Corporate Managers and Climate Change Impacts

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Abstract : It is well known today that climate change is impacting the world; it's a clear and present danger. It's also evident that we need to scale up our efforts massively from what is being rendered today to combat this impending crisis. How can corporate managers play a role in addressing climate change? This paper proposes that corporate managers can help shore up resilience in affected communities and also enable them to prepare better for impending calamities in a structured and systematic way. This paper proposes an integrated supply chain management framework where corporate managers would apply climate change redressal initiatives at every stage of the supply chain. The framework involves business processes, business partners, affected communities, livelihoods, and the surrounding infrastructure. To illustrate the practical application of the framework in business, the paper showcases shining industry examples of how an FMCG company applied mitigation initiatives across its supply chain and how a celebrated resort hotel applied adaptation initiatives across its supply chain.

Keywords : *FMCG, Climate change, Supply Chain.*

Prelude

The entire campus was submerged under water.

Dr.Taposhi, a visiting professor at one of India's most prestigious business schools, looked out of her balcony of the Faculty Guest House in disbelief as she bore witness to nature's fury. Never had something like this occurred in the history of Chennai, a prominent metro south of India. It had been raining incessantly for days, and a city that typically had water shortage issues was now grappling with floods, an alien phenomenon for the city.

The Faculty Guest House was situated in the Dean's Resort Campus, a picturesque location housing enormous classrooms, offices, computer centers, convention halls, hostels, canteens, tennis courts, soccer fields, carparks, and inhouse faculty residential buildings. The campus was positioned between the scenic highway on one side and an awe-inspiring Bay of Bengal Ocean on the other. On any regular day, the precincts were a hive of activity. But this was not a regular day. Classes had been canceled; there was no electricity or wifi. Everyone had been cooped up in their rooms, waiting for the nightmare to end.

Hunger was gnawing at Dr.Taposhi's stomach. Fed up of being confined to her room, Dr.Taposhi decided to venture out through the rains and water to the college canteen. And then, she saw some students using a broken door as a raft and rowing down on the submerged roadway. Now she had seen everything! If only she could order a boat using an app! Were Uber and Ola listening? Speaking of mobile apps, Dr. Taposhi remembered that her mobile phone battery was on its last

legs; she had better switch it off. Mustering up courage, Dr.Taposhi set out of her guest house towards the canteen, looked out, and stood still.

There was no road. Only water everywhere. When all seemed lost, Dr.Taposhi spotted an obscure pathway of bricks leading up to the canteen. Hopscotching on the bricks and splashing through the water, Dr. Taposhi soon made her way to the canteen. To her surprise, students had already packed the canteen. Though it was dark inside, the students were hungrily wolfing whatever was available. Dr.Taposhi joined the students and asked them how they were doing. Between mouthfuls, the students replied that they had never experienced such a high-intensity monsoon earlier; they knew that climate change was causing this. Some students recounted flash floods happening in other parts of the country, the miseries that people were going through, being locked up in higher floors of their homes. There was an acute shortage of food and medicines, people were entirely at nature's mercy, waiting for help to arrive. The students added they were very keen to do something to help the affected communities. The students saw themselves as future leaders and managers and explored ways of pooling their talent to come to the rescue and address the impact of climate change. However, they felt helpless & disappointed as they didn't know how.

Dr. Taposhi never forgot the story. Throughout her teaching career, Dr.Taposhi kept wondering whether she had delivered her primary message to future leaders of her country. If there is any threat to human well-being and existence, we need to put aside our differences, come together pool our resources. And who better to take up any humanistic cause than corporate leaders and managers, Dr. Taposhi's primary target audience. The brilliance and expertise of the private sector, its capacity to innovate and produce new technologies for management processes, could be harnessed to address climate change impacts, once the managers are aware and inspired that they could be of tremendous help to save communities from ravages of climate change.

How climate change threatens humanity

That climate change is happening, that we know. The primary cause of climate change is the burning of fossil fuels and the consequent emission of greenhouse gases which trap the sun's heat in the earth's atmosphere. Deforestation and land-use change have also contributed significantly towards bringing about climate change.

However, what has caught us unawares is the speed, frequency, and intensity of the impacts. Cyclones, floods, droughts, and forest fires, airborne and waterborne diseases were now more widespread; they occur in greater frequency and increasing intensity with every occurrence. Moreover, they are highly unpredictable and are happening in the unlikeliest of places.

Empirical research shows that the temperatures at the earth's surface, atmosphere, and oceans have increased determinably. This adversely affects crop production; food and potable water are becoming scarce, and heat waves are becoming common. Climate change threatens human health and well-being with increased mass migrations, mortality, morbidity, and lowering the quality of life (Climate Change Synthesis Report, WMO, UNEP 2001: 35-98).

How climate change will affect key sectors.

Climate change affects the following four sectors.

(a) Water sector

In this sector, we should consider water-related impacts, such as floods, drought, cyclones, availability of clean water for communities, water for agriculture, water for industries, etc. Higher average temperatures and changes in precipitation and temperature extremes affect the availability of water resources through changes in rainfall distribution, soil moisture, glacier and ice/snowmelt, and river & groundwater flows. These factors are expected to lead to further deterioration of water quality as well. The poor, who are the most vulnerable, are likely to be affected the most. (UN water, climate change, mainly about water)

(b) *Ecosystem sector*:

This sector comprises industry, settlement, and society. The affected industries, settlements, and communities are usually located in coastal areas and river flood plains. Wherever the economies are closely linked with climate-sensitive resources and to locations already prone to extreme weather events, the impacts are felt very harshly. In addition, areas undergoing rapid urbanization are vulnerable to climate impacts. When severe weather events become more intense or more frequent, the associated ecosystems are severely affected.

