Managerial Perceptions of a Low Carbon Economy: A Study

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Abstract

In the wake of industrialization and continued growth of the world economy, a low carbon economy has emerged as the new paradigm to sustain growth. The Indian economy is developing rapidly; sustaining industrialization in India will demand a substantial shift in the role of companies towards the low carbon path. Presently, there is a need for urgent collective action to achieve a transition to a low carbon green and more resource efficient economy. The present study focused on enormous opportunities to invest in efficient, clean technologies, and resource efficient infrastructure, which could be inspiring and beneficial for the Indian companies in securing global solutions to reduce carbon footprints. Accordingly, the study analyzed how Indian companies are responding to environmental threats as well as the opportunities that lie ahead for low carbon green developments.

Keywords: **low carbon economy, green economy, sustainability, GHSs, carbon disclosure project (CDP), climate change, clean development mechanism (CDM)**

JEL Classification: Q 54, Q 55, Q56

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With the growth of industrialization and development of the world economy, the unrestrained use of ecological resources has seriously affected the environment and economy of the world (Zhao &Wu, 2010). The world is now experiencing a growing number of adverse consequences since continued economic development and resource exploitation threatens the strength of natural systems. Desire for material prosperity with more modern facilities is presently based on the high-carbon model. The Millennium Ecosystems Assessment Report (2005) explained the way in which 15 of the 24 ecosystem services - including provisioning services (water, food, timber, fiber, etc.), supporting services (soil formation, pollination, etc.), and regulating services (water quality, waste treatment, etc.) being consumed at current rates would be unsustainable in the future. Industrialization and over-exploitation of natural resources are affecting various natural resources like soil, water, air, and so forth, and have impacted the environment. As a result, nature has also started to fight back with a vengeance.

The impact of climate change has been receiving increasing attention with the recognition of the problem of global warming such as increased sea level, natural disasters such as floods, droughts, hurricanes, and other extreme weather, which pose a severe challenge for the survival of mankind. Climate change and high GHGs (green house gas) emissions are among the frightening aspects of the crisis precipitated by the conventional developmental models. According to scientists, climate change and global warming could become catastrophic if emissions are not checked immediately. Presently, we are surpassing the carrying capacity of Earth and are debasing the ecosystems we rely upon for our life.

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The Millennium Ecosystems Assessment Report (2005) suggested that there must be an effort to increase efficiency for resource use and reduce the negative effects on our ecosystem. The fourth assessment report of the Intergovernmental Panel on Climate Change (IPCC, 2007) dispersed many uncertainties about climate change. It is apparent that global warming is mostly due to man-made emissions of GHGs (mainly CO2). The IPCC Report gives a detailed projection for the 21st century and the projections show that global warming will continue and accelerate. The best estimates indicate that Earth could warm up by 4°C by 2100 (global average temperatures will reach 30°C). The Stern Review, considered by many as the most comprehensive study on the economics of climate change, calculated that the impact of unabated climate change would be equivalent to a loss of at least 5% of global GDP each year and could reach as much as 20% of the global GDP. This led Stern to conclude that climate change is the "greatest market failure the world has ever seen," particularly given that the cost of action on climate-change mitigation is estimated at only around 1% of the global GDP (United Nations Environment Programme (UNEP), 2009, pp.1-2). Climate change is occurring more rapidly than expected, and according to economists, considerably slowing climate change requires greater investments in reducing GHGs emissions than originally recommended by Stern. The World Bank (2010, p. 1) explained the relation between environmental and economic, social, ecology, energy, technology, financial, and state institutions. The Stern report and World Bank report explained the benefits of a low carbon economy in combating against climate change and also emphasized the importance of institutional and technological innovation in developing low carbon economies.

In recent years, climate-change mitigation and green growth have progressively emerged on the agenda of governments in emerging economies. Rather than simply a contribution towards solving international environmental problems, policy making in these areas can reflect a range of motivations (Howes & Wyrwoll, 2012). By offering a clear vision for the unleashing of a low-carbon economy, the government can unlock private and public sector investment and usher in a period of investment, growth, and opportunities through credible and stable policies. Therefore, businesses should consider the risks and opportunities posed by climate change alongside the prospects of moving towards a low carbon green path.

Increasingly, reporting and acting on carbon and climate change is being viewed as an opportunity for the low carbon green economy. The Carbon Disclosure Project report (2011) exhibits how the world's largest public companies are managing carbon. The report revealed that carbon management activities and climate change are now at the heart of these companies' business strategies. Indian companies are also improving in their responses towards climate change and adopting green technologies, which are the reflection of integration of climate change into their business strategies at the policy level, and this was acknowledged in the Carbon Disclosure Project report (2012). Indian companies understand the risks associated with climate change on their corporate functioning. Climate change can increase some costs of doing business, and in some cases, may completely disorder the supply chain of a business. If ecological change and ruin were to occur on a large scale, employees, suppliers, operations, and other stakeholders would be affected, usually adversely. According to the Carbon Disclosure Project report (2012), Indian companies have started considering sustainability and carbon emission related disclosures as a tool to enhance their reputation among their stakeholders on climate and sustainability performance. They have started recognizing climate change and energy security as a key sustainability challenge, and can do better business by identifying and mitigating the potential risks and harnessing the opportunities.

