INNOVATION AND TECHNOLOGY FOR GREEN GROWTH TOWARDS SUSTAINABLE DEVELOPMENT IN INDIA

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Abstract

Today, the growth model towards sustainable development widely recognized by the international community is green growth. However, understanding and application of Green Growth, innovation and technology are still being developed in most countries. Promoting innovation and technology for Green Growth in India is not only appropriate for the current economic integration process, but more importantly, it comes from the requirement of the domestic economy for transforming the growth model. India after three decades of rapid growth is now facing several development problems such as low quality of economic growth, low competitiveness, low efficiency, social inequality, depletion of environmental pollution, climate change and natural resources. In this study innovation and technology for Green Growth can be a potential solution to these problems and helps India move towards sustainable development. This paper aims to analyze the basic dimensions of Green Growth in India by focusing on the following content (i) the development context in India (ii) reasons for choosing the Green Growth model in India (iii) India's commitments and steps towards green growth (iv) the opportunity and challenge of India towards the Green Growth model and (v) the policy implications for Green Growth in India. This article uses secondary data collected from official international and national sources in India. Economic growth is an essential objective of all nations. After more than two decades of embracing economic reforms, India has joined the middle-income group. The paper analyzes the relationship between Innovation and Technology for Green Growth and the quality of sustainable development in India.

Keywords: *Innovation, Technology, Green Growth, Climate Change, Energy Efficiency, Sustainable Development, India Green Growth Strategy.*

Introduction

Green Growth is widely recognized around the world. Faster Green Growth is inconceivable without innovation. Frontier innovations are evolving towards production opportunities that enable more production to be produced and newer and more environmentally friendly products produced with fewer or different inputs. Innovations thus contribute to de-coupling growth from the impoverishment of natural capital and pollution of the environment, for example towards more efficient and resource efficient technologies. Some innovations can directly increase resilience to environmental shocks. Catch up innovations, which make the use of existing technologies more widespread by adapting them to local contexts, are even more important for all countries. The introduction of new products, processes, business models and other organizational methods, as well as marketing techniques, whether through the frontier, innovation or catching up, in principle contributes to market expansion and the creation of new markets. In this paper, we examine existing models of environmental innovation, how innovation policies need to be designed differently to reflect the Green Growth agenda and what changes are likely to improve Impact in the short term or at least in the medium term. The paper discusses the implications of the dual marginal inherent in knowledge-related market failures aggravating traditional environmental activities.

What is Green Growth Innovation?

This Green Growth concept is based on the idea that economic outcomes can no longer be the only parameter of societal progress and are in themselves an incomplete representation of the full value of an economy and are likely to mask the inherent risks and costs production and consumption. This recognition has helped to integrate the concepts of economic growth and environmental sustainability. Green Growth means promoting economic growth and development while ensuring that natural resources continue to provide the environmental resources and services that underpin our well being. To do so, it must catalyze investment and innovation that will sustain sustained growth and generate new economic opportunities.

Review of Literature

The literature on Green Growth is, most recently, as a significant political debate on this issue took place only after the global financial crisis of 2015. The literature is also dominated by the applications or context of industrialized countries or World. The relative novelty of the policy concept means that the overall work on definitions and the potential for Green Growth is broader than the analysis of experience.

In addition to the more general theoretical and diagnostic literature, specific fields of technology and innovation, employment, trade and metrics are strongly reported in the literature to date. The efficiency of resources, the transformation of energy systems, the valuation of natural capital in economic calculation and the pricing of environmental activities (Jouvet et al., 2013).

Schmalensee (2012) suggests that there is little evidence of a threat to economic growth in the short to medium term from natural resource depletion or uncontrolled environmental degradation. It is not clear that the transition to a green economy can itself generate the desired growth countries (Huberty et al., 2011) and for developing countries, conventional growth can provide a faster way out of Poverty (Dercon, 2012). Nor is it clear that giving up economic growth is a necessary condition for tackling the environmental crisis (Janicke, 2012). The critical debate focuses on accepting short-term adjustment costs while awaiting long-term gains (Resnick et al., 2012).Most green policies have an economic cost over the short term, despite the economic benefit from a better environment and natural capital in the long term (Strand and Toman, 2010; Hallegatte et al., 2011).

Green Growth policies should reconcile the short and long term, maximizing synergies and mitigating trade-offs between space and time (Hallegatte et al., 2011). As a result, the World Bank (2012) suggests that Green Growth should focus on what needs to be done in the next five to ten years to generate immediate benefits and avoid blocking into unsustainable paths. The theory of Green Growth cannot determine whether a particular strategy or path of Green Growth will achieve the demands made for it (Jacobs, 2013), and some argue that the conventional tools of the neoclassical economy Have serious limitations for incorporating environmental considerations into economic policy (Kosoy et al., 2012).