(c) Food & Agriculture sector:

The temperature changes and the frequency of droughts and floods are likely to negatively affect crop production, increasing the number of people at risk from hunger, malnutrition, displacement, and migration. In addition, the heating of ocean waters would affect fish life adversely, resulting in a lack of availability of seafood of all kinds.

(d) *Disease & Health sector*:

The unpredictable climate changes are sure to alter the health condition of millions of people through the prevalence of diseases, heat stress, increased deaths, disease, and injury. This could happen due to heatwaves, floods, storms, fires, and droughts. In addition, increased malnutrition, diarrheal disease, and malaria in some areas will increase public health vulnerability. As a result, development goals will be threatened by long-term damage to health systems and quality of life.

The impacts on these four sectors are highly interrelated, each affecting the others in nature of effects and intensity.
(The IPCC Fourth Assessment Report of the Working Group II “Impacts, Adaptation and Vulnerability”)

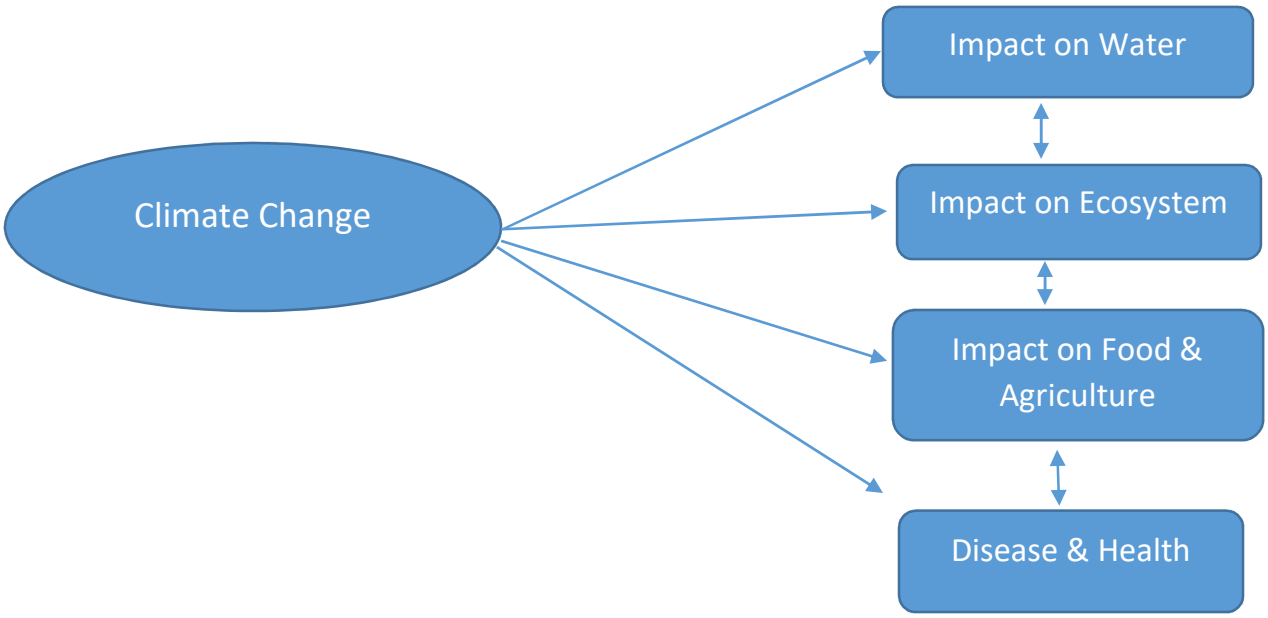

Figure 1: Impacts of Climate Change.

The causal link between climate change and disasters.

In addition to the four sectors, we need to consider disasters occurring because of climate change. Disasters happen when an exposed, vulnerable, and ill-prepared population or community meets with a hazardous event. Climate change will likely affect disaster risks in at least two ways. First, the risk would get accentuated with the likely increase in the frequency and severity of weather and climate hazards. Second, the risk would manifest even more through increases in the vulnerability of communities to natural hazards, mainly through ecosystem degradation, reductions in water and food availability, and changes to livelihoods. Climate change will thus add yet another dimension to the stress of environmental degradation, further reducing communities' abilities to cope with even the existing levels of weather hazards.

Strategies to deal with climate change?

In general, awareness about climate change, its causes, and its adverse effects are widely known. However, what is not known and not clear is how to address these impacts strategically to help/save communities who are suffering from loss of housing, transport & logistics, availability of food, other infrastructure, clean potable water, medicines. To address the impacts of climate change, many worldwide forums have come up with various strategies that government and non-governmental organizations can follow. The strategies are broadly categorized into two types.

a) Mitigation strategies that prevent or reduce the generation of greenhouse gases causing climate change.

b) Adaptation strategies that help communities to adapt to the inevitable impacts of climate change.

Initial strategic frameworks focused on mitigation, aiming to reduce and possibly stabilize greenhouse gas concentrations in the atmosphere (UNFCCC 1992). However, the increased levels of greenhouse gases would continue to cause disastrous impacts, which are unavoidable. Thus, there is no alternative but to learn to adapt to such impacts and try and reduce the damage to the extent possible, leading to the development of adaptation strategies.
(Asian Development Bank, Climate Change ADB Programs 2007: 2009).

