living is much higher. (*Planning Commission, 2011*)

Major growth indicators continue to suggest that the economy has not been able to reach its full potential to achieve equitable economic performance and “the divergence in the growth performance across states continues” Kumar and Subramaniam (2011). Evaluating the social impact of growth process following economic reforms since 1991 until 2012, Bhattacharya & Sakthivel (2012) found that economic divide between rich and BoP and between urban and rural areas has increased sharply. Income inequalities have grown steadily since the 1980s, in both urban and rural areas. Growth in the gross state domestic product is starkly lopsided across the country (*Indicus Analytics / Mar 22, 2012*).

Despite several years of growth averaging 7%, unemployment in India still remains fairly high (8.8% 2013). The gains of economic growth are yet to filter down to the rural and urban poor. An estimated 41% of the population still lives below the poverty line of \$1.25. There remain regions where poverty is still deep and severe and hence require greater attention. (UN Report on Poverty, D’Costa, 2011). The period of rapid growth and poverty reduction (2004–09) also witnessed a rise in inequality, with the Gini index rising from about 0.27 in rural and 0.35 in urban India in 2004/05 to about 0.28 and 0.37, respectively, in 2009/10 and globalisation causing rural-urban and regional inequality. (*IMF Working Paper (WP/14/63-2014)*). (Cornia 1999).

To derive the greatest benefits from the knowledge revolution India must press on with the economic reform agenda that it put into motion more than two decades ago. In the new paradigm Innovative industrial development for inclusive and sustainable growth is the focus of policy measures in order to ensure a continued success of India’s unusual development path and to mitigate attendant problems risen out of recent economic growth. Innovation paradigm is of utmost importance for India to become a sustainably developed country in future, therefore, India has declared 2010-2020 as the ‘*Decade of Innovation*’.

INNOVATION PARADIGM

“Every organization - not just business - needs one core competence: innovation”. Peter F. Drucker

The power of innovation is extraordinary. Innovation is the lifeblood of human civilisation. At this stage of evolution, the scale, speed, and democracy of innovation are radically changing industry landscapes. Interestingly, innovation itself is being continuously innovated. The new paradigm is defined by globalisation, emergence of transition economies, concern for sustainability and inclusiveness. Innovative solutions for sustainable and inclusive growth are policy imperatives. But there is limited knowledge as to why, when and how innovation occurs (Szmytkowski 2005). According to the Oxford Dictionary, the word ‘Innovation’ first appeared around 1297. Joseph Schumpeter described ‘innovation’ itself as the motor of development (Schumpeter, 1911).

“[Innovation] is generally understood as the successful introduction of a better thing or method. [It] is the embodiment, combination, or synthesis of knowledge in original, relevant, valued new products, processes, or services.” Luecke and Katz (2003).

Stephen Shapiro suggests three levels of Innovation --

- Level 1: Innovation as an Event;
- Level 2: Innovation as a Capability;
- Level 3: Innovation as a System.

Under the new paradigm countries are building perspectives casting wider net for innovation activity that caters to international competition on the one hand and local needs on the other.

Using time series empirical research on innovation studies Gaynor (2002) proposed a much simpler definition— *‘Innovation = invention + implementation / commercialization’*. Innovation creates new value rather than new knowledge. Innovation is not science or technology, it is about business. Innovation can occur from the bottom-up or be sponsored from the top-down. Each approach will have its strengths and limitations.

India’s National Knowledge Commission that actually ushered in the extensive restructuring of the national innovation system defines the Innovation in the new context as the:

“Process by which varying degrees of measurable value enhancement is planned and achieved, in any commercial activity. This process may be breakthrough or incremental and it may occur systematically, in a company or sporadically; it may be achieved by:

- Introducing new or improved goods or services and/or
- Implementing new or improved operational processes and/or
- Implementing new or improved organizational/ managerial processes

in order to improve market share, competitiveness and quality, while reducing costs”.(National Knowledge Commission, INDIA)

Another significant perspective is offered by the Global Innovation leader:

“Innovation is a process through which the nation creates and transforms new knowledge and technologies into useful products, services and processes for national and global markets – leading to both value creation for stakeholders and higher standards of living.”
National Innovation Initiative: 21st Century Innovation Working Group (USA)

The underlying theme in these two perspectives is reflective of a mindset that respects the need for accessing multidimensional knowledge systems, interdisciplinary approach to integrate the diversity of knowledge sources.

