

IMPACT OF CLIMATE CHANGE ON MARKETS

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ABSTRACT

Climate Change will impact the weather like extreme weather events and rainfall patterns and it is causing sea level rise. These would intensify the disasters. Therefore the markets would have more severe shocks of disasters and would result in greater price fluctuations. There would be many negative impacts of climate change on the economy, businesses and the markets. Some of the assets and the markets would get damaged. There would be opportunities for business including businesses generated by climate change mitigation. There are efforts to control the climate change, it is expected the warming would be limited. There are regulations and interventions influencing the markets. Under such controls on the climate and the markets, detecting impact of climate change on the markets is somewhat complex. In this paper we study impacts of climate change on different sectors and how the corresponding markets are likely to react.

Key words: Mitigation, sea level rise, markets, Green House Gases, intensified disasters

Introduction

From the analysis of past weather observation it was detected that the Earth's temperature is rising. The tide gauge data and satellite observations established that the sea level is rising at a speed of 3.3 mm per year. The air quality measurements established air constituents Carbon Dioxide (CO₂) has increased from 300 ppm to 415 ppm and expected to up further to 450 ppm in 2100. The CO₂ absorbs Earth's infrared radiations and gets heated up. Other gases like methane (CH₄), Nitrous Oxide (N₂O), water vapour present in the atmosphere also absorb infrared radiations causing the Earth's atmosphere to become warmer and this warming due to increased level of these Green House Gases (GHGs) is termed global

warming. Due to this warming, changes in rainfall, extreme weather events are noticed world over. These changes called climate change has varying impacts on different sectors.

Most of the atmospheric CO₂ comes from the respiration and the fossil fuel, and CH₄ from agriculture, ruminants and decay processes. The industries where fossil fuel is used they release gases like CO₂, CO, SO₂, etc.. If a city is using electricity which does not produce CO₂ but electricity produced at a thermal power plant may be using coal and injects CO₂ into the atmosphere, thus adding CO₂ indirectly. The rotting and composting processes release methane (CH₄) into the atmosphere. The CH₄ is about 28 times stronger in absorbing infrared radiations. The cooking gas or gas from sewer, garbage dumps contain CH₄. The water vapour also works as GHG. Nitrous oxide (N₂O) gets added to the atmosphere through the vegetation and through lightning. The nitrogen gets fixed into the plants through nitrogen fixing and released on denitrification by decomposition or burning the plants and trees.

Pre-industrial level (Before 1850), of CO₂ and CH₄, N₂O were such that they were maintaining the temperature of earth to comfortable level of average temperature of 12.0 °C. The excess of these gases is causing the temperature of the earth to rise. By the end of the century the temperature is expected to rise by 1.5 to 2 C with all efforts to control it.

IPCC

IPCC makes reports on ongoing research that helps in finding knowledge gaps and finds scope of further research on climate change, its impacts, and mitigation. The IPCC has published Assessment Reports 1 to 5, many special reports. These reports generally contain Summary for Policy Makers and other details on the research on the impact, mitigation and responses to the climate change induced disasters that are likely to occur in future.

To keep the warming limited to 1.5 °C, a number of measures are suggested. These include reduced fossil fuel use, use of green energy, mass transportation systems, energy efficient equipments, water management for crops, food additives and vaccination for ruminants, waste and waste water management in the urban settings etc.

Impacts of Climate Change

Research has projected a warmer world will effect almost every sector. The warming will not be uniform. The warming would cause shift in climates, changes in weather patents. The dry areas will get drier and the rainfall intensities may increase high rainfall areas causing more server floods in the flood prone regions. The extreme weather events will increase in number and intensity resulting in more intense disasters. Droughts may increase in frequency, intensity and geographical coverage. Warming would result in longer heat wave periods and shorter cold wave durations.