What happened in Chennai required a comprehensive emergency preparedness system to help communities avoid unavoidable disasters. Here, the adaptation strategy to help communities adapt/ survive due to the effects of climate change was most appropriate.
(Schipper, 2006; Tol, 2005, Klein et al., 2007).

Recently in research and general literature, the potential of combining both mitigation and adaptation approaches have been considered within the scientific community (Burch and Robinson 2007, Dowlatabadi, 2007, Goklany 2007, Jones, Dettmann, Park, Rogers, and White 2007, Klein et al. 2007, and Swart and Raes, 2007). It has emerged that they need to be integrated because they both influence each other. The more we mitigate, the lesser the need for adaptation.

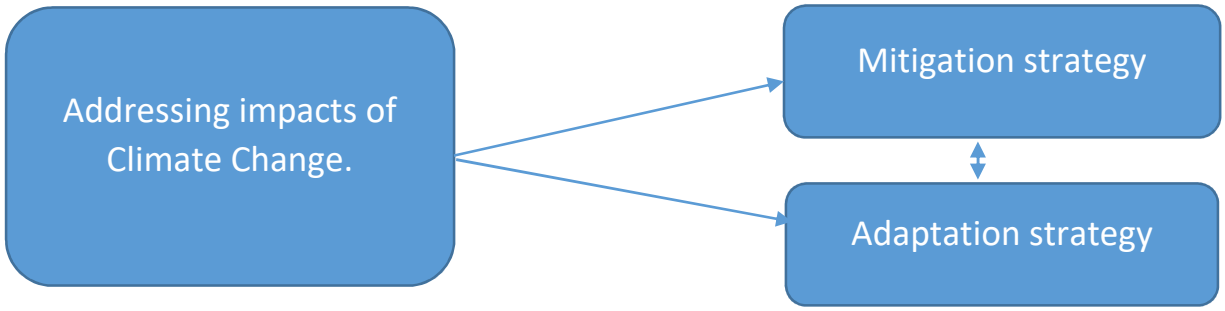

Figure 2: The two strategies for addressing the impacts of climate change

Instances of Mitigation and Adaptation strategies to deal with climate change.

In mitigation strategy, we are trying to reduce greenhouse gas sources and emissions and enhance greenhouse gas sinks, which help absorb greenhouse gases. For instance, green plants have chlorophyll, which enables plants to absorb carbon dioxide and manufacture plant food in sunlight. Thus, they serve to remove carbon dioxide from the atmosphere, at least partially. Carbon dioxide is a greenhouse gas, which is not as potent as the others, but it has significantly brought about global warming because it's present in abundance. Therefore, climate scientists welcome green plants for their contribution to reducing greenhouse gases in the atmosphere.

Other examples of mitigation actions include more efficient furnace systems, developing new low-energy technologies for industry and transport, reducing consumption of energy-intensive products, and switching to renewable forms of energy, such as solar and wind power. Natural carbon sinks, such as forests, vegetation, and soils, can be managed to absorb carbon dioxide.

Technologies are being developed to capture carbon dioxide at industrial sources and inject it into permanent storage, deep underground.

The second task in responding to climate change is to manage its impacts until mitigation policies become effective. This is adaptation strategy. Future impacts on the environment and society are now inevitable due to the amount of greenhouse gases already in the atmosphere from decades of industrial and other human activity and the added amounts that will happen from continuing emissions over the next few decades.

In adaptation strategy, we are trying to prepare and make adjustments in natural or human systems in response to actual or expected climatic reactions or their adverse effects. Examples of adaptation include preparing risk assessments, protecting ecosystems, improving agricultural methods, managing water resources, building settlements in safe zones, developing early warning systems, instituting better building designs, improving insurance coverage, and developing social safety nets. These measures are intrinsically linked to sustainable development, as they reduce the risk to lives and livelihoods and increase the resilience of communities to all hazards. Ideally, adaptation and mitigation should be considered jointly, as some adaptation measures can reduce greenhouse gas emissions. Conversely, mitigation measures can be planned to help reduce and not inadvertently exacerbate disaster risks. (Climate Change and Disaster Risk Reduction 2008).

Examples of Mitigation strategy.

There has been extensive research, seminar discussions, conferences, and international forums on building awareness of mitigation strategies to reduce the generation of greenhouse gases. (Climate Change ADB Programs, 2007, Joint MDB Report 2008, Munasinghe, 2008). Mitigation initiatives could be at (a) the individual level and (b) the organization level.

At the individual level, one could plant trees or prevent/protest against trees planned for cut down. Trees absorb carbon dioxide, a greenhouse gas. One could also use a solar lighting system; solar energy does not generate greenhouse gases. Other initiatives could be using energy-efficient lighting, switching off lights when unnecessary, using LED lights, using emission-free cars, reducing car trips, reducing gasoline consumption, etc.
(Reference: Climate change, ADB Programs. Strengthening Mitigation and Adaptation in Asia and the Pacific, 2007).

In addition, there are mitigation initiatives at the organization level, such as using climate change friendly production & cooling systems, raw materials, cleaning agents, boilers, which do not produce greenhouse gases. Organizations could ensure buildings have adequate insulation to minimize the energy needed for cooling in summer. Building designs could maximize natural light to reduce the demand for lighting. Other initiatives could be to use solar energy in production, produce products that do not generate greenhouse gases upon use by the customer, and use systems to capture methane gas from landfills so that methane, a potent greenhouse gas, does not go to the atmosphere. (Reference: Climate change, ADB Programs. Strengthening Mitigation and Adaptation in Asia and the Pacific, 2007).