“Despite deep and persistent innovation divides between countries and regions, a new dynamic of innovation is emerging around the world”. *Global Innovation Index*. 2012. INSEAD. “The rising weight of influence of emerging economies has shifted the balance of power” (Pascal Lamy, President, World Trade Organization) “The emerging world, long a source of cheap labour, now rivals the rich countries for business innovation”, says Adrian Wooldridge in “The world turned upside down” interviewed by *The Economist* (London) 15 April 2010.

Innovation is essentially a mental process driven by a mind-set. In physical occurrence it may depend on four major elements: resources, infrastructure, culture and process. It is important to examine innovation not only as an organisational and environmental phenomenon, but also from a psychological point of view (Cropley 2012). Ability to employ mental processes, however, encompasses three overlapping dimensions, – the individual, teams, and the organization. It is the interplay of these elements and dimensions that determines the culture of the organisation that in turn nourishes mental processes. Idea generation is an individual act that passes through a process of three developmental phases: developing, implementing and commercialisation of these ideas. The common factor in these three phases is teamwork – synergy amongst all elements and dimensions of innovation.

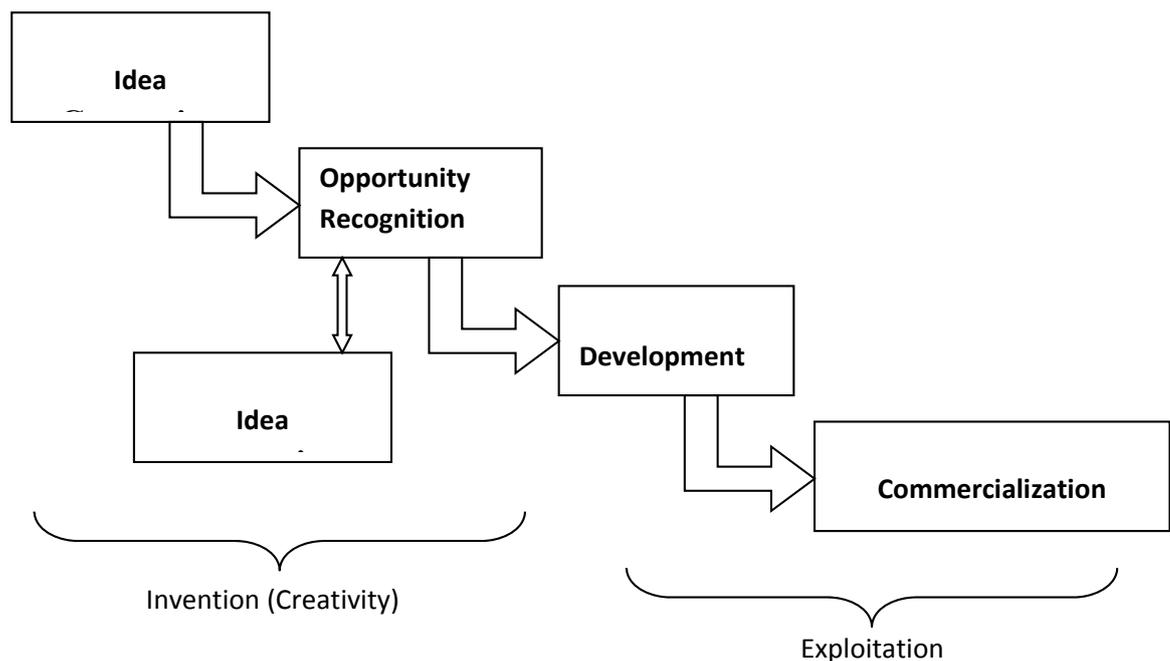


Figure 2: A Business Model of the Innovation Process as suggested by Luecke and Katz, 2003.

Innovation is the life blood of human civilisation. Innovation is of utmost importance to India's future as a sustainably developed country. One tends to wonder how a country that has been known for its mathematical prowess, spirit of entrepreneurship, and some ground breaking innovations, manages to position itself far from the most innovative countries in the world. India continued its dismal performance on GII for the fourth consecutive year dropping off to 76th position, a slip of 10 places from last year, in the annual Global Innovation Index (GII) survey for 2014.