The agriculture will be impacted by shorter growing period, early ripening, smaller grain and fruit size. Growing in higher levels of CO₂ would result in lower nutrient value of the agricultural products. The food and fodder may lower nutrients and mineral contents. [15]

Warmer Ocean and lakes would have fast growth and early decay of planktons and lower dissolved oxygen. This may lead to more death of fish releasing CH₄ into the atmosphere, thus exacerbate the climate change. Ocean acidification, lower dissolved oxygen levels would destroy the coral reefs, habitats of many aquatic species. With the rising temperature the fish may go into the deeper waters or may shift from the equatorial region to pole wards. This shift of fish may cause extinction of many native species in the cold regions. The fish catch in the tropical regions may drastically reduce and in the higher latitudes it may go up [2].

Ice melt may cause floods inland and Seal Level Rise (SLR) due to additions of more water into the sea and also thermal expansion of the upper layers of water. This has been causing a threat to many coastal villages and cities, many islands as the land is getting submerged into the sea water, The increased sea surface temperature would also cause increased number and more intense cyclones. These cyclones will travel on elevated sea floor and would have capacity to penetrate deeper into land areas. Thus the damages would be considerably larger compared to the damages now. Higher Sea Surface Temperature will result in more intense and more number of storms. New areas on the oceans will be prone to cyclone formation. Melting of polar ice and permafrost may result in release of trapped CO₂ in ice and may further increase the Carbon concentration in the atmosphere.

The damages caused by climate change intensified disasters would not be linear. As floods would be more intense, bridges may collapse which may otherwise sustain at a little lower levels of floods. The floods due to sea waves on the elevated sea floor in coastal areas may cause sea water intrusion in the coastal fresh water resources, beaches and soils and may destroy the habitats of fresh water species.

The cities have grown to approximately from about 25 square kilometres to about 2500 square kilometres and further in about past 50 years. The hydrology of these areas is getting modified due to water supply and producing waste water and sewage.

Climate Change Mitigation

Climate Change Mitigation can be through (i) Preventive Measures through reducing GHG Emissions or absorbing the GHGs (ii) Adapting to the Climate Change and adjust to the changed environment (iii) Preparedness Measures – reducing the chance of drought and floods through infrastructural, policy based or nature based methods (iv) Response to the disasters by dealing with the drought, floods, and food and water scarcity. Reducing carbon emission, net zero emission, fixing the excess CO₂ artificially, converting CO₂ into O₂ are some efforts to bring the CO₂ levels to pre-industrial levels. In view of limiting the warming of the earth, net carbon neutral and climate restoration have emerged in the recent past.

The CO₂ reduction could be through sucking CO₂ and sending it to basalt to form rocks [2] or to send it deep into the ocean. There are developments in the direction of decomposing the CO₂. At present these processes are expensive and implementing these worldwide may cost of the order of world economy. Carbon footprints can be reduced by adopting methods which would reduce the GHG emissions. There are a number of methods to reduce the CO₂ and CH₄ emissions.

There are many processes in place to cause and control the climate change. The regulations are helping to limit the emissions. Implementing emission standards, promoting non polluting industrial units, making mass transportation systems running, new technologies for energy efficient equipments, electric cars, would help in reducing the emissions. But the city growth and population growth are consuming these benefits.

Impact on markets

Barrett et.al. [1] has studied impact of climate change on markets in Nepal using the HELVETAS Swiss Intercooperation. It is observed in Nepal that one or two major storms can damage horticultural crops. Banana farmers experienced a temporal shift of wind storms from March-May to July-September. This is coinciding with the fruiting time. The plants are more exposed and damages because of the fruit weight at that time. The changing wind patterns affect production of charcoal. The combination of increased wind storms and dry conditions worry the partners in the charcoal market as it affects the timing of charcoal production due to higher forest fire risks, which reduces the raw material availability. For walnut trees, flowering and fruiting timings have changed from October-December to April-May. Hails are found increased in number of events and the size causing more damages to crops.