Literature Survey

Climate challenges, resource exploitation, human inequality are raising questions as how companies are responding to these emerging issues. To a large extent, the review of literature focuses on examining the background of low carbon green economy, corporate perception about its risks and opportunities, sensitivities, new business paradigms, and so forth. Existing literature about a low carbon economy in a developing country like India and others has revealed that the perception about low carbon economies stays well behind on a global scale despite the perceived importance by the government and companies. Considerable literature has historically focused on different areas of a low carbon economy, from definitions to policies and practices,

governance, and mechanisms for developing a low carbon economy, benefits, challenges, and so forth, but in terms of Indian companies' perception about climate change with a special focus on low carbon options, no concrete literature could be found. A greater focus on the perceptions of Indian companies about climate change could provide some useful insights as to how Indian companies can be motivated towards accepting low carbon options. While many businesses may experience low carbon drivers as a threat in the beginning, but it represents significant opportunities for those who will be able to respond more opportunistically and innovatively.

Mitra and Mittal (2010) pointed out that large private-sector companies have undertaken a number of major efforts to promote a low carbon economy in India, and proposed that a number of measures also need to be taken to develop awareness about climate change among the small and medium entities. A CII discussion paper (2008) pointed out that environmentally conscious investment decisions can allow the country to leapfrog into an era of carbon - efficient technologies, and India can also lead the newly industrialized countries to follow a low carbon growth path by demonstrating clean technologies and resource efficient infrastructure. A KPMG (2008) report highlighted that Indian businesses are positive in their role in responding to climate change issues and emphasized the importance of domestic regulatory environment and a structured approach to respond to climate change. Joshi, Arora, Pamlin, and Sinha (2008) explained (in a comprehensive manner) how large Indian companies in India are understanding and responding to low carbon sustainability trends through innovation and business strategy. Another study for Defra by the Commission on Environmental Markets and Economic Performance (CEMEP) pointed out that transition to a low carbon, resource efficient economy will create enormous business opportunities and will stimulate new business models, products, and services by creating a new industrial world (CEMEP, 2007).

The Asian Development Bank Institute's study on climate change and green Asia (2012) pointed out that low carbon green growth is a good opportunity for generating new green jobs and boosting the economy while reducing greenhouse gas emissions that lead to climate change. Sullivan (2008) cited that most large companies appear to have been positively responding to climate change actions by establishing governance and management systems to reduce GHGs emissions. According to a final report by Middlesex University (2009), smaller companies remain in an unfavorable situation as compared to larger companies in that they have less capacity to trail and respond to climate change regulations and policies framed by the government and, therefore, they might face higher costs as compared to the benefits. The Climate Group's (2011) report made it clear that the government and the business leaders of the country have an important role in seizing the opportunities for clean growth and in the next two decades, India will be in a leading position in the world in low carbon economic development. Carbon Disclosure Project's (2012) report showed an increasing trend in the response of Indian companies, which is a reflection of the integration of their concern for climate change into business strategies at the policy level. The question arises as to whether or not such disclosures (sustainability and carbon emission related disclosures) should be mandated by the regulators or stock exchanges for all companies subjected to audit under the present law. The ASSOCHAM and Ernst & Young report (2011) stated that the shift to a low carbon economy will have economic implications that will transform businesses, and the Indian businesses are embarking on this transformational approach.

Objectives of the Study

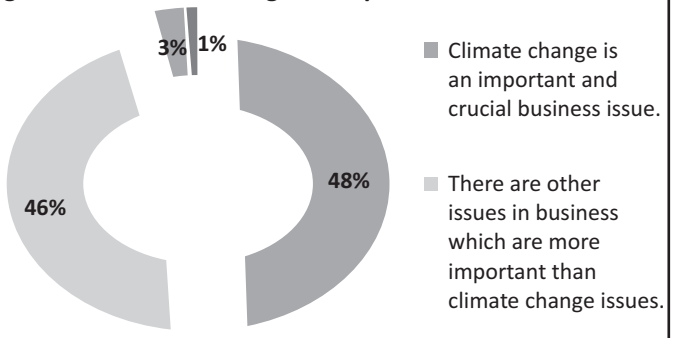
This paper has the following objectives :

(1) How do Indian companies perceive climate change as a contemporary business issue with a focus on its risk and opportunities? ;

(2) To exhibit the potential of low carbon business risks and opportunities and how Indian companies fit in the upcoming agenda of a low carbon economy ;

(3) To discuss a few case studies about useful and effective low carbon business practices that might benefit a wide range of companies in their low carbon business strategies.

Figure 1. Is Climate Change an Important Business Issue?