Schumpeterian framework (1911) underscored the significance of innovative activity in the economic performance of a country. In apparent contradiction, while India continues to slide on innovation index its economic performance remains relatively buoyant. India appeared as the worst performer among BRICS countries on the GII 2014 but its economic performance was second only to China and much higher than many of the developed economies. According to IMF *World Economic Outlook, October 2014*, when GDP measured in terms of PPP valuation India appeared as third largest economic performer. Despite low scores and apparent deficits in its innovation capacities and capabilities, there are many bright spots in India's innovation system. Continually positive economic performance in the midst of a global slowdown suggests a relentless innovative activity at some level. Globally, in certain areas of high technology such as software, pharmaceuticals, automobiles

and aerospace India has steadfastly maintained its superior position. Besides, below-the-level innovative activity that defies current measurable standards spawns the grassroots level across the entire socio-economic landscape is now attracting global attention. There is apparently a yawning gap between capabilities of enterprises and aggregate capabilities of the country. The country is now in the process of putting in place the eco-system necessary for innovation.

Lundvall has pointed out that innovation “is a ubiquitous phenomenon in the modern economy. In practically all parts of the economy, and at all times, we expect to find on-going processes of learning, searching and exploring, which result in new products, new techniques, new forms of organization and new markets” as the innovation systems are both social and dynamic (Lundvall, 2000). He stresses that innovation is both gradual and cumulative, and is a process rather than a stage. This process, however, is not linear “but involve[s] continuous interactivity between suppliers, clients, universities, productivity centers, standard setting bodies, banks and other critical social and economic actors” (Mytelka, 2001). “an institutional context...constituted by laws, social rules, cultural norms, routines, habits, technical standards,” knowledge flows, innovation, and learning in developing countries. New studies confirm that the firms combining different types of innovating ways perform best. (Isaksen, 2011)

INNOVATION – INDIAN PERSPECTIVE

Innovation isn't new; it is probably man's primordial instinct to see new, feel new and perceive new. Innovation is mostly about individuals, who have a very different perspective and approach to looking at things. Innovation is not new to organisations either. Innovation is about thinking and creating solutions with an uncommon perspective, that tend to positively impact the environment, both socially and economically. Innovation is the principal driving force of human evolution. It is the material conception of mental processes; an expression of interiority of being; Heideggerian *Aletheia- bringing forth; the revealing*. Innovation is inseparable from the philosophy of human nature formulated by Martin Heidegger. Heidegger identified three elements of human nature: (1) it is human nature to be practically involved in a complex world rather than rationally involved with a conceptually simplified world; (2) it is human nature to be authentic (i.e., unconventional, uncommitted to one's paradigm) at least some of the time; and (3) it is human nature to be cooperative. In other words, the methods and organizational structures that characterize “good” science are in direct conflict with human nature. By examining things in isolation from their natural linkages, the scientist misses the holistic view—the big picture—necessary for successful innovation.

Indian perspective holds innovation as the “embodiment, combination or synthesis of knowledge in original, relevant, valued new products, processes or services”. Impact of India's profound diversity on the innovation process is generating varied forms of innovation. Thus, Indian innovation system is extremely complex in terms of user segments and income disparities, and markets are highly differentiated and at the same time, parts of some sectors need to cater to global demands. Most important factors to innovate are cost reduction, broadening the range of products, and increasing value added. These drivers are not surprising since innovation in large part is seen as a source of competitiveness for companies. Therefore, it is felt that in order to broaden the scope of innovation activity India needs an innovation strategy aimed at creating an ‘Indian model of Development’.

CHALLENGES TO SUSTAINABLE & INCLUSIVE GROWTH IN INDIA:

Sustainability Dimension

In the wake of significant changes in business landscape and the emergence of new technologies, sustainability dimension as key issue in the strategic agenda of both business and public policy have called into question established conceptualizations of competitiveness, wealth creation and growth. Value creation dynamics must respond to environmental and social change. Great efforts are being made to encourage industries to move towards sustainable business models. The focus on sustainability is increasingly becoming a necessity for large companies, start-ups and investors as it creates new drivers for innovation. Making growth more inclusive and addressing widespread poverty is a key challenge for India, that requires sustained investment in human capital such as health, education and skills training on the one hand and physical infrastructure including transport, energy, and communication on the other.

