Climate Change, Green Innovation and Patent Regime: A Roadmap for Developing Countries

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Abstract *– In current times, climate change and environmental deterioration have emerged as global issues of concern. Innovators across the world are now engaged in developing technologies which mitigate the negative impact of human activities on the environment. These technologies are call green or clean technologies and the process of developing is popularly called as green innovation or eco-innovation. There are various legal socio-economic factors that come into play when we discuss the issue of green innovation. This paper aims to critically analyse the correlation between economy, innovation and law while focusing on developing countries. The focus will also be to come up with various policy tools to promote green innovation in these countries. This is an analytical piece of research in which the researcher has adopted doctrinal method of study. Various secondary sources like journals, magazine articles, working papers, etc. were used to collect and interpret information and data.*

Keywords *– Green innovation, Patents, Green technology, Transfer of technology, Licensing, Foreign collaboration*

INTRODUCTION

Market expansion and sustainable economic development are the main goals of any innovation system and to ensure the same it is important to diffuse green innovations in emerging economies of the world. Knowledge-based markets have the potential to play a crucial role in the transfer and diffusion of green technology (for example by way of patent pools). It is imperative to guarantee free and sustainable flow of research and adoption of green technologies in both parts of the world – developed and developing.

There have been policy discussions across countries about calibrating the IPR regime in order to promote the diffusion of critical green technologies. It is observed that a major obstacle in the way of technology adoption is the limited capability of developing countries which is a bigger problem than the market value of the invention. There are various ways which have been considered to boost the local adaptive capacities which include technology transfer, R&D. These would prove more helpful than patent-centred policies [1]. Technology transfer, as a policy, aims at promoting diffusion and adoption of green technology by ensuring ample access to innovative knowledge through modes such as education and training which is also categorized as disembodies technology transfer. Funding is also released to cover the adoption costs which include imported technical equipment which is categorized as embodied technology transfer.

Various pertinent factors like foreign direct investment, technology licensing, cross-border transactions and government aid play a vital role in promoting transfer of technology and building local capacity.

Promoting Catch-Up Green Innovation

In developing countries, boosting green innovation is not so much about frontier innovation. It is more about enhancing the diffusion and adoption of already existing green technology in the developed economies. An efficacious strategy of green growth, particularly in emerging economies, would involve facilitation of access to climate change mitigation technologies and their successful adoption. The prevalent business environment in most of the developing nations reveals extensive policy distortions and weaknesses that need to be addressed. These distortions are a major impedance in the way of diffusion and uptake of green technologies as compared to economically advanced nations [2]. There are several policy-based dimensions that need to be explored and exploited such as strong licensing and

liberalized international trade regimes. One more way to boost the adoptive capacity towards green technologies is to strengthen the metrology, testing and quality (MSTQ) facilities. Other policy efforts in this direction may involve the following: Enhanced financial access; Improving skills and developing capacities; Implementation of demand-side policies; and Enhancing the access to internet and other modern ICTs.

Enhancing Access to Climate-Friendly (Green) Technology

One key method to promote access to green technology is a liberalized regime of international trade and open channels for foreign direct investments (FDI). Many green technology embodiments can be found in imported goods or machinery and some are also inbuilt in business models and processes which can be learned by an individual. These technologies can be diffused by persistent efforts by the people attached to the movements of such technologies across international frontiers. Research has shown that in comparison to patent protection, imposition of tariffs on renewable energy technologies and fossil fuel subsidies result in diminished levels of technology transfer. A recent study has revealed that removal of tariff barriers in the forerunning 18 developing economies (ranked on the basis of GHG emissions) would increase the imports of energy-efficient lighting by 63 percent, sources of wind-power production by 23 percent, sources of solar power generation by 14 percent and clean coal technology by 4.6 percent. [3] One more study based on Indian electric power plants has shown that by eliminating various hurdles in the way of import in relation to coal of standard and refined quality would result in enhanced adoption environmentally sound technologies and significant reduction of carbon emission levels.