Source: Adapted from KPMG. (2008.) Climate change: Is India Inc. prepared? Retrieved from http://www.outlookbusiness.com/pdf/ClimateChangereportfinal.pdf

Methodology

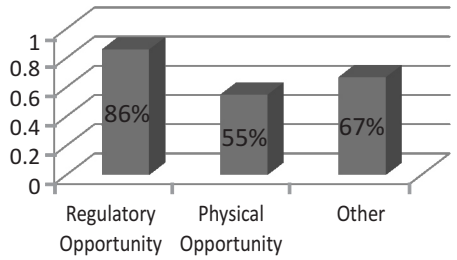
With the stated objectives in view, a number of companies across business types, such as operations, manufacturing, IT, supply chain management were considered and the types of benefits generated were looked at over a time period spanning between 2005 and 2012. Finally, this study was planned based on 37 Indian companies (Table 1) that participated in the Carbon Disclosure Project (2012). Four companies out of 37 companies were chosen for the present study.

Awareness, Challenges, and Opportunities for Indian Companies

KPMG conducted a study among India Inc. regarding the awareness about climate change issues and their importance in business strategic decisions. This study was conducted by taking the opinions of 70 big business leaders using a structured questionnaire; 48% of the respondents felt that climate change is a very important issue, and it must be considered in business plans; 46% opined that there are other *'more'* important issues than climate change that are more crucial in business strategic decisions; 3% of the respondents were not at all worried about climate change; while 1% of the respondents had no idea about this issue (Figure 1). Therefore, it can be inferred from this analysis that Indian corporates are quite positive in their approach to climate change issues and have been seriously considering the risks and opportunities attached with global warming, climate change, and a low carbon economy.

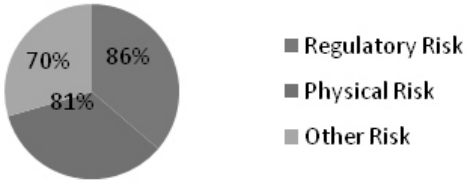
➲ **Landscape of the Indian Corporates About Climate Change Issues :** According to the Carbon Disclosure Project (2012) report, 86% (37 respondents) of the surveyed respondents perceived opportunities based on missions such as the National Mission on Energy Enhanced Efficiency (NMEEE), National Solar Mission (NSM), carbon credit, and selling of renewable energy certificates ; 55% (24 respondents) of the respondents identified physical opportunities to diversify and rise above limitations posed by climate change; 67% (29 respondents) of the respondents perceived other opportunities such as gaining goodwill in the market by investing more in carbon management projects and public disclosures (Figure 2) ; 86% (37 respondents) of the respondents recognized regulatory risks such as NAPCC (National Action Plan on Climate Change) and PAT scheme (Perform, Achieve, and Trade). This risk also engages stakeholders to evaluate financial, human resource, and strategic risks at the organizational level ; 81% (35 respondents) of the respondents identified physical risks due to changes in the precipitation levels (extreme climate), droughts, and rise in the sea level, which may create serious implications for businesses ; 70% (30 respondents) of the respondents identified other risks such as changing consumer behavior, demand for sustainable and green products, and increasing

Figure 2. Climate Change Opportunity



Source : Adapted from Carbon Disclosure Project. (2012). CDP India 200 climate change report 2012 : Responsible business striving towards a low carbon future (pp. 14-15). Retrieved from https://www.cdp.net/CDPResults/CDP-india-2012-climate-change-report-summary.pdf

Figure 3. Climate Change Risk



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humanitarian demands, which are forcing businesses to consider climate change issues since businesses need protection from the above-mentioned risks (Figure 3).

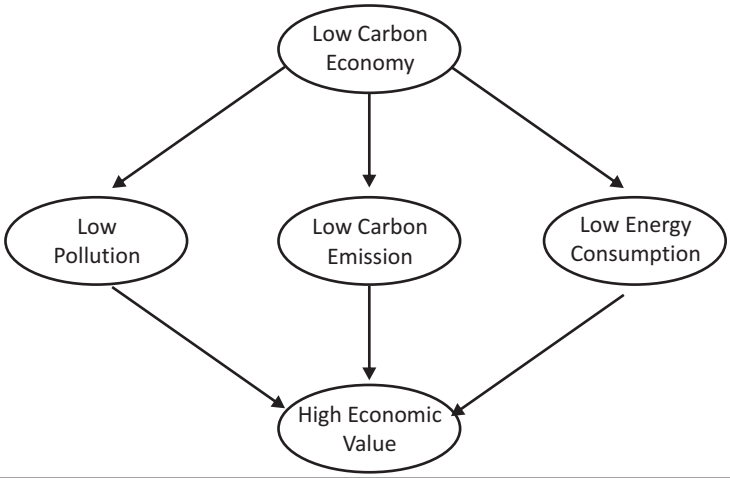
In the backdrop of serious threats of global climate change, a low carbon economy is an effective way to shift the pattern of economic growth towards an environmental-friendly one. The environment now demands to widen the concept of low carbon green model of business that addresses the opportunities which are available to developing countries to take part in the greening of their economies.