Given the high population density, vulnerable ecology, extreme climate and a significant share of the economy heavily dependent on the natural resource base, environmental sustainability might well be the next greatest challenge along India's development path, reducing disparity, eliminating poverty and promoting social cohesion. According to the *Statistical Yearbook 2013* the poverty ratio is likely to be 26.7% by 2015 as against the target of 23.9%, while infant mortality rate (IMR) would be 43 per 1,000 live births against the miles tone of bringing it down to 27. India was supposed to halve the percentage of population below the national poverty line by 2015 over the 1990 level. In 1990, poverty ratio was 47.8% that came down to 37.2% in 2004-05. India was also required to reduce the mortality rate for children under-five years to 42 per 1,000 live births by 2015. However, the current estimates suggest that it would be around 52 when the MDG deadline lapses.

Mirroring the country's size and diversity, environmental risks and problems are wide-ranging. The damages are still dominated by "poverty-related" risks, however, the share of "growth-related" risks manifested by the deteriorating urban environment, industrial waste and chemical pollution is increasing. (World Bank- MOEF Study 2005). Making massive investments in infrastructure, urban development, and industrialization, the issues of managing the environmental impacts associated with rapid growth are capturing public attention. The emerging environmental agenda is of immense proportion. Infrastructure bottlenecks, a cumbersome business environment, complex and distorting taxes, inadequate education and training, and outdated labour laws are increasingly impeding growth and job creation. Female economic participation remains exceptionally low, holding down incomes and resulting in severe gender inequalities. Although absolute poverty has declined, it remains high, and income inequality has in fact risen since the early 1990s.

Since knowledge based economy is dependent upon the users' ability to create, generate and use the knowledge, any imbalance, if continued in the knowledge economy will have adverse impact on growth process. India needs to evolve an indigenous model of development more suitable for Indian needs. Indian Challenge lies in Bridging Social capital based on trust and risk preparedness through fostering viable and sustainable Innovation partnerships within the Mind to Market Chain and Financing innovations (DST). Roadblocks along the growth path only reaffirm the need for deep internal restructuring and unlocking the drivers of sustainable and equitable growth. India's pursuit of a unique developmental path makes comprehensive review and restructuring of poverty reduction programmes a policy imperative.

Inclusive Growth Dimension

The concept of inclusive growth is by no means new. However, the recent discussions help us better understand the dynamics of growth and development. Inclusive growth, by its very definition, implies an equitable allocation of resources with benefits accruing to every section of society. Implicitly it means a non-exploitative and participatory form of economic activity. Inclusive growth refers both to the pace and pattern of growth, which is considered, interlinked, and therefore need to be addressed together (Lain Begg, 2011).

The 'inclusive growth' as a strategy of economic development received attention owing to a rising concern that the benefits of economic growth have not been equitably shared. The concept "Inclusion" should be seen as a process of including the excluded as agents whose participation is essential in the very design of the development process, and not simply as welfare targets of development programmes "a growth process in which people in different walks in life... feel that they too benefit significantly from the process." (Planning Commission, 2007). Policies for inclusive growth are an important component of most government strategies for sustainable growth.... to provide equality of opportunity for individuals and firms. (Ianchovichina & Lundstrom 2009)

Inclusive growth cannot be reached simply by the state redistributing the gains from economic growth. Important as redistributive schemes like cash transfers are, public policies for inclusion must focus on small entrepreneurs in the informal and rural sectors to generate their livelihoods as economic governance institutions, operating at national and international levels. The commission noted that inclusiveness – a concept that encompasses equity, equality of opportunity, and protection in market and employment transitions – is an essential ingredient of any successful growth strategy. Emphasis is on the idea of equality of opportunity in terms of access to markets, resources, and unbiased regulatory environment for businesses and individuals.

Growth Report: Strategies for Sustained Growth and Inclusive Development (Commission on Growth and Development, 2008)

The relation between growth and poverty is not as straight as it is often assumed. It is also determined by the level and changes in inequality of any country. While there remains no consensus on how to define or measure pro-poor growth, the issue has attracted a fair amount of attention within academia as well as among development practitioners. (Kakwani et al 2004). One view is that growth is 'pro-poor' only if the incomes of poor people grow faster than those of the population as a whole, i.e., inequality declines (Kakwani and Pernia, 2000). An alternative position is that growth should be considered to be pro-poor as long as poor people also benefit in absolute terms. (Ravallion, 2004).