Detecting market response to climate change is complex due to many forces working on the markets. The climate change is increasing the intensity of extreme weather event thus the disasters would get intensified. Markets get shocks of disasters and therefore the shocks in the market would be intensified. The price fluctuations will thus amplify due to climate change.

The impact of climate change would appear very slowly and over a long period of time e.g. 50 to 100 year or beyond. Some business gets impaired by the shocks of disasters while some are benefited as demand of certain items goes up viz. the essential items may go up in demand and prices may become sky rocketing, while non-essential items go out of demand.

Markets have some controls like regulations from the Government, Minimum Support Price (MSP), Maximum Retail Price (MRP), The Government may intervene markets through controlled prices, rationing through fair price shops and public distribution systems. In case of disasters there could be supplies from Government, NGOs and international organisations. These processes enforce prices stabilization. Even with number of these systems the prices of some commodities, particularly essentially required may show high fluctuations in the prices.

The disasters are likely to get intensified under the influence of climate change; our approach to the impact of climate change on markets is based on the impact of disasters on the markets.

Markets operate to support in pre-disaster preparedness and post disaster responses. Markets work according to the need and demand of the people and supply from the producers.

Some situations under the influence of climate change would heavily impact the economy, business and the markets. The climate change may be at risk to some businesses while it would bring opportunities to other businesses. The direct risk of some business may come in the form of regulations and restrictions from the Government or sometimes from the community. Community may object to certain kind of business, while some products may be discarded by the community.

The impacts of climate change will affect many natural and man made systems. Climate Change may impacts the following segments of the market:

- Increased cooling requirements will increase demand of cooling equipments
- Energy demand may go up in the hotter regions for cooling
- Reduced heating requirement will save on heating, cooking etc.
- Reduction in winter clothing all over the world – low demand of wool, fur etc.
- Energy demand may go down in the colder regions for heating
- Water resources, agriculture, livestock and fisheries would get affected
- Property at low land near coast and on low height island may be flooded
- Food consumption patterns may change based on what is available
- Maintenance of vehicles, roads, bridged will generate new demands
- More health services, medicines, nutrients will be required,
- Security threats will generate demand for technology and security professionals

Cooling Requirements

In the rising temperature scenario demand of cooling will be up all over the world except the cold climates where the heating requirements would be reduced. The cooling requirements will further increase due to comfort cooling demands. Urban heat islands are observed to raise the temperatures in the range of 3-10 °C compared to the surroundings. Cooling efforts would need massive energy and this will further increase the warming if the power generation is fossil fuel based. The 1.5 °C warming will increase the temperature by 12.5 % and 2.0 °C

warming will cause 16.7 %. To think of bring the temperatures back at the level of 12°C it will need to have increase in cooling systems of 12.5% and 16.7% respectively. These assessments are under ideal conditions of no inflation and ideal cooling systems. Many currencies are continuous falling in its value against US\$, so the cost of mitigation may go up e.g. the current rate of a US\$ in rupee is about Rs 74 and if rate of US\$ becomes Rs 220 in 2100 the cost would be 37.5 % and 50% respectively for 1.5°C and 2.0 °C warming. However comfort cooling demand will be about 80% up [6].

There will be increased requirements of cooling equipments like fans, coolers, air conditioners, refrigerators, cooling towers and the costs towards installation, running and maintaining these systems. Cooling demands will need stronger infrastructure and more energy which may increase chances of disasters. A hotter planet needs more cooling, i.e., more energy, leading to a worsening of greenhouse effect. This will result in further warming due to energy production and energy consumption. The IEA projected an increase of 80% in cooling efficiency by 2050, with building design and building codes. There is a doubt if the developing and third world countries will reap the benefits. Further the case of fire and forest fire may increase due to temperature, dryness, droughts combined with lightning.

Market of cooling equipments will grow many folds mainly in the urban areas. As the temperature rises the people will try to get rid of the discomfort by using cooling equipments. Measures like energy performance standards, improved building design, and strict building codes may help in reducing cooling demand. The IEA estimated aggregate global cooling demand will double by 2035, which will require additional power to operate the equipments.