Background Study of Low Carbon Economy

The concept of low carbon economy was conceptualized by Weina, Hao, and Shunkui (2010). The background of advocating the concept of low carbon economy is to reduce the GHGs which require human beings to change from traditional high carbon economy of high energy consumption, high pollution, and high carbon emissions, and look forward to a low carbon economy of low energy consumption, low pollution, and low carbon emissions.

According to Wikipedia, a low-carbon economy (LCE), low-fossil-fuel economy (LFFE), or decarbonized economy is an economy that has a minimal output of greenhouse gas (GHG) emissions into the environment biosphere, but specifically refers to the greenhouse gas carbon dioxide. GHGs emissions due to anthropogenic

Figure 4. Low- Carbon Economy : "Three Lows and One High"



(human) activity are increasingly either causing climate change (global warming) or are making climate change worse (Low carbon economy, n.d.). A low carbon economy or a low fossil fuel economy is a popular term that refers to an economic structure that has a minimal output of greenhouse gases, thereby causing less pollution. A low carbon economy is a concept and style of production and living. It allows businesses to deliver their products and services, while at the same time, they reduce their level of carbon emissions (Figure 4). Developing a low-carbon economy is a path of adjusting economic structures and achieving economic development, conservation of resources, and environmental protection. Therefore, it can be said that this is another important progress for human civilization following agricultural civilization and industrialization of human society, and is also the fundamental change of human survival notions and developmental ideas.

➲ **Low Carbon Business Perceptions :** For over 200 years, industries of the world have been transferring fossilized carbon from underground deposits of coal, gas, and oil to a more potent and rapidly active circulating carbon dump in the entire biosphere, including the air, oceans, soil, and vegetation. These greenhouse gases form a blanket over the earth's surface, thereby resulting in increasing the temperature of the earth, which is known as the greenhouse effect. Climate change has emerged as one of the most important political and business issues of our time, and its negative impact has also been receiving growing attention. Global response to the problems of climate change is leading to a massive shift in industrial technology to switch to a new, less-polluting alternative which will create a global market for low-carbon technologies. Companies around the world are increasingly realizing that a more active and diverse strategy is needed to address climate change and in doing so, the low carbon agenda can bring new opportunities for both the public and private sectors. Low carbon growth, low carbon jobs, and low carbon stimulus packages are becoming more common as policy makers look to turn climate change and environmental threats into a sustainable advantage.

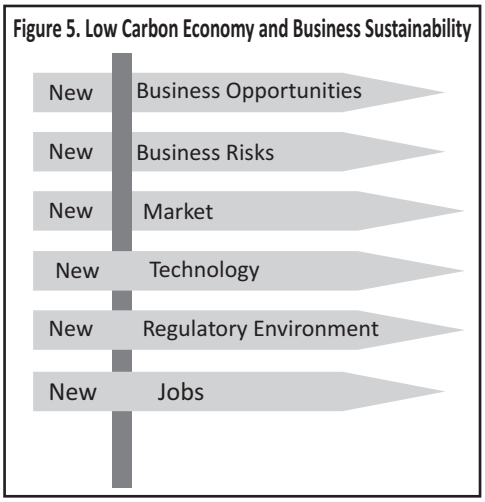
In recent years, climate change mitigation and green growth have progressively emerged on the agenda of governments in emerging economies. Rather than simply being a contribution towards solving international ecological problems, policy making in these areas promises a range of motivations. Those countries that succeed in attracting private capital into low-carbon growth areas, cleaner and renewable energy, energy efficiency, and decarbonization will enjoy manifold payback in terms of new jobs, technological innovation, research and development, more resilient and secured energy systems, and eventually, moving to sustainable economies. Transition to a low carbon economy ensuring sustainable development will require a fundamental shift in our thinking about growth and development, production, and consumption of goods and services.

➲ **Low Carbon Economy and Business Sustainability :** From the social and environmental perspective, sustainability issues are transforming the competitive landscape, motivating organizations to change the way they think about businesses, markets, technologies, regulations, and the business environment (Figure 5). It can be said that socially responsible firms receive more positive responses as they enhance the value for the companies. If companies can prove themselves to be socially and environmentally responsible, then the trust and confidence amongst the stakeholders of the companies increases, which in turn enhances the brand value of the companies.

➲ **New Business Opportunities:** International environmental regulations can bring financial benefits for low carbon businesses, for example, carbon credits and selling of renewable energy certificates and opportunity based missions such as the National Mission on Energy Enhanced Efficiency (NMEEE), the National Solar Mission (NSM), and so forth.

➲ **New Business Risks :** Business risks associated with a low carbon economy include frequent changes in national and international regulatory structures, possible damage to physical infrastructure, obsolescence of technologies due to carbon constraints, and change in consumer behavior.