Inclusive growth as the literal meaning of the two words refers to both the pace and the pattern of the economic growth. Inclusive growth is supposed to be inherently sustainable as distinct from income distribution schemes. While income distribution schemes can allow people, to benefit from economic growth in the short run, inclusive growth allows people to "contribute to and benefit from economic growth".

The Govt of India has identified five serious challenges facing inclusive growth strategy:

(1)Poverty (2) Employment (3) Agriculture (4) Problems in Social Development (5) Regional Disparities

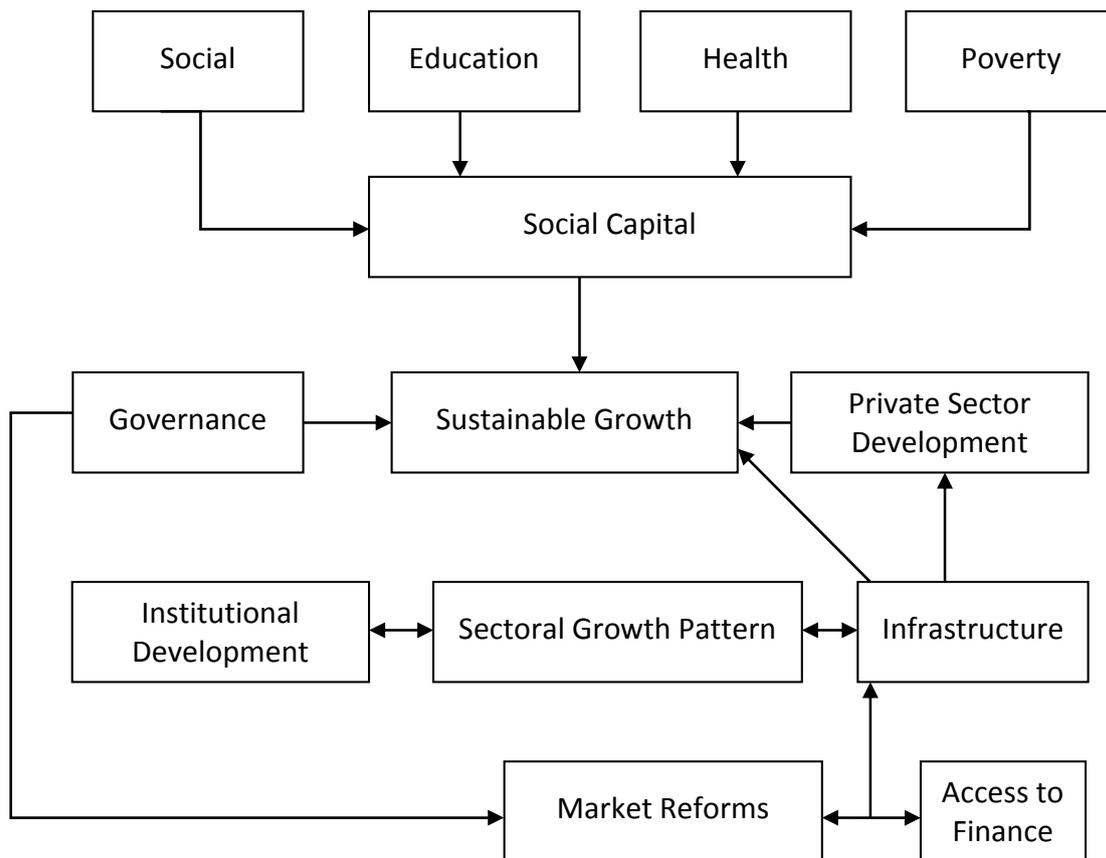


Figure 3: Elements of the proposed strategy and the linkages for Pro-poor Growth

Accordingly, India has stepped up for inclusive growth by launching many initiatives with features that are innovative, flexible and reform oriented such as:

1. Rural Infrastructure (Bharat Nirman)
2. Employment (Mahatma Gandhi National Rural Employment Guarantee Scheme)
3. Regional Development (Backward District Development Program)
4. Education (Sarva Shiksha Abhiyan)
5. Rural Health (National Rural Health Mission)
6. Urban Infrastructure (National Urban Renewal Mission)
7. National Agricultural Innovation Project



Vision of Indian Innovation Leadership

DESIGNING AN INDIA-NICHE MODEL FOR AFFORDABLE INNOVATION.