District Cooling

Demand for cooling is increasing more rapidly in developing countries. Cooling is expensive, having power demand surges during the day for workplaces and at night and the weekend for residential spaces. The district cooling is based on aggregating demand, in multiple buildings that combine residential and commercial spaces. Usually district cooling is energy-efficient compared to traditional cooling. It is more cost-effective, and it reduces peak power demands.

District cooling cools the targeted objects with chilled water or other medium from a central source to multiple buildings through a network of insulated pipes. It reduces the overall energy requirements. District cooling systems consume 20-30 % less power than the most efficient conventional cooling systems, and 60-80 % less power than the average conventional cooling system. District cooling can reduce peak power demands by up to 30 % with an additional 20% reduction which may be unlocked through thermal energy storage [5].

Cold Climates

Cold climate require heating of buildings to keep buildings warm. The heating equipments will be used for lower duration in case of warming takes place. Electricity /fuel consumption will also be reduced. The markets of warming equipments and winter clothing would respond accordingly. The sales, prices will go down due to reduced demand.

Woollen and fur cloths are required in chill weather. In the tropical area during winters the warm clothing may not be required at all. The market of wool, woollen cloths, fur and even low cost material may vanish. The animal particularly sheep, goat, rabbit farming for wool may not remain profitable and these animals may be used for meat, The population of animals producing wool or fur is low, rearing of these animals may go out of fashion.

District Heating

District heating is a system for heating in a centralized location through a network of insulated pipes for residential and commercial heating requirements like space heating and water heating. The heat is often obtained from plants that burn fossil fuels or biomass, heat-only boilers, geothermal heating, heat pumps and central solar heating and heat waste from nuclear stations. District heating can provide higher efficiencies and better pollution control than localized boilers. District heating with combined heat and power (CHP) can be the lowest cost for carbon reduction, and is one of the lowest carbon footprints [12]. Fifth generation district heat networks do not use combustion on-site and have zero emissions.

The building sector uses more than one third of the end energy and produces the largest amount of GHG of all sectors. The cooling demand is generally met by using electricity

produced through fossil fuels. District heating can contribute significantly to a more efficient use of energy and integration of renewable energy into the heating and waste heat from industries thus can reduce fossil use, thereby reducing GHG emissions.

Climate Change would require lower amount of energy and heat supply in the District Heating Systems. In mild low temperatures these systems may not be required and may become defunct in the case of warming. The growth of cities would accelerate the process of these infrastructures becoming defunct.

Water Requirements

Water requirement will grow in climate intensified drought affected regions. Cities requirement of water has already grown manifolds due to their growth. The cities are producing larger amount of waste water. The water treatment plants do not have capacity to filter these huge quantities of wastewater. In a large number of villages the drinking water is not available yet. With the climate change the condition of water availability will worsen. Many rivers, on whose banks big cities are located, got polluted beyond dangerous level. Fresh water aquifers near the polluted rivers may be destroyed. Coastal fresh water resources may get saline due to sea water inundation because of SLR, higher waves on elevated sea.

Most of the cities depend on packaged water or piped water supply that delivers water after passing through a series of water cleaning processes. As the water demand will grow and water may become scare the prices of packaged water will go up enormously in many areas, particularly in intensified droughts. The scarcity of water will create massive business opportunities for water treatment, water filters, packaging and supply and water coolers as well. New facilities for packaging, desalinization or facilities like OTEC will be needed. There is expending market for the packaged drinking water. Demand for equipments like water filters, RO, water coolers, water storage will grow. More desalinization plants will be required to maintain drinking water supply in coastal regions and countries of low rainfall.