Green Growth in Developing Countries

The limited literature on developing countries is largely linked to the potential of Green Growth policies, emerging economies and the formulation of Green Growth strategies. Green

Growth was proposed as a way for rapidly growing emerging economies, such as Brazil, China, India and Indonesia, to tackle greenhouse gas emissions and environmental degradation (Jupesta et al., 2011, Ellis et al., 2012) suggest that there are lessons to be learned from their experience. Green Growth strategies have been developed for low-income countries Need to be strengthened to fully address environmental and social issues, such as Bass et al. (2013) found in Ethiopia. For Malawi, Mozambique and South Africa, Resnick et al. (2012) May be incompatible with their comparative advantages and their past investments, economically costly and face popular resistance.

Need of the Study

The need of the study is to preserve natural capital in the process of sustainable economic development. Both Technology and innovation are needed to significantly reduce the impact on the environment and this innovation and technology for Green Growth can provide opportunities for long-term economic growth by improving production efficiency while creating new industries and markets in national economies.

Research Methodology

The specific methods used in this study are historical, analytical and empirical. Interviews were also conducted to obtain expert opinion on certain issues. Most of the data on which this research is studied from periodicals, newspapers, brochures, NGO working papers, government policies, ordinances and circulars. This article uses secondary data collected from official international and national sources in India.

Objective of the Study

This article aims to analyze the fundamental dimensions of Green Growth in India by focusing on the following content :

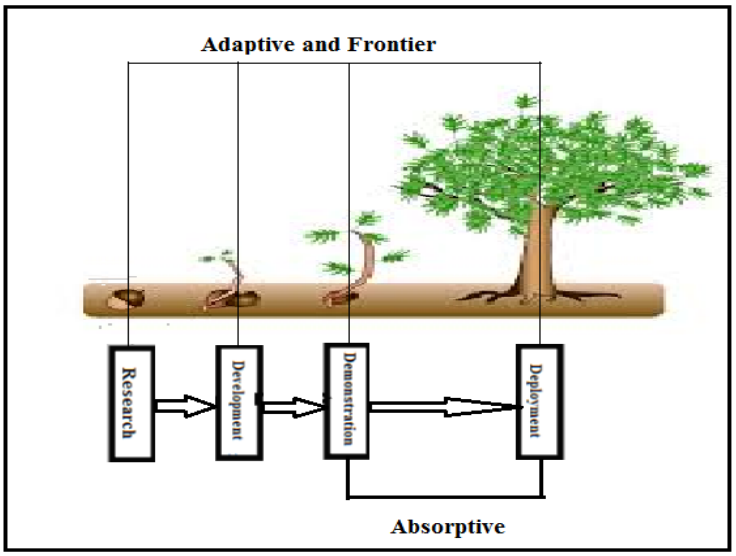
1. To Study trends in innovation in green growth
2. To Explore the development context and the reasons for the choice of the Green Growth model in India
3. To Identify India's commitments and milestones for green growth;
4. To Explore India's opportunities and challenges of green growth
5. To Suggest the political implications of Green Growth in India.

Trends in Green Growthinnovation

Innovation is at the heart of sustained economic growth and prosperity for both advanced and developing countries. Defined as a whole as the introduction of new technologies and practices in an economy, innovation has a positive impact and can lead to a transition to a knowledge based economy. By analyzing how innovation occurs, decision makers can develop more effective strategies to enable and accelerate. In Figure: 1 indicates the innovation towards the growth of technology development based on adaptability, frontier and absorptive method. For innovation linked to green growth, the structure and functions of the innovation system are similar to those of general innovation. However, in addition to the typical problems of innovation in general, innovation in Green Growth is also hampered by market failures

related to the environment. It is possible for an innovation system to successfully support innovation in many technological areas, but not in those related to green growth. For this reason, it is necessary to focus on both types of failures in order to drive innovation towards a pathway of green growth.

Figure 1: Innovation Towards the Growth of Technology Development



Commitment and Steps of India Effort toward Green Growth

India is emerging as one of the fastest growing economies in the world and is currently the third largest economy in Asia by GDP. India's gross national income for 2014 - 2015 was 105.27 trillion, with an annual growth rate of 7.4% (Economic Survey 2014 - 2015). The share of the service sector is the largest of India's total GDP at 57% (2013) followed by the industrial sector at 25% and the remaining 18% of the agricultural sector. By 2014, India's total population was 1.29 billion and its share of the world population was about 17.84%. Overall, economic growth appeared to have picked up in the past year and is expected to improve in 2015-2016. In India development is an imperative, the environmental consequences can be considerable, as they will put serious constraints on natural resources such as land, water, minerals, fossil fuels and increase in the price of energy and raw materials.