An important international environmental instrument plays a vital role in boosting dissemination and uptake of green technologies that is the Clean Development Mechanism (CDM) of the Kyoto Protocol. It simply allows economically advanced countries to finance GHG emissions reduction projects in developing economies in order to receive emission reduction credits. An analytical study pertaining to technology relating to the mitigation of emission of greenhouse gases has revealed that cross-national transfers have actually occurred in less than half of all the assessed CDM projects. These projects, for the record, involve a combination of operating skills and machinery/equipment transfer. The study also found out that most of the technology transfers took into account end-of-pipe destruction of GHGs in agricultural, chemical, waste management and wind-power sectors. Various other projects such biomass electricity production and energy-efficiency measures majorly rely on local technologies rather than transferred ones.

In conclusion, the study finds an ambiguous link between local absorptive capacity and cross-border technology transfer. While there is requirement of high technological capacities to build adoptive capacities for new green technologies but this would also mean that the need for international technology transfer in presence of high technological capacities will actually not be there. Thus, the study impressed upon the need of local capacity building as a mechanism to catalyze diffusion of technology. This mechanism should be coupled with strong efforts by local governments to strengthen technology capabilities that would encourage both the import of foreign technologies and diffusion of local technologies. There are various other useful mechanisms to enhance the access to prevailing green technologies which can are summarized below:

(i) *Compulsory License:* It compulsorily acquires the invention in lieu of compensation to the patent-holder. It is issued to make critical inventions available at affordable price particularly to poor households in low-income countries.

(ii) *Patent Buy-out:* It is a mechanism wherein the purchaser - a governmental institution or a private organization - acquires exclusive marketing rights for a patented climate-friendly product or technology from its original patent owner and subsequently grants a royalty-free licence to a legitimate green manufacturer to market the same in the targeted developing economies.

(iii) *Patent Pool:* It includes the cross-licensing of patent products among two or more patent holders *i.e.* a closed a pool or even a combined set of patents to a third party which generally referred to as an open pool. Patent pooling has been considered as an effective mechanism in order to curb the inefficiencies in any patent system because fragments of patents are required to develop comprehensive inventions of the future. A lot of pools have been witnessed in the area of pharmaceuticals, biotechnology, ICTs, etc.

(iv) *Patent Commons:* As a system, it is wider in operation as compared to patent pools. Patent commons basically allow patent holders to pledge their inventions for diffusion and royalty free utilization. As discussed earlier, few MNCs came together in 2008 to create a non-profit Eco-Patent

Commons which was duly coordinated and cooperated by the World Business Council. Up to mid-2011, over hundred patents had already been pledged by 13 participating MNCs [4].

If we consider initiatives from India, the Council of Scientific and Industrial Research (CSIR) launched a significant initiative called Open Source Drug Discovery (OSDD) in September, 2008. OSDD is basically a public-private partnership that established a linkage between industry and academia using the free source mode with the sole target of speeding the discovery of important compounds and drugs for overlooked ailments and diseases through mutual exchange of knowledge and information. This creates a pathway for the formulation of similar partnership in the neglected areas of green innovation and green growth.

Accelerating Green Technology Absorption

In order to enhance creation and diffusion of green technology across the globe, following factors are required to be implemented in an efficient manner:

(i) Market prices should reflect the absence of environmental costs;
(ii) Policies pertaining to demand-side such as regulations, standards and public procurement should be enforced properly;
(iii) Monetary policies such as feed-in tariffs for renewable sources, tradable permits to emissions, tax rebates to users of green technologies, etc should be implemented;
(iv) Awareness through comparison labelling, endorsement labelling on green products should be generated in order to promote green consumerism; and
(v) Stringent government rules regulating emission and pollution standards should be introduced.

On the one hand, regular technologies are adopted by companies due to the fact they reduce costs and amplify the profile and market presence of a company. On the other hand, adoption of green technology is a slow process because they are costlier than regular technologies and are not attractive to the consumers. Therefore, it is extremely important to fine tune demand-side policies to incentivize the adoption of green technologies. It is obvious that scarcity of demand of a particular technology will not encourage the inventors to create such technology.