India needs more 'frugal, distributed, affordable, diverse and malleable innovation' that produces more 'frugal cost' products and services that are affordable by people at low levels of incomes without compromising the safety, efficiency and utility of the products. The country also needs 'frugal' innovation processes with least impact on the earth's resources and be designed to be environmentally sustainable. Innovation in India, hence, needs to cast a wider net to benefit more and more people who are currently marginalised by the system.

The chief architect of India's new Innovation policy who has been a major force behind many a Technology Missions and the technology revolution that has put India on the global map expressed his thinking underlying the emerging National Innovation System:

"The old consumption –intensive approaches cannot work, given the sheer scale of our needs and our vast population: instead, our innovation needs to be frugal with scarce resources, affordable for our poorest citizens, and environmentally sustainable. The work of India's National Innovation Council reflects this thinking. Our effort has been aimed at creating an Indian model of Innovation, of the people, by the people and by the people. Only through this inclusive approach where people are beneficiaries in knowledge creation and generation can we hope to create more sustainable models of development."

Sam Pitroda, in *"Introduction"* to Jugaad Innovation (2012) Random House: NOIDA.

INNOVATION STRATEGY : SI2 * INNOVATIONS

**The concept of SI2 has been proposed by the CII-ITC Centre of Excellence for Sustainable Development (CII-ITC CESD)*

Decades of research on innovation have shown that countries developing an effective Innovation System should work to stimulate innovative firms, provide long-term sustained funding to develop innovation capabilities, and promote the establishment of networks not only among themselves but also with leading centers in developed countries. Studies also point to the fact that firms combining different types of knowledge and different ways of innovating perform best. Jensen et al. (2007) maintain that firms that combine science driven STI (Science, Technology, Innovation) and user driven DUI (Doing, Using, Interacting) modes of innovation are more product innovative than firms relying on only one mode. Likewise, Laursen and Salter (2006) demonstrate that firms that seek knowledge from a diversity of external sources are the most innovative. "Government's role' then "is to create an enabling environment, by facilitating, supporting, incentivizing, financing, adopting, adaptation, marketing, commercializing and mass-production of innovation products to the society," said Vinod K. Goel, *Inclusive Innovation Policy Advisor at the World Bank*. Innovation can occur from the bottom-up or be sponsored from the top-down. Going beyond mere research laboratories, India must build a powerful national innovation ecosystem comprising robust physical, intellectual and cultural constructs. The current restructuring of India's innovation system takes cognizance of this imperative.

India is emerging as a global hub of Innovation-low cost as well as high value products and services. Recent acquisitions by Indian companies in the global market signify an increasing trend by the Indian companies to leverage the various possibilities of Innovation that the global market offers. Global community has begun to recognise that India has 'inherent reasons' for innovative activity such as the existence of an open society, a technology base, democracy, diversity, an environment that allows experimentation, a vibrant capital market, availability of young populations necessary as human capital to fully reap the demographic dividend, full and free competition in the private sector, opportunities for technological leapfrogging as well as the availability of necessary infrastructure.

It is a cliché to say that India is a country of contradictions. That cliché holds true for innovation as well. It has equally complex below the level innovation system driving a growth process that defies established theoretical propositions of economic progress. Mirroring complexities of its economic growth process India is putting in place an equally unique innovation strategy. India's ability to deliver low cost high efficiency innovations has caught global attention setting off a flurry of academic activity investigating into this unique Indian trait. Inspired by such Indian innovative traits, we find the entry into innovation literature, of new terms like *Gandhian Innovation (Prahalad & Mashelkar, 2010)*, *Jugaad Innovation (Radjou, Prabhu & Ahuja, 2012)* *Frugal Innovation (Bound & Thornton, 2012)*, *Reverse Innovation (Govindrajana & Trimble, 2013)*, *Nanovation (Freiberg & Dunston 2011)*, and even *Indovation (Peter Löscher, Siemens, 2010)*, *MLM Innovation etc.* World Economic Forum even organised half a day session on the MLM innovation that caught the world attention.