Technologies for Green Growthinnovation

Innovation and Technology for Green Growth in different sectors with examples are explained in the below Table 1.

Table1: Key Sectors and Technologies for Green Growth Innovation

Sector	Examples of Technologies
Electricity Access	• Smart power grids • Indoor cooking stoves using renewable energy (for example : solar, wind) • Off grid technologies such as local wind turbines

Water Management	• Desalinization plants • Wastewater treatment facilities
Climate Change/ Reducing Emissions	• Mitigation technologies • Smart power grids • Renewable energy technologies • Wind, solar, geothermal, marine energy, biomass, hydro power, etc. • Electric and hybrid vehicles • Carbon capture and storage • Adaptation technologies • Higher yield seeds • Drought resistant crops and cultivation practices • Climate resistant infrastructure: sea walls, drainage capacity, water, forest and biodiversity management, etc.,
Transport	• Bus rapid transit • Low emission vehicles and fuel biogas, hybrid and plug in electric vehicle
Building Energy Efficiency	• Smart power grids and smart meters • Thermal insulation • Energy efficient lighting: energy efficient compact fluorescent lamps, Electroluminescent light sources • Energy recovering stoves using thermo-electric generators
Agriculture	• Genetically modified crops • Mechanical irrigation and farming Techniques

Source: www.brookings.edu.,

Opportunities and Challenges for Green Growthin India

Our research indicates that India has a tremendous opportunity to increase its level of sustainability beyond what it expects to achieve through the ambitious programs already inaugurated. India has the opportunity to establish itself as a hub of a range of clean technology industries, laying the foundation for new avenues of growth. This plurality will contribute to ensuring sustainable development in order to respect ecological limits and to involve communities. Among the many challenges, it is clear that attitudes must be changed and new growth models need to be taken into account. Over the next two decades, India is expected to grow at a rate of 7% - 8%. And during the same period, it will build about 80% of the physical assets, including infrastructure, commercial and residential real estate, vehicle stock and industrial capacity that will constitute India in 2030. Will bring enormous benefits, but it also poses many challenges, especially in terms of sustainability.

Green Growth- the Way A Head

Greening an economy requires financial and human resources and an effective and coordinated governance regime to establish and support the implementation of green policies, regulations and initiatives. A clear government commitment across the public sector is needed. Policy and institutional coherence are necessary. This can be supported by the integration of

Green Growth objectives in environmental, social and economic into public planning, i.e, master plans, social economic development plans, investment land use plans, restructuring plans of public enterprises, technological renovation. Therefore, Green Growth has an important position in the strategy of deep growth in India in the time to come.

Findings

India is expected to grow at such a rapid pace over the next two decades that it could build about 80% of physical assets, including infrastructure, commercial and residential real estate, fleet and industrial capacity which will constitute India of 2030. For India, Green Growth is essential to solve the problems of the current growth model, as low labor productivity, intensive waste and resources, environmental pollution and low technology. Over the past decade, India's strong growth has increased employment opportunities and has lifted millions out of poverty. India's economic growth was predominantly based on quantitative rather than qualitative development, with high fuel and energy consumption in the production of products, thus harming the environment. Environmentally friendly industries are largely underdeveloped. India's remarkable growth record, however, has been overshadowed by a degrading environment and the increasing scarcity of natural resources.

Suggestion

Green Growth strategies are needed to promote sustainable growth and to break the pattern of environmental degradation and depletion of natural resources. The Paper suggests that India focuses on four areas, improving energy efficiency in industry, vehicles and appliances. Accelerate the transformation of its electricity sector, including the adoption of clean technologies. Build ecological infrastructure for urban habitats and transport and the establishment of sustainable agricultural and forestry practices. They may focus on the scope of support for innovation in favor of balance of payments and low margin innovations. They may Create a support structure to enable entrepreneurs to expand their own expertise and access networks.

Conclusion

Green Growth is one way to achieve economic, environmental and development goals. It offers the opportunity to make existing heavy industries more sustainable while simultaneously encouraging new industries and economic diversification. Technological innovation and the establishment of creative, integrated, private and public approaches to support innovation in developing countries are at the center of the Green Growth strategy. Without these creative approaches and the new technologies and market transformations they create, we can hardly achieve the goals of universal access to clean energy, water and sanitation or to the broader environmental goals of climate stabilization and biodiversity, while encouraging economic growth and vitality in all development contexts. For an environmentally sustainable future, India needs to value its natural resources and ecosystem services to better inform policy and decision making.

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