

## Innovation Policy and Sustainable Development

Manish Anand and Shailly Kedia, The Energy and Resources Institute (TERI), New Delhi<sup>1</sup>

### Introduction

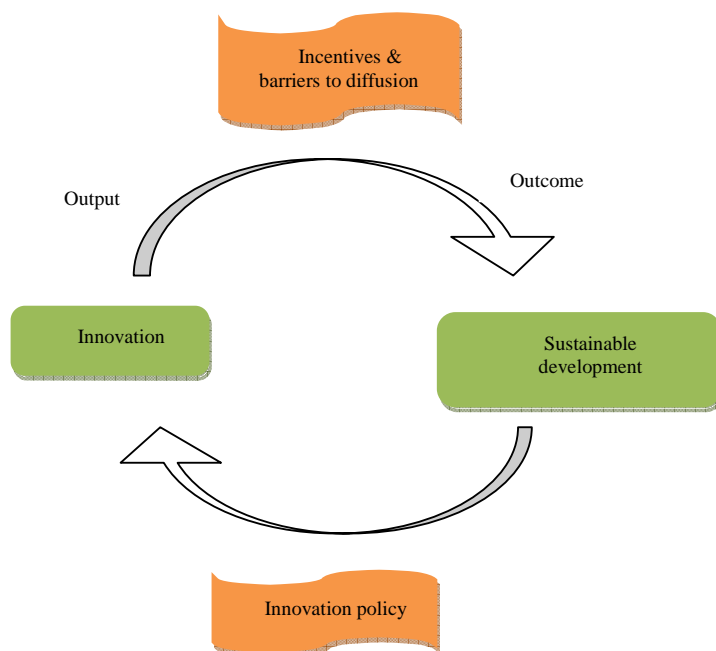
In Joseph Schumpeter's view, fundamental breakthroughs of technology are the essence of the process, and they affect the entire economy. Thus technology and innovation policy can also be linked to the three pillars of sustainable development namely economic growth, social equity and environmental protection. Existing production technology and consumer behaviour can produce positive outcomes only up to a point or a frontier; beyond which depleting natural capital has negative consequences for overall growth for the economy. According to OECD (2010), innovation – implying both the creation of new products, processes and technologies, as well as their diffusion and application – can push the frontier outward and help to decouple growth from the natural resource degradation.

A key feature of innovation that emerges from existing analysis is that it does not follow a linear path that begins with research, moves through the processes of development, design, engineering, production, and ends with the successful introduction of new products and processes into the market, rather, it is an interactive (and cumulative) process that involves continuous feedback loops between the different stages. A second feature is that innovation is essentially the result of an interactive process between many actors, including companies, universities and research institutes.

Recent notions surrounding innovation policy refer to innovations with a reduced impact on the environment (Schiederig et al., 2011). This brief highlights the recognition of the need for “innovation” and the role of “innovation policy”

to help in realization of sustainable development goals for tackling the trade-offs between economy, society and environment.

Figure 1 shows the process in which the innovation performance on the one hand and green growth and development on the other hand can influence each other mutually over time.



**Figure 1:** Schematic diagram depicting interdependencies between innovation and sustainable development

Research and Development (R&D) and innovation activities in many sustainable development related technologies especially related to environment are characterized by low investment and slow diffusion. Incentives

<sup>1</sup> Email: manand@teri.res.in. The views and opinions expressed are the authors' and do not represent those of the Secretariat of the United Nations. Online publication or dissemination does not imply endorsement by the United Nations.

for low carbon innovation are further weakened by real and perceived uncertainties about lack of clear direction and policy instruments.

### **Trends in technological innovations**

In the settings of both the developed and the developing world a wide range of initiatives to foster innovation mainstreaming environment supporting interventions include green taxes, clean energy funds, payment for ecosystem services schemes, and developing renewable energy industry are increasing in practice.

As argued by Krugman (1979), countries, rather than strictly aiming for least-cost solutions would prefer to adopt strategic behaviour, aiming for competitive advantage through economies of scale in new markets which can be a significant source of gains from trade. Thus, it may be assumed that the competitive advantage could continue to play an important role in innovation policy in developed countries.

The relation between environmental quality and human well-being is relevant as it impacts basic human needs such as food production, clean indoor air and portable drinking water (Shafik, 1994; Dasgupta, 2004). The connection between natural environment and quality of life has been a treatise of recent schools of thought such as ecological economics and sustainability sciences. The relationship between energy and human well-being is depicted in the relationship between per capita energy use and the Human Development Index (HDI) (UNDP, 2001; Najam and Cleveland, 2008). It is thus assumed that innovation in developing countries would be directed more towards sectors that would contribute to human development.