Examples of Adaptation strategy.

Adaptation in the context of climate change refers to how communities, groups of people, sectors, regions, or even countries develop systems to better cope with the impacts of climate change. (Brooks, 2005, Smit et al. 2003, Pielke, 2007). Adaptation may also be defined as the adjustments in individual groups and institutional behavior to reduce society's vulnerability to climate change. The adaptation process can be anticipatory or reactive and could be autonomous or planned. (Fankhauser et al., 1999; Smit et al., 2000). Governmental agencies, municipalities, and NGOs have implemented adaptation strategies in general.

Adaptation strategies are specific to local conditions; they consist of locally appropriate action plans to reduce climate-related risks. These action plans are community-based development projects to promote information sharing, develop early warning systems (warn of an impending calamity) & preparedness plan. Examples: develop more diverse crop strains that can withstand various conditions (heat, drought, salt, etc.), bolster social capital and resilience, increase storage capacity for freshwater by building reservoirs or recharging aquifers, improve public health infrastructure, and bolster disease surveillance. These strategies would be valuable regardless of the exact impacts of climate change at a particular time or location. (GEF 2009). Adaptation strategies should be developed looking at the precise nature of vulnerability of the target communities, who are in danger of climate change impacts and suited to help them best adapt to address the impacts. (Kelly and Adger, 2000; Downing, 2001; Turner et al., 2003; Smit and Pilifosova, 2003; Yohe et al., 2003; Adger, 2006).

When the flooding calamity happened in Chennai and continued for a few weeks, it was felt that if corporate organizations were involved and organized to address such issues, the miseries of communities could have been lessened a great deal. Also, during the floods, many manufacturing units of the small and medium enterprises (SME) category were washed off and endured huge losses financially. Much of this could have been avoided if proper know-how had been available in advance. (Urban resilience to adaptation to climate change in Chennai, 2014).

How can corporate managers/private sector help address climate change concerns?

Given the magnitude of help required to protect populations from climate change, corporate managers could come forward and use their managerial skills and expertise to take up initiatives to address climate change. With its unique expertise and ability to innovate, the private sector would augment government efforts to build capacity for the communities affected by such calamities to survive the adversities caused by climate change. Corporate managers throughout the industry have been effective in planning and carrying out successful projects to bring about efficiency from the organizational perspective. If they take it upon themselves in addressing an impending climactic disaster, they can be equally effective in enhancing resilience and minimizing vulnerability.
(http://unfccc.int/adaptation/workstreams/nairobi_work_programme/items/4623.php).

There is also another important reason why the private sector should address climate change-related initiatives. The private sector generates a tremendous amount of greenhouse gases through

its operations. The total greenhouse gas emissions from a selection of global 500 companies approximately amount to the USA and the EU15 combined. Not only do corporations have a significant climate footprint, but the impact of climate change on the business landscape is already noticeable. (Patenaude, 2011). Operating manufacturing setups that use coal and other fossil fuels, using unlimited use of resources like water and electricity, deploying massive industrial air conditioning units that generate greenhouse gases, using non-renewable lighting, employing non-environment friendly transportation & distribution systems; the private sector has been a primary agent of global warming and climate change. So, it is crucial that private sector organizations be made mindful of the perils of their activities and nudged to devise systems/ activities and use materials that minimize greenhouse gas generation.

So far, the involvement of the private sector in the climate change issue has been only in the realm of mitigation strategies and carbon trading. A company reduces the emission level, equates the reduction to what is called a certified emissions reduction (CER), and sells it to countries that need CER. However, though emission saving is achieved at the world level, carbon trading does not necessarily lead to adaptation or reduction in vulnerability for the poor, which is an urgent need in today's world. (McCarthy et al., 2001). Also, after policies regarding mitigation and adaptation have been designed, it would be necessary to translate the policies into action plans, implement them in real terms and bring about an actual reduction in climate change. (Halady and Rao, 2010). Preclude to this would be enhancing the awareness of the impacts of climate change and initiatives to address the challenge (Burgess et al., 1998). For the private sector, especially for small and medium enterprises (SMEs), it is essential to know what to do in the face of climate change calamities and how to make their businesses resilient. While climate change poses several risks to vulnerable communities and enterprises worldwide, many opportunities are unfolding for private companies to implement actions towards reducing risks to their business operations and investing in adaptation action in vulnerable regions sustainably and profitably.

Adaptation activities for corporate organizations may thus relate either to ensuring the resilience of business operations or the provision of technologies or services that assist in the adaptation for vulnerable communities.
(http://unfccc.int/adaptation/workstreams/nairobi_work_ programme/items/6547.php).

However, corporate managers need a thorough knowledge base and awareness to take up planning and preparedness effectively and efficiently. Such awareness and know-how could be imparted to the managers through continuous managerial publications, seminars, and discussion forums.
(Halady & Rao, 2010)

Over the last few years, there have also been numerous research initiatives to explain the gap between environmental awareness, environmental knowledge, and the actual display of pro-environmental behavior (Kollmus and Agyeman, 2002). Using the learning from such research, one may observe that knowledge and awareness, other variables such as availability of funding and resources, societal pressures, and an individual or organization's capability to take up the challenge, can lead to initiatives to address climate change.

Awareness is the key

In an empirical research study conducted with a section of Indian managers on their awareness of climate change impacts and their pro-climate change behavior, it emerged that there was a significant association between awareness and initiative (Halady and Rao, 2010). Thus, once awareness kicks in, initiatives towards addressing the adverse effects of climate change would also start to happen.