➲ **New Markets:** Low carbon economies will create new markets for new products produced using low carbon



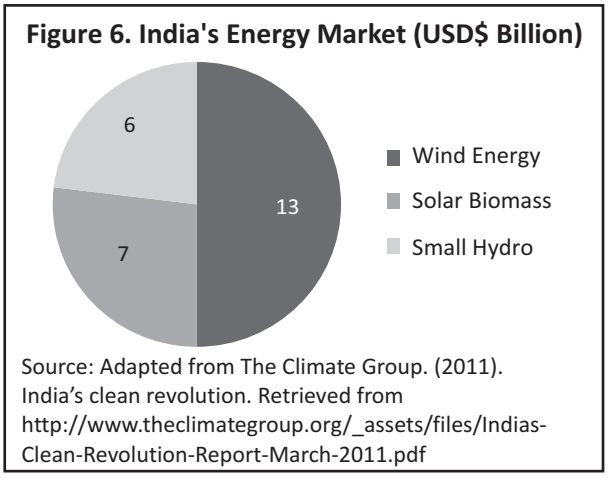
technology, clean development mechanism projects, low carbon transportation (electric vehicles/clean fuels), low energy materials, green buildings, and so forth.

➲ **New Technology:** Indian companies are looking for modern technologies around the world. Many global acquisitions are happening for acquiring cutting-edge technology such as Suzlon acquired RE Power and Hansen Transmission, Hindalco acquired Novelis, Tata Steel acquired Corus, and so forth. International firms such as Areva, GE, and so forth are establishing R&D centres in India.

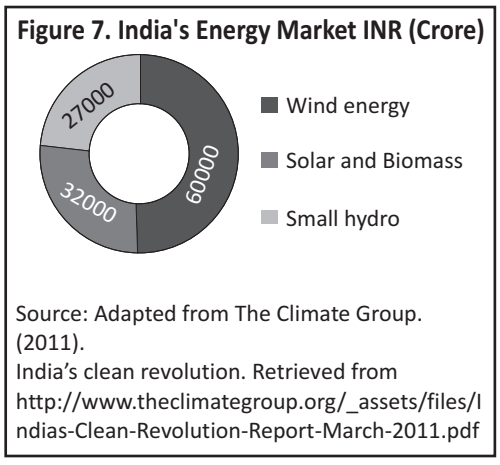
➲ **New Regulatory Environment:** In terms of regulatory environment, a low carbon economy is associated with new regulations, new carbon policies, new carbon disclosure requirements, reassessment of demand for regulatory responsibility, and so forth.

➲ **New Jobs:** Low carbon economies will lead to the emergence of small, medium, and micro enterprises in the areas of old waste management, renewable energy sectors, manufacturing solar water heating systems, and so forth.

➲ **Opportunities for Indian Companies :** Although India has not been an emitter historically, the past may not be a predictor of the future. As the economy grows and consumption patterns change, there is little doubt that

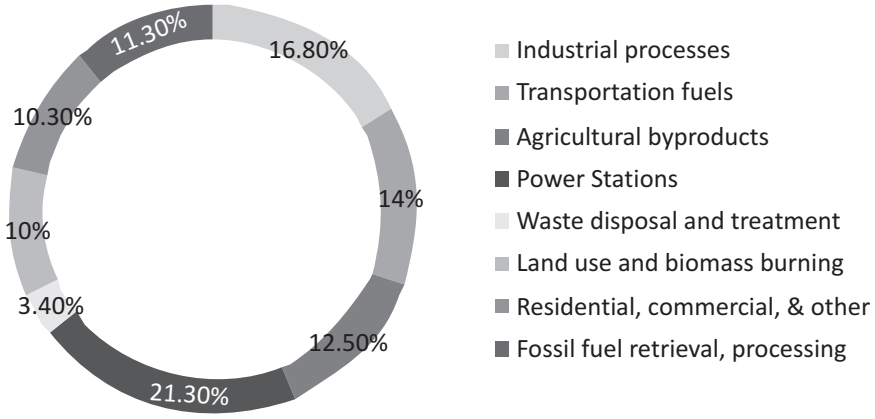


Source: Adapted from The Climate Group. (2011). India's clean revolution. Retrieved from http://www.theclimategroup.org/_assets/files/Indias-Clean-Revolution-Report-March-2011.pdf



Source: Adapted from The Climate Group. (2011). India's clean revolution. Retrieved from http://www.theclimategroup.org/_assets/files/Indias-Clean-Revolution-Report-March-2011.pdf

Figure 8. Main Sectors Contributing to India's GHGs Emissions



Source: Adapted from I. Guha (2011, April 27). Low carbon transformation: A business imperative. Ernst and Young Top Management Conclave on 'Sustainability & Carbon Management in the Hydrocarbon Sector', New Delhi. Retrieved from http://petrofed.winwinhosting.net/upload/27%20April%2011/Presentation/Session%20II/1_Indra%20Guha.pdf

emissions will rise and our country's carbon footprint will increase dramatically. In India, most black carbon, for example, is emitted by old-fashioned cooking stoves, improperly maintained and poorly regulated diesel engines, and outdated power plants. Emissions from all of these sources could be reduced with available modern technologies, market-based mechanisms, and low cost government regulations. India's response to climate change is wide-ranging, facilitating the country to move steadily towards a low-emission growth trajectory. In the coming years, the existing markets will change dramatically, and new markets will emerge that did not exist before. According to IEA-UNIDO Technology Roadmap (UNIDO, 2011), the worldwide market for low-carbon technologies is estimated to amount to USD 3 trillion per year by 2050, throwing up considerable commercial opportunities.