One more measure to accelerate green development in a country is to improve its monetary infrastructure which involves releasing significant funds to build a strong green infrastructure. Farmers should also be encouraged to use energy-efficient and climate –efficient technologies that both decrease the crop losses and harm to the environment [5] There are several research studies in this regard:

(i) It is revealed that in low-income nations, monetary incentive creates a significant impact on the effect non-hydro renewable energy generation. Capital infusion in renewable energy resources are limited and accessibility to long-term loans is highly restrained. [6]
(ii) One more study find that providing access to financial credit acts as significant barrier to the adoption of solar home systems in China [7].
(iii) After World War II, relationship-based financial systems have played a vital role in enabling the absorption of low risk technologies by firms and enhancing the revamping of entire Europe [8].

To conclude, there are three pertinent factors that need to be considered in the context of developing economies:

The continuous advancement of green technologies and the reducing costs of adoption as compared to the prevailing non-green technologies result in more adoption by firms of green technologies. Also, this also mitigates adoption costs of environmental regulations formulated by governments. In a study conducted across 39 nations of the adoption regulations aimed at limiting nitrogen oxide and sulphur oxide emissions at cola-based plants, it was revealed that the countries making delayed adoption of such regulations make efficient use of per capital income than those who adopted those regulations earlier [9]. Technology availability at affordable rates should be able to help tune the regulations that are required to incentivize firms belonging to low-income countries to adopt them.

The sustainable benefits of well-formulated environmental regulation play a key role in improving innovation and competitiveness in the market particularly in the markets which are still evolving in terms of physical and institutional business infrastructure and are slowly reaching maturity. For example, a study has found out that the efficiency and productivity of the Mexican food industry significantly in the presence of stringent environmental regulations. To quote another example of study on Quebec, it was shown that across 17 manufacturing sectors strict environmental regulations resulted in the progressive increase in the productivity [10]. In case of developed countries, stringent and well-formulated environmental regulations result in enhanced

innovation activities by firms an increase in R&D investment on patents. However, the relationship between innovation and regulation costs still is not defined in clear terms as to whether increasing innovations are enough to cover the costs of meeting the regulations. In a study, majority of countries (10 out of 13) shown negative relationship environmental regulations and productivity [11]. Thus, it has been suggested that during the formulation of environmental policies and regulations, efforts must be made to create a healthy atmosphere for firms and stability should be tried to be achieved. Policies should aim at achieving favourable end results rather means [12].

The conformity of innovative products and processes with the continuously evolving international sustainable standards significantly helps local firms in enhancing their environmental practices. Establishing a nexus between local firms and global value chains of renowned MNCs who have already adopted these international sustainability standards helps in ensuring environmental improvement and balancing global market pressures.

Supply-Push and Demand-Pull Policies

It is clear from studies various economies that different systematic arrangements of policy instruments are required at different stages of technological advancement. For example, a recent empirical study has shown that high magnitude of government R&D funding to increase supply-push in presence of adequate technological capacities is much more effective than implementation of demand-pull policies which are aimed at generation of new frontier innovations. This study was a result of the analysis of patent applications filed across the globe during the period between 1994 and 2005 in wind power technology. Almost a million dollars invested on public support for R&D led to the generation of 0.82 new inventions whereas the same amount invested to strengthen demand-pull policies generated only 0.06 new inventions [13]. There was also no substantial evidence (based on the change in California wind industry) to suggest that demand-pull policies by themselves promoted radical and state-of-the-art technological transition [14].

In case of mature technologies, however, more attention should be given to demand-side policies so as to enable firms to introduce more innovations and initiatives. The main drivers of green innovation in any commercial market include the structure of environmental regulations and consumer demand. It is interesting to note that direct public support is the least important factor in motivating green innovation in all countries. In an environmental survey conducted on 19 countries, majority of innovative firms thought that the environmental benefits garnered by innovation is more on the cost side (measured in the terms of reduced use of energy per unit of output) rather than on the revenue side (consumers' capacity and willingness to pay more for green products). This suggests that firms that are engaged in innovation can only move ahead with smaller and incremental innovations rather ground-breaking product innovations.