A subsequent empirical study was conducted in South India to evaluate/measure the linkages between awareness of climate change, its impact on the poor, and the willingness of the private sector to act on adaptation and mitigation strategies. Again, it emerged that there was a significant linkage between awareness and the willingness of the corporate executives to support adaptation strategies. (Rao & Thamizvanan, 2014). In 2020, yet another empirical research supported the conceptual hypothesis that awareness, especially in health impacts, led to a significantly higher propensity to initiatives to address climate change impacts (Rao, 2020). Awareness encompasses not just the existence of impacts of climate change but also possible initiatives. Executives need to be made aware of how they can make a difference by learning about the roadmaps, existing initiatives, and how they can implement them.

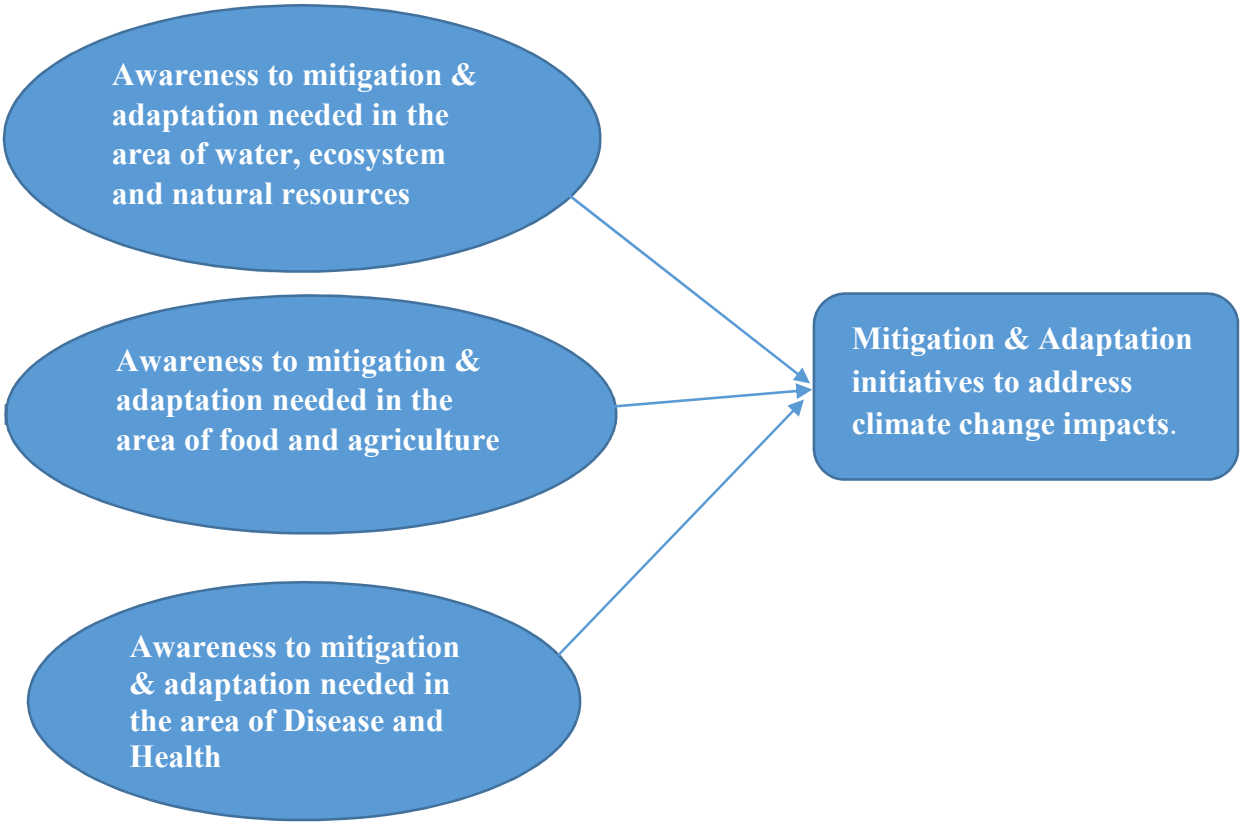

Figure 3: Awareness and Mitigation initiatives
Source: Adapted from Rao, P.R. (2020)

Existing industry initiatives to address water shortage impact of climate change.

Climate change impacts the availability of clean water for communities, water for agriculture, and industrial use. Industry investment in recycling and treatment of industrial wastewater to reduce water demand would surely help. Incorporating efficient water usage practices, water conservation, rainwater harvesting, monitoring water consumption, wastewater treatment plants to reduce water demand would also be helpful. In addition, optimization of operations such as cooling tower operations would help address the water shortage impact of climate change.

Strategy framework for corporate managers to address climate change

The journey from a willingness to help to the actual implementation of initiatives requires a structured framework. This framework can help corporate managers and business leaders identify and develop strategies to address impacts of climate change in mitigation and adaptation, integrate these into planning processes, and influence future developmental activities.

Consequently, these organizations and the communities they support become more resilient to climate change and variability. The framework builds on the work done by many countries since 2002 on Integrated Water Resources Management (IWRM) plans. (EU Water Initiative Finance Working Group. 2010. Strategic Financial Planning for Water Supply and Sanitation in Africa. May 2010. Available at: www.euwi.net/wg/finance)

There are two phases in the framework.

In the first phase, the executives need to be aware of the entire climate change phenomenon, the reasons, impacts on our world, and implications to industry and communities. This can be done upon with the help of climate change experts and specialists.