PRINCIPLES OF GANDHIAN INNOVATION

1. Deep commitment to serving the unserved
2. Unambiguous vision
3. Ambitious goals to foster an entrepreneurial spirit
4. Accept that constraints will always exist, and creatively operate within them
5. Focus on people, not just shareholder wealth and profits

Gandhian engineering is inclusive innovation: developing products and services that improve life for everyone, innovation that doesn't leave out the poor. (R A Mashelkar)

Jugaad innovation is a typical Indian innovative instinct prevalent across the entire landscape of the country adding value to lives on the margins. Chief characteristics of Jugaad are frugality, flexibility and inclusiveness. The authors propose six principles of "Jugaad innovation": (1) seek opportunity in adversity; (2) do more with less; (3) think and act flexibly; (4) keep it simple; (5) include the margin; and (6) follow your heart. (Radjou, Prabhu & Ahuja, 2012)

India's emerging structure of NIS is aimed at solving multiple contradictions and develop the system as virtuous feedback loop. India must continue with laboratory based structured innovative activity where it is slashing cost of innovation as much as 70% and carve a niche. (India's Mars Mission Mangalayan is the latest case in point). The primary challenge lies in scaling up the Jugaad innovations and diffusing these "grassroots" innovations across industry, 'monetisation of indigenous knowledge'. "Evidence accumulated that the rate of technical change and of economic growth depended more on efficient diffusion than on being first in the world with radical innovations and as much on social innovations as on technical innovations" (Freeman, 1995). Second level of challenge lies in combining high tech with frugality and connecting grassroots with structured activity. Associated with this, third issue is how to connect grassroots innovative activity, 'bottom of the pyramid' with globally competitive structured activity that happens at the 'pinnacle of the pyramid'. Studies have shown that most innovation takes place "at the margins", where people are struggling to find solutions to real problems.

Concept of SI2 aims to build a cohesive, integrated innovation system reconciling inherent contradictions of divergent innovation landscape. Sustainable and inclusive innovation or SI2 is about innovations that add value to business, to customers, to the environment and to society. It is about getting out to the real people, much before you start innovating solutions for them. It is about bringing in the real people to your strategy room and laboratories to co-create solutions. It is about working together to get new solutions delivered in a manner that creates value beyond just getting a job done. The CESD sustainable innovation framework classifies four types of innovation - reactive, incremental, radical and transformative – based on combined scales of business and sustainable benefits.

The process of converting an idea into an innovation, which makes tremendous impact, is difficult to realise. Not all attempts succeed. There are four characteristics that set these innovations apart from the ones that do not go very far:

1. Such innovations add value to the life of the people much beyond the immediate use of the product or service;

2. Such innovations create a product or service of an uncompromising quality at a price that is affordable;
3. Such innovations address the challenge of resource use efficiency to manage drastically low cost structures; and finally,
4. Such innovations are scalable and replicable to suit requirements of local circumstances and complexities.

PATTERN OF SI2 USAGE BY COMPANIES IN INDIA – SURVEYED BY CII-ITC CENTRE OF EXCELLENCE

Sustainable and Inclusive Innovations (SI2) is defined by CESD as innovations in products, process or business models that address economic, social and ecological challenges of the 21st century. In order for an innovation to be SI2, it should have at least one of the four below mentioned characteristics: (1) Add value to the life of people much beyond the immediate use of the product or service; (2) Create a product or service of an uncompromising quality at a price that is affordable; (3) Address the challenge of resource use efficiency to manage drastically low cost structures, (4) Scalable and replicable to suit requirements of local circumstances and complexities

Most of the of SI2 companies interviewed in the survey use all the four characteristics

Add value beyond its immediate use	85%
Uncompromising quality	73%
Address resource use efficiency	69%
Scalable and replicable	77%

Innovation factors that are high on companies' agenda

Reducing costs per unit produced or provided	77%
Increasing range of goods or services	77%
Increasing value added	73%
Exploiting green growth opportunities	65%
Reducing environmental impacts	65%
Improving quality of goods or services	65%
Increasing market share	62%
Entering new markets	62%
Meeting regulatory requirements	50%
Improving health and safety	42%
Replacing outdated products or processes	35%
Entering BOP markets	31%
Increasing capacity for producing goods or services	31%
Improving flexibility for producing goods or services	27%

Companies have also identified exploiting green growth opportunities and reducing environmental impacts as other important factors to innovate. Tightening environmental legislation in India, demand for demonstration of better environmental footprint by international buyers, business risks due to environmental challenges, and creation of new markets for green products, are the four reasons for companies to go green.

Source: How India Innovates: The Promise of Sustainable & Inclusive Innovation. A Report by CII-ITC Centre of Excellence for Sustainable Development. 2013

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