India's energy-efficiency market will treble to INR 351,500 crore (USD 77 billion) in the next 10 years driven by demand in buildings, industry, transport, and energy storage. All enterprises in India, including the small ones, are also increasingly realizing the opportunities presented by low carbon economy. By 2020, the wind-energy market is expected to be worth INR 60,000 crore (USD 13 billion), solar and biomass INR 32,000 crore (USD 7 billion) each, and small hydro INR 27,000 crore (USD 6 billion) (Figures 6 and 7).

The Figure 8 shows the main sectors contributing to India's GHGs emissions. Agriculture is the crucial sector that will be affected by climate change. Two-thirds of the total population of our country is dependent on agriculture as it is the main source of livelihood. This sector is particularly at risk from unexpected changes in the climate and is likely to benefit from low carbon agriculture practices. Sustainable use of ecological resources through organic farming can go a long way in tackling the problem of GHGs emissions. Indian industries can achieve low carbon green growth by adopting suitable policies. An innovative approach should be taken by the Indian industries that includes energy conservation in building, low carbon and energy efficient transport systems, solar and biomass initiatives for shifting to renewable based energy sources, use of clean technology and processes, improvement in energy efficiency in industries and power plants, and so forth. All these initiatives and approaches should be put into practice in an accelerated manner. In the year 2011, the Carbon Disclosure Project India introduced the Carbon Disclosure Leadership Index (CDLI) in India. The essence of CDP is that the large companies need to disclose information about climate change risks and opportunities to the Carbon Disclosure Project. This shows that a large number of companies are becoming proactive with respect to carbon- related issues, and are becoming low carbon friendly. The Table 1 lists the companies that participated in the Carbon Disclosure Project in 2012.

Table 1. Carbon Disclosures by Indian Companies

Name of Companies	Sector
Titan Industries	Consumer Discretionary
Mahindra & Mahindra	Consumer Discretionary
Indian Hotels	Consumer Discretionary
Bharat Forze	Consumer Discretionary
Godrez Industries	Consumer Discretionary
Maruti Suzuki India Ltd.	Consumer Discretionary
Tata Motor	Consumer Discretionary
ITC	Consumer Staples
Godrez Consumer Products	Consumer Staples
Tata Global Beverages	Consumer Staples
Cairn India	Energy
Esser Oil	Energy
Indian Oil Corporation Ltd.	Energy
HDFC Bank Ltd.	Financials
ICICI Bank Ltd.	Financials
IDBI Ltd.	Financials
IDFC Ltd.	Financials
Yes Bank Ltd.	Financials
Mahindra & Mahindra Services	Financials
Power Finance Corporation Ltd.	Financials
Reliance Capital	Financials
State Bank of India	Financials
Indusind Bank	Financials
HCL Technologies	Information Technology
Infosys Ltd.	Information Technology
Tata Consultancy services	Information Technology
Tech Mahindra	Information technology
Wipro	Information Technology
iGate Patni	Information Technology
ACC	Materials
Tata Steel	Materials
Mahindra & Mahindra	Materials
Hindusthan Zink	Materials
Sesa Goa	Materials
Sterlite Industries	Materials
GVK Power & Infrastructure	Utilities
Tata Power	Utilities

Source: Adapted from Carbon Disclosure Project. (2012). CDP India 200 climate change report 2012 : Responsible business striving towards a low carbon future (pp 14-15).

Case Studies of Selected Companies

A number of companies have already successfully identified, developed, and launched low carbon innovations, and their experiences offer valuable lessons for others with similar opportunities. This section of the paper focuses on the experiences and perceptions of the chosen four companies for effective low carbon business management. These case studies have a clean sustainability approach and could be inspiring and interesting examples for others.

➲ **ITC:** ITC is one of India's foremost private sector companies with a market capitalization of US $ 35 billion and a turnover of US $ 7 billion. ITC is rated among the World's Best Big Companies, Asia's 'Fab 50', and one of the World's Most Reputable Companies by Forbes's magazine and is one of India's Most Valuable Companies (as per Business Today). According to a study conducted by Brand Finance and published by the Economic Times, ITC ranks among India's '10 Most Valuable (Company) Brands and in addition to that, ITC ranks among Asia's 50 best performing companies compiled by Business Week.