In the second phase, the executives need to be aware of stakeholders like customers, employees, suppliers, distributors, and communities. The organization would then need to develop feasible strategies to address climate change impacts immediately.

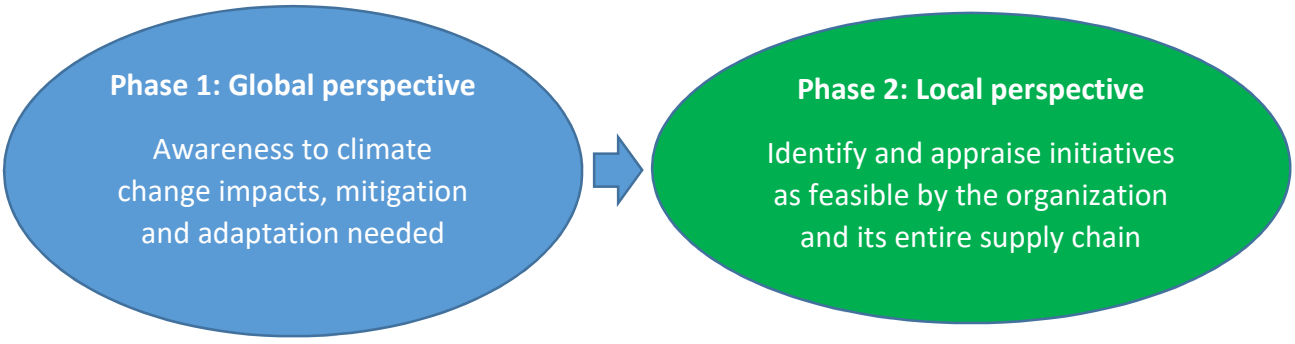

Figure 4: The two phases in the strategic framework.

To identify the climate change impacts on all stakeholders, a good starting point could be the organization's integrated supply chain of the organization.

The integrated supply chain would apply not only to the production of tangible products but also include the production of services like hospitality, healthcare, transportation, etc.

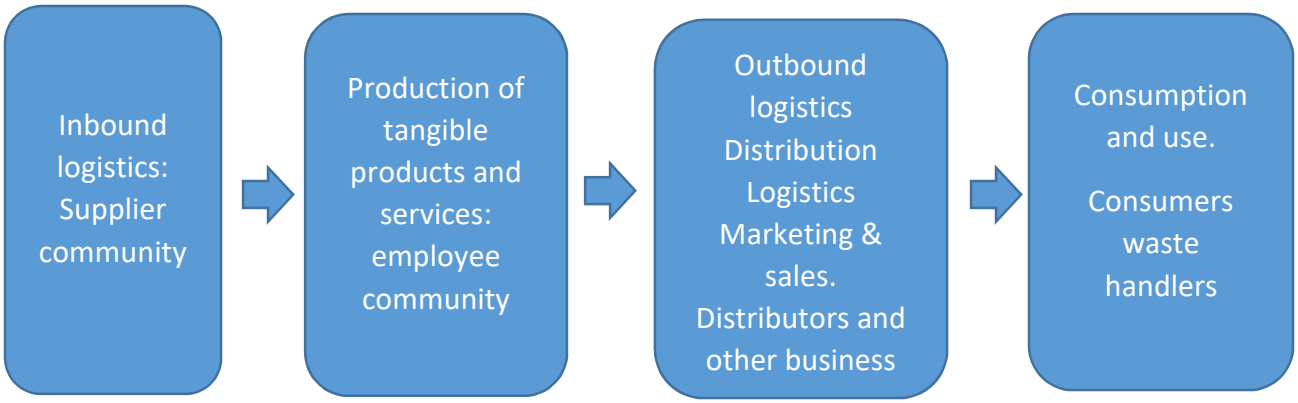

Figure 5: The integrated supply chain for tangible products or services.

At each phase of the supply chain, the executives can consider all the people involved and enumerate if their livelihood and living conditions are affected by climate change impacts. If there is an impact, the executives can formulate action plans to address them. Such actions would boost the company's trust, goodwill, and brand equity with the communities and, consequently, enhance the impact of the company's topline & bottom-line. Of course, if there is a direct climate change threat to the business at any part of the chain, the organization would also need to address it.

How an FMCG company implemented Mitigation initiatives across its supply chain.
Consider the case of a medium-sized FMCG company that wanted to measure carbon footprints and reduce greenhouse gas generation across its supply chain. This company followed the integrated supply chain framework, starting from the inbound logistics phase.

Mitigation Initiatives in Inbound logistics

- The company started checking the carbon footprint contribution of the varied raw material sources.
- It collaborated with its suppliers to reduce the overall carbon emissions in supplier operations.
- It invested in the transportation of raw material from suppliers and switched to more environmentally friendly modes of transport.

Mitigation Initiatives in Production/Internal logistics

- The company implemented carbon-efficient techniques in its production line.
- It started using alternative, renewable sources of energy.

- The company maximized the use of natural lighting and reduced the demand for electrical lighting.
- It started using efficient boilers to reduce the use of fuels and the generation of greenhouse gases
- The company carried out regular energy audits to identify energy leakages.

Mitigation Initiatives in Outbound logistics

- The company started measuring carbon emission from various modes of outbound transportation- road, rail, ship.
- It optimized its logistics by maximizing each vehicle's capacity in to and fro trips.
- The company invested in energy-efficient and optimized transportation modes of goods from the company to retailers/consumers.

Mitigation Initiatives in Storage/Distribution centres

- The company started using efficient sorting systems.
- It started using a carbon-friendly transportation system integrated with suitable storage.
- It implemented carbon-friendly cross-docking (minimizing storage between stages in logistics).