Therefore, it is revealed that most of the green innovations are only incremental in nature rather than being a novel and radical one. It can fairly be contended that in order to spur radical frontier innovation in the field of climate friendly technologies, greater stress should have to be laid upon demand-side policies in presence of ample local capabilities. On the other hand, emphasis on supply-side policies will have the effect of promoting incremental environmental innovations – frontier and catch-up. Both the policies have to be carefully mixed in order to stimulate local green innovation especially in developing nations.

Promotion of Absorptive Capacities

In a given economy, the more potent drivers seem to be the policies that mitigate the stigma of failure and promote chances for re-entry and revamped experimentation. Speeding up the efficient use of otherwise unused economic resources in order to avoid corporate bankruptcy has been a major initiative in the United States. Statistically, while on the one hand, winding up a gravely ill business in the US consumes a time period which is slightly less than 10 months and allows somewhat over 90 cents on the dollar that is ultimately recovered in countries like Singapore or Canada while on the other hand, it still takes an average of 7 years to recover almost 16 cents on the dollar in Mumbai [15]. Therefore, as part of a corporate regime, easing the method of winding up of business may have the effect to promote new and innovative ideas in companies and even encourage the existing innovation models. Building a strong resale market where unused machinery can be easily sold for further commercial use is also a good way to support the innovation scene. One more way is to remove any hurdles from the paths of businesses that are largely based on electricity and information technology services. The policy makers should focus on efficient use of monetary resources.

To enhance mutual learning across the globe, inclusion of various firms in a global value chain alliance is the way to go. The advancement of wind-energy

technological capabilities in both India and China was a result of licensing mechanism with producers based in Europe. The prime objective was to gain primary access to turbine-related technologies. Cross-border migration of skilled and semi-skilled workers also proved to be an important factor in this regard. More about Indian and Chinese green technology sectors has been discussed in a later chapter.

In this context, various steps have been taken by various nations like renowned Indian wind turbine manufacturer, Suzlon, has set up various research facilities in countries like Netherlands and Germany to impart intensive training to the workforce and expose them to global expertise; Chinese producer Goldwind sent its workers to foreign countries for rigorous training; and Fibrovent Wind, a wind turbine blade start-up based in Chile included itself into a Spain-based market value chain operating at a global level. It also derived benefits advantages from cross-border migration of skilled workers. It also sought help from a Brazilian wind turbine company.

Development and skilling of global MSE industries has played a vital role in the dissemination of information pertinent for green growth. An effective policy point that would work in favour of local absorptive capacities is enhanced coordination with the private sector in urban entrepreneurial development. It would play a key role in attracting and retaining local talent. The mobility of worker population from rural to urban areas would expose them to creative and fruitful interactions with innovators, young and emerging entrepreneurs, institutions, organizations, etc. and would certainly provide a boost to local innovative instincts [16]. Intense urban-industrial cluster aggregations have played a vital role in enhancing technological capabilities and productivity by boosting supply of skills and capital. One major example of such cluster aggregations is in China. Special economic zones (SEZs) coupled with heavy government support for industrial strengthening cover three of the most prominent urban-industry mergers which are as follows: Pearl River Delta which is on Shenzhen, Dongguan and Foshan; The region of Yangtze River around the axis of Shanghai-Suzhou; and The Bohai region in the area of Beijing and Tianjin. These agglomerations play a key role in enabling the Universities to deepen their industrial ties, attracting foreign or local anchor firms that promote in-migration of suppliers and building strong communication infrastructure [17].

CONCLUSION AND RECOMMENDATION

To conclude, promoting green innovation and accelerating the development of green technology would require continuous efforts on part of the policy-makers. Pressing issues like local capacity building, capital infusion to support domestic innovators, ensuring robust patent protection regime to secure inventors' rights and foreign collaborations have to be addressed efficiently.

In the continuously growing demand for environment friendly products and technologies across the globe it has become crucial for the technological players worldwide to engage in innovative practices that are significant in environmental protection and sustainable development. The future lies in the growing markets of developing economies.

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