ITC has recognized climate change adaptation as a key long-term business strategy, and has developed low carbon oriented quality standards for products, services, and solutions that also meet consumers' current and emerging needs. In order to track the progress of climate-related strategies, ITC has a written EMS (environmental management system) policy supported by a well-designed system which ensures environment-friendly functioning (Mitra & Mittal, 2010). ITC is integrating climate change risks and opportunities into key decision-making strategies, with particular emphasis on addressing energy. ITC is constantly expanding its renewable energy portfolio. ITC's commissioning of 13.8 MW wind power projects in Maharashtra and Tamil Nadu contributed to increased utilization of renewable energy.

ITC has identified practical methods of incorporating adaptation into its business models and accordingly, ITC has introduced the concept of Responsible Luxury in the hospitality industry, which has blended elements of nature to convey a unique message to guests - to be aware of their responsibility to be planet positive. ITC has put into operation a number of measures in waste management to make an environment friendly footprint which is a commitment towards sustainable natural resource management. It is efficient in resource use and recycles 100% of its wastes, thus saving emissions (Joshi et al., 2008) .

➲ **Tata Steel:** Tata Steel was established in 1907, and Tata Steel is among the top 10 global steel companies in the world. It is now one of the world's most geographically-diversified steel producers, with presence in 50 European and Asian economies and operations in 26 countries. Tata Steel is a Fortune 500 company. Tata Steel's vision at environment management is well defined. Underpinning this vision, Tata Steel is incorporating adaptation priorities into all-inclusive sustainability strategy in order to reduce its vulnerability to climate change risks. It has included environmental protection as a clause in the company's code of conduct and environmental policy. Its green drive 'Ecocitizen' has been well appreciated. Its Vision 2012 focused on reduction of CO2 emissions and the company has targeted a goal of reducing its carbon footprint at least by 20% by the year 2020.

To develop awareness among it employees about a low carbon economy, it organizes training and workshop for its suppliers, vendors, and employees regarding emission reduction, pollution control, and energy conservation. For Tata Steel, organization of these events and having consistent interactions with stakeholders are crucial to developing new ideas and inclinations towards moving to a low carbon economy (Mitra & Mittal, 2010).

➲ **Maruti Suzuki India Ltd:** Maruti Suzuki India Ltd. (formerly Maruti Udyog Ltd.) is a major player in the automobile industry, holding over 50% of the domestic car market. Maruti Udyog Limited initially started as a joint venture between the Government of India and the Suzuki Motor Corporation of Japan. Maruti Suzuki recognizes climate change as a global issue. Therefore, environmental management is considered necessary and is of significant importance for the company. Accordingly, the company has developed adaptation-oriented

quality standards for products and services. The concept of 3Rs "Reduce, Reuse, Recycle" has always been the driving principle of Maruti, and accordingly, it has taken several steps to reduce its material and energy consumption in order to reduce emissions from its production operations.

As a part of the environment management system (EMS), it has undertaken CDM (clean development mechanism) projects to reduce its carbon footprint. This environment friendly initiative shows that low carbon strategy is included in the agenda of Maruti Suzuki, and the company strongly believes that an investment in environment friendly programmes could be in the best interest of the society as well as the business and with this vision, it has already enhanced its green belt area to 27% of the total geographical area covered by its units through afforestation programmes (Mitra & Mittal, 2010).

➲ **Indian Oil Corporation Ltd :** IOC Limited is one of the largest commercial enterprises of India and is also a flagship national oil company. Indian Oil has structured verticals - business operations from refineries, pipelines, marketing, R&D centres, and business development – E&P, petrochemicals, and natural gas. Indian Oil has been facilitating to meet India's energy demands for over half a century. With its vision to be the energy of India, it is also committed towards the protection of the environment. Indian oil recognizes the environmental impact due its energy-intensive manufacturing processes. It attempts to keep all its refineries and production units as eco-friendly as possible. The major contribution of Indian Oil towards the creation of low carbon economy is the development of green alternative fuels such as autogas LPG , CNG, ethanol-blended petrol , bio-diesel, and hydrozen energy on a commercially feasible scale (Mitra & Mittal, 2010).

Indian Oil is fully focused on "sustainable development" and has a self-defined green agenda. It has an investment of INR 7000 Crore (US$1750mn) in green fuel projects at its refineries. To develop awareness about a low carbon economy among its employees, it has introduced the environment management system and got accredited with ISO 14001 (Mitra & Mittal, 2010).

India is directly affected by climate change, which is also a threat to the livelihoods that are already faced with cost of adaptation. However, the risks of climate change are far outweighed by the opportunities that arise. It is important for the government of the country as well as corporates to seize opportunities for a low carbon economy. A low carbon strategy will be the only way to accelerate growth while contributing to global efforts to combat climate change. The governments and companies across the globe are waking up to the economic prospects inherent in low carbon businesses and services (Mitra & Mittal, 2010).