Mitigation Initiatives in Packaging

- The company started measuring the energy involved in packaging large sizes of goods.
- It procured fuel-efficient and carbon-friendly packaging equipment.
- It then started using carbon-friendly and recyclable materials for packaging to minimize greenhouse gases and reduce energy consumption.
- The company began labeling the total carbon footprint on the final product sold to retailers and end customers.
  (Verma et al, 2017)

How a celebrated resort hotel implemented Adaptation initiatives across its supply chain.

This celebrated resort hotel was established about 40 years ago on a golden coastline bordering the ocean's blue waters. Coconut trees and mountain ranges adorned the coastline giving it an idyllic charm. The region discovered originally by pirates in the 16th century gradually evolved to a bustling tourism and trading center over the years, attracting tourists worldwide. As a result, the locality became a melting pot of fascinating cultures, religions, and food with frequent traders and historical events. These attractions, combined with the tranquility of the seas, provided a perfect backdrop for the hotel. Consequently, the hotel experienced tremendous growth in its size, number of customers, and volume of business. In addition, the hotel also received many awards and recognition from different national agencies, which showcased that the hotel's commitment to excellence in service, quality, and customer satisfaction.

Along with serving individual customers, the hotel also served as a business retreat and provided large convention rooms where many companies would hold their strategic planning workshops. The hotel also served as a venue for numerous wedding parties against the beautiful ocean backdrop.

This hotel was now being threatened by climate change, with the sea level rising every year.

The local communities (to which the hotel's staff and local suppliers belonged) had agricultural land and fruit orchards within a few kilometers from the hotel premises. Many of them grew rice, vegetables, spices, fruits and supplied them to the hotel. They also maintained cattle farms and poultry farms and supplied egg and meat products to the hotel. These communities were in trouble because their houses, roadways, water supply, school buildings, electricity generation systems, and even fruit orchards would be submerged by salty seawater. The flooding seawater would increase the salinity of the land and adversely affect crop production, limiting the number of crops from three to one, and possibly none.

Apart from the local farming communities, the hotel also had seafood suppliers who would take their fishing boats out into the ocean every morning and return with fresh fish, shrimps, oysters, and other seafood in the afternoon. The fishermen sold their fresh catch to the hotel's kitchen. However, the warming sea waters, another impact of climate change, was depleting the availability of fish, so the fishermen were often unable to supply the amount of seafood required by the hotel.

Let's now consider the adaptation initiatives the hotel took across its supply chain.

Inbound phase: Putting up dikes and check dams.

To address the salinity of the agricultural land, the hotel put up ten feet high dikes along the seashore bordering the land where the farming communities lived. The dikes ran for several kilometers along the coast. This prevented the flooding seawater from entering the agricultural land. The dikes also protected the local houses, neighborhoods, water supply stations, schools, roadways, markets, electricity generation plants, and other infrastructure from getting submerged.

The agricultural land had small freshwater seasonal rivers, which flowed into the ocean but dried up during the summer. The hotel invested and built check dams to allow for better percolation and recharge of underground water. The dams helped in putting up potable water reservoirs for all. Existing village ponds were de-silted, deepened, and inter-linked. This resulted in improved agricultural productivity. Instead of one crop per year, farmers were able to grow three. Overall, agricultural productivity increased significantly with the enhanced availability of sweet water from the interlinked rivers. The flower orchards and horticulture prospered. Moreover, the improved quality of drinking water led to the improved health status of the population. The saline water was causing kidney stones and bone-related ailments; these problems declined.

To enhance the availability of fish & seafood, the hotel constructed water reservoirs and cultivated various kinds of fish. This helped increase the supply of fish to the hotel to address the falling levels of fish produce that the warming seawater had depleted.

Adaptation initiatives in the Production Phase.

The production phase constitutes the production of hotel service: providing ambiance and comfortable accommodation to hotel guests, excellent food, sports & gymnastic facilities, water sports activities, great outdoor space, etc.

Because of climate change, the water level had been continuously rising over the years, making the high tide waves much taller and stronger than before. This caused large cracks in the sand on the open beach area, where the hotel guests loved to walk around, making the area rather dangerous and unsuitable for walking. The site also posed a potential threat for families who came to the beach for swimming.

The strong and high tidal waves splashing on the beach weakened the ground under the hotel structure; parts of the hotel walls were sinking into the ground as well. The stronger waves also damaged the foundation and increased the salinity of the soil, causing the hotel gardens to deteriorate.

The hotel implemented various adaptation initiatives to address these issues, like repairing the cracks daily using high potency cement. But, unfortunately, it could not build dikes along the coast in this area because they would block the excellent ocean view of the hotel. So instead, the hotel planted some coconut trees and substantial orange-flowered flame trees to strengthen the ground and form a protective barrier around the hotel from the seawater.

Adaptation initiatives in the Outbound Phase

Waste management
The waste generated in the hotel was mainly kitchen waste, glass and metal containers, paper and plastic packaging materials. These were all harmless because cleaning agents, laundry detergents, etc., were all nonhazardous. The liquid waste was taken to the recycling ponds and treated with nonhazardous neutralizing agents. The clear water which flowed out was used in gardening, and the solid leftover residue was combined with cement and used to make walk paths or fill up the cracks caused by the strong waves. The hotel gave the other waste of glass, plastics, etc., to waste handlers.

Green building
The hotel also followed all guidelines of green building and set up rows of clay pots lining the roof where various plants were grown, which helped absorb the sun's rays, keeping the building cool.