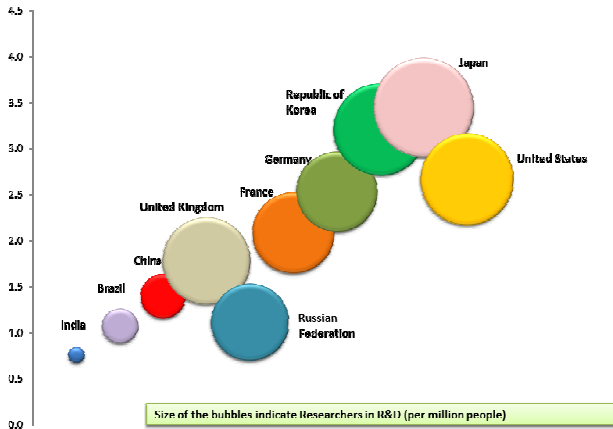
Analysis of patent data in environment related technologies for selected OECD countries and non-OECD countries reveal that for Germany

and Japan percentage share of innovation in the automotive sector (measured in terms of emissions abatement and fuel efficiency in transportation) is greater as compared to other patents in environment related technologies. Similarly, for Korea percentage share of innovation in lighting and appliances is greater. For developing countries including India and China percentage share of patents of the country in categories of general environmental management (air, water, waste) and energy generation from renewable and non-fossil sources is more. This could also be attributed to the existence of policies and institutions for local environment in countries – say for countries like India and China. Another factor is that renewable energy policies have been encouraged in these countries for promoting energy security and other co-benefits from clean energy.

There is very little South-South (between the developing countries) collaboration on technologies to promote green innovations, and there exists a huge potential for expanding green production and trade. Also, there has been very little attention to base-of-pyramid (BoP) innovations that address the needs of the poor. There is much scope for innovation that helps improve the delivery of a wide range of public services. Inclusive innovation is needed in fields of preventive clean water, education, medicine and other public services.

### **The case of India**

India performs poorly in many social as well as environmental indicators. Hence there is a need for innovation policy to address these issues. R&D policy plays an important role in promoting innovations to achieve sustainable development. As depicted in figure 2, R&D as a percentage of GDP as well as number of researchers is low in India.



**Figure 2:** R&D as a percentage of GDP and researchers

Source: Compiled from data.worldbank.org; Data for 2007

In context of India, more than half of population is under 25 years of age. Though India has the benefit of a dynamic young population, but to sustain its rapid economic growth and help realize demographic dividend, it is important that India has an enabling R&D policy that helps in harnessing innovation potential by adopting innovation-led, rapid and inclusive growth to enhance economic and social transformation.

The R&D and innovation related institutional system in the country is elaborate and multi-layered, having evolved over several decades. The Ministry of Science and Technology plays a lead role in identifying and promoting priority areas of R&D in various disciplines.

The Science, Technology and Innovation Policy of India, 2013 recognizes the role of the science, technology and innovation (STI) system in realizing sustainable development goals and operationalizing the National Action Plan on Climate Change. The document states that the STI system will "serve as a source of strategic knowledge to cope with the challenges of climate variability and change as well as to meet equity-based differentiated and shared responsibilities of India."

An expert consultation in The Energy and Resources Institute identifies the following areas of strengthening the policy:

- Organizational/systemic innovation is critical for diffusion and needs to be adequately dealt with.
- The current framework is linear with a R&D and techno-centric focus devoid of recognition to aspects such as sustainability and engagement with society.
- There is a thrust on publications and patents but the policy needs to also capture informal knowledge systems and innovations.
- The document does not specify provisions of financing and funds that are needed for operationalizing.
- There should be stronger linkages with other ministries such as human resource development, environment and finance among others.

### Concluding Remarks

It is observed that frontier innovations are mainly concentrated in high-income countries. However, the share of developing countries is also gradually increasing. Also, a significant capacity for frontier green innovation exists in a small group of more technologically-sophisticated developing countries and these are emerging as significant innovators. However, their innovations are limited to only a few technologies. This means appropriate innovation policy is likely to differ between these and other developing countries.

Focusing on environment related innovations across sectors would have certain co-benefits in terms of growth, inclusion, local environment and carbon mitigation. A brief qualitative assessment of co-benefit potential would be an important dimension of technology

development and innovation in the developing country context.

Innovation also benefits from the development of a sound policy and regulatory environment that contributes to incentives as well as protection of intellectual property. In this regard, transition to a sustainable development pathway could be accelerated by incentives through a national directive for R&D in low carbon development, setting up of low-carbon technology incubation centres with strong industry-academia-government linkages, facilitation of technology transfer through existing and new technology transfer offices, a focus on low carbon innovations in the informal sector, among others.

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