Managerial Implications

Climate change has become a threat which businesses can no longer ignore. Corporate social responsibility (CSR) is being considered by companies for a number of years, but the emergence and popularization of the international climate change debate has created an increasingly relevant focus on the potential of low carbon economy within the corporate sector. Even though the perception of a low carbon economy has become popular in controlling greenhouse gas emissions in big organizations in India, many organizations, including SMEs, are yet to seize the benefit of these perceptions such as less carbon emissions, use of modern technology, improvement in productivity and quality, financial benefits, environmental sustainability, and developing human life on a long term basis.

Low carbon knowledge and putting carbon management in practice could be useful for managers in providing favorable conditions in support of firms' climate-change adaptation measures. A company's perception of a low carbon economy shows the company's commitment in reducing its GHGs emissions. Implementation of low carbon management strategies depends on various outputs like cost savings and efficiency advancements (Porter & Linde, 1995). Company size is also a factor in implementing carbon management strategies by a company. Smaller companies usually find it difficult to implement low carbon management in practice, while larger companies are relatively focused on this issue due to resource availability and pressure of the stakeholders (Matthews, 2012). Carbon dioxide (CO2) - as a resource and in the form of emissions - is both a threat and an

opportunity for companies. Many sectors like renewable energy, waste reduction and management, energy and resource conservation, and carbon finance markets will be expanding rapidly while the same is an economic threat for carbon-intensive production systems (Busch & Shrivastava, 2011). Therefore, corporates, irrespective of size, must be well aware of the sources of opportunities and threats and business models that will help them transition their own companies to prosper in low carbon environments.

Conclusion

The general conclusions which are drawn from the present study are as follows :

(1) It may reasonably be expected that companies' GHGs emissions and their vulnerability to climate change would be widely considered and disclosed by companies.

(2) The review of literature indicates that there are enough reasons for large Indian companies to be motivated towards adopting low carbon business practices, which can be closely aligned with sustainability development.

(3) In general, it was found that there were almost no studies about low carbon economy, climate change, or the consequences of transforming into a low carbon economy in the Indian context.

(4) Strong advocacy for a low carbon economy demands a mandatory approach to disclosure - sustainability and carbon emission related disclosures by Indian companies.

(5) The lack of awareness about low-carbon economy, climate change, and green practices among small and medium sized enterprises, as well as among many large companies in India , should be a cause of concern.

To achieve a low-carbon growth, corporates must focus on the decarbonization strategy. Growth through decarbonization is a much accepted word in the corporate sector today. Investment in climate-resilient and low carbon infrastructure will enable Indian companies to be competitive in the low carbon business world and this will help them to enhance/upgrade themselves to modern technology and skills so that they can capture the opportunities coming their way, and thereby improve the quality of life of their employees, clients, and stakeholders as a whole. This transition should be aligned with India's effort to reduce poverty and unemployment. The companies need to implement a coherent business strategy that enables utilization of the opportunities presented by a low carbon economy and minimize the exposure of risks to climate change.

Low carbon business awareness among large corporates is not enough for the economy as a whole. SMEs account for an important portion of gross domestic product (GDP) and private sector employment in most of the countries across the world. It is a fact that small and medium companies have limited resources in terms of access to finance, technology expertise, and organizational practices as compared to large companies. Considering the vast potential of SMEs, it is suggested that SMEs need to be included in the low carbon business practices. Concerted efforts for the dissemination of education/information among the informal manufacturing and service sector entities are also necessary.

Big Indian businesses are beginning to look towards the future of low carbon investment and green products because they realize that the market is changing, and this is the time to act. With a supportive and credible policy environment, Indian businesses can do much more. All across India, there is an obvious sense that the companies have awakened and are on the move regarding climate change. To succeed, a low carbon economy can be the modern business agenda of opportunity, innovation, growth, and hope. Addressing this could be the best way for companies to secure growth and development for the future.

Limitations of the Study and Scope for Further Research

Theoretical soundness notwithstanding, the perceived limitation of the study is the use of secondary data. This limitation offers an opportunity to expand the study by using data from the concerned companies. This study uses

some theories and concepts from environmental economics, statistics, survey reports, literatures of many areas relating to the environment (for example, climate change, low carbon, carbon dioxide emissions, and so forth). However, this study does not try to raise questions related to the validity of these theories and concepts. A significant amount of the present study has focused on the area of low carbon opportunities, but it appears that there is no parallel study about low carbon perceptions in the corporate world. The corporate world may find it useful while executing their own plans.

Business has an important role in climate change mitigation through reduction in its own direct emissions from manufacturing and the use of its products and services. Reducing carbon emissions as a business strategy is emerging. Presently, low carbon business concepts are being initiated in many developed and emerging economies. Therefore, it is expected that Indian companies must try to exploit the underlying benefits of this concept. The existing studies have given a direction - from different perspectives - about the benefits of a low carbon economy, but little consideration has been given to challenges and barriers that will come up for low carbon economies, especially in the Indian context. In addition, the study did not discuss what measures are needed for encouraging Indian companies to grab low carbon business opportunities in their battle against climate change.

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