Outreach to build climate change awareness
Corporations were major customers; they regularly held events like planning retreats in the hotel. Corporations brought groups of employees who stayed and attended conventions & workshops in the hotel. For these customers, the hotel offered awareness-building seminars to address climate change. Sometimes these seminars were held on the hotel premises. Sometimes hotel executives involved in adaptation initiatives would address employees of their customer's company at their office premises.

This initiative received a lot of accolades in the media and brought honor and awards from the industry.

Like the adaptation initiatives, the hotel also carried out many mitigation initiatives across the entire supply chain. For instance, the hotel cars were all powered by natural gas or were electric vehicles. The cleaning agents were specially chosen so that they did not generate emissions. All cooking was carried out using renewable fuels. LED lights and solar heaters powered all lighting and water heating, respectively.

Industry accolades for carrying out climate change-related initiatives.

The hotel's climate change initiatives were unique and served a tremendous purpose. When the hotel started the initiatives, it just thought of providing a safe and enjoyable environment for guests to come, rest and rejuvenate. The hotel certainly achieved this, as observed from the glowing feedback in the periodic customer satisfaction surveys. In addition, the initiatives towards addressing climate change enhanced the hotel's sustainability and made tremendous business sense. For instance, the hotel's survival might have been threatened without putting in the adaptation initiatives to strengthen the foundation and beach area. Furthermore, without putting up dikes near the seashore, their local supplies would have been completely disrupted.

What the hotel did not foresee was that these climate change initiatives were also making the hotel a change leader for the region. The media was writing about them consistently. As a result, other hotels in the area were motivated to follow suit and implement similar initiatives. Thus, the hotel had inadvertently become a role model in the cause of addressing climate change impacts.

The examples of FMCG company and the resort hotel demonstrate that once corporate managers decide to address climate change, the strategic integrated supply chain framework can be used as a primary conceptual tool to consolidate and streamline the feasible actions.

However, the process would have to overcome a few barriers to implementation. Let us now look at these barriers which could discourage corporate managers from taking action.

Challenges and barriers

Limited Resources and capacity gaps
More often than not, organizations have limited financial, technical, and human resources required to make a comprehensive plan to adapt to climate change. They may have other priorities too. So, the resource constraint may discourage corporate managers from undertaking a comprehensive program of mitigation & adaptation, from planning to implementation.

Uncertainty on the nature and magnitude of the climate change impacts
Though there is awareness and consensus that climate change impacts need to be addressed, there is uncertainty around the nature and scale of these impacts. Managers often do not have precise forecasts of the magnitude and timing of climate risks. It will be essential to adopt a planning approach that acknowledges and can accommodate this uncertainty.

Local information not available
A lack of locally relevant and practical information about potential climate impacts may be compounded by a lack of technical expertise to interpret climate change projections for the local area. At best, this may mean employing consultants to support planning efforts; at worst, planning can stall with minimal or no adaptation.

Not enough financial resources
Small to medium-sized organizations, including local governments, often have limited funds to spend, and these are often prioritized to more immediate issues. Thus, developing a feasibility analysis for mitigation & adaptation plans may be necessary to identify actions that deliver existing and future benefits, actions that can be supported and funded through existing programs, and take up activities that are urgently needed.

Lack of leadership
Leadership provides the direction; it decides how the organization will proceed/ not proceed towards addressing climate change. Good leadership can inspire creativity and action, while poor leadership can make action difficult or impossible. *(https://coastadapt.com.au/barriers-to-adapting-climate-change).* Notwithstanding the above barriers, the predominant reason organizations do not address climate change impacts is a lack of awareness and clarity on the mitigation and adaptation strategies, the areas they need to be applied, and how to apply these strategies.

Conclusion: Has Covid forced us to act?

The Covid catastrophe hit and caught us unaware, unprepared, and helpless. The world had never seen a global disaster situation as pervasive and disruptive as Covid since World War 2. Covid has demonstrated how terrible the impacts of natural disasters can be and how difficult it is to survive if we are not ready for it. Yet, at the same time, it has also taught us to collaborate.

Nudged by local governments, corporate managers and leaders across nationalities have played a stellar role in getting together and addressing the crisis using adaptation and mitigation measures, both on an organizational and individual basis. Examples:

- developing detection kits and vaccines in record time,
- designing apps giving real-time data on infections,
- designing apps indicating the availability of hospital beds with oxygen cylinders and medicines,
- creation of plasma banks,
- arranging for food and transportation to the most affected communities: migrant workers, homeless, daily wage laborers,
- creation of new businesses around personal protective equipment and detection kits of employees, allowing employees to work from home.

The list is endless.

Covid has shown what we can do if we join hands in the face of an impending crisis that threatens humanity.

Now, extending the above list of examples to combat impacts of climate change, corporate managers could use the integrated supply chain framework proposed in this paper, identify the impacts at each stage to the various stakeholders, design and implement mitigation and adaptation initiaves. Examples:

- developing early warning system to detect incoming impacts of climate change,
- designing apps giving real-time data on incoming devastations like floods,
- designing apps indicating the availability of food, logistics support, medical support etc.
- arranging for food and transportation to the most affected communities,
- and many more possible initiaves that have already been covered in this paper.

Climate change is a crisis that is already playing out with increasing intensity each year. What happened in Chennai was likely a teaser by mother nature. There is no time to lose; we all have to act together to address the threat and help the world survive. Corporate managers and leaders would need to come forward and play their part for us to succeed in addressing climate change impacts.

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