Food and Agricultural Markets

Increasing family size has decreased the land holdings resulting in number of small and marginal farmers is growing world over. The increasing consumption levels at farmers end will reduce food supply into the markets. Due to its potential impacts on yield, climate change may reduce the earnings of small producers, threatening their livelihood. The efforts of agricultural research institutes in bringing up high yield crops and weather resistant crops will help to some extent. Growth of population and decrease in land holdings of small farmers may continue to increase the threat of food supply into the market. This will increase food prices [10]. High food price could risk vulnerable people for access to food. There have been many incidents of rapid food and cereal price increases after extreme weather events. The markets respond quickly to the excess availability or scarcity of any food item. For the perishables price crash is much faster in case of excess supply. Many times farmers throw their produce if they are not able to sell or do not get reasonable price. Governments make some efforts by introducing systems like Minimum Support Prices (MSP) and establishing agricultural markets and also sometimes intervenes the markets through distribution, procuring produces at MSP etc.

The climate change will have significant impact on markets of agricultural commodities, animal produce, fish and other aquatic food under the stress of climate change and the increased demand for food. The crops growing in higher levels of CO₂ would reduce nutrient value [3]. As agriculture has limitation of land, the staple food will become costlier, particularly in the countries already importing staple food. These signals are already present in some part of the world, e.g. the present condition in Haiti.

Shifts in resources will force vulnerable communities to adapt to consumption patterns to new aquatic species to replace existing species which are likely to move into deep water off the continents or pole wards. Fishing communities and fisher folk are at high risk of losing ocean fish catch due to climate change and the capacity of their fishing vessels. Small Island Developing States will face the threat of shrinking coastlines due to SLR. Aquaculture may face higher incidence of disease on warming. This will further risk the food availability. Movement of fish from warmer water to colder places may lead to many aquatic species becoming extinct. Fish migration towards deeper or pole ward, may cause non availability of

fish in the waters in the tropics. This may result in importing fish and sea food to tropical countries from countries in the extra tropics.

Higher temperature may result in low dissolved O₂ thus increased death of fish and other aquatic animals in inland water resources and ocean both. This may result in further increase in GHGs release from these water bodies.

Dead zones may become more pronounced due to loss of fish catch at low latitudes, and acidification of ocean. The global annual catch of marine fisheries may decline by 1.5 million tonnes for 1.5°C and by 3 million tonnes at 2°C warming [7]. Such a huge gap in food would affect all the related business. The countries now exporting fish and sea foods may have to import from the countries whose waters may become new fish catch zones. The low latitude countries may loose heavily and the countries in the extra tropics may gain. The countries in extra-tropics will require infrastructure to catch fish. Accordingly the markets will respond as facilities for catch, processing, storage, export need be built.

Thus the food security, poverty and the sustainability of food and agricultural systems will be influenced by climate change. Growing income in low- and middle-income countries may lead to dietary transition towards meat, fruits and vegetables, relative to cereals. This would add pressure on the food resources. Thus the prices of all food items would go up in general.

Although investments and technological innovations in agricultural are boosting productivity, growth in yields has slowed down to too low rates. Reducing food losses and waste would reduce the need for production increases. But, the required acceleration in production is lowered by the natural resource degradation, loss of biodiversity, spread of trans-boundary pests and diseases of plants and animals.

Climate change will affects disproportionately food-insecure regions. It will jeopardize crop and livestock production. Meeting increased food demands through agriculture with existing farming may lead to more intense competition for resources, higher GHG emissions, deforestation and land degradation. Some land in cold climates may come out of frost and may become suitable for agriculture and these may become food exporting regions.

Increased migratory flow of male members from rural areas is causing the feminization of agriculture in many countries [4]. This tendency intensifies in droughts because of reduced rural livelihood. Thus the climate change will build more overcrowding pressure on cities.

Conflicts, crises and natural disasters would increase in number and intensity under the influence of climate change. They result in lower food availability, disrupt access to food and health care, and undermine social protection systems, pushing many affected people back into poverty and hunger. It fuels distress migration. By more people trapped in the poverty, the purchasing power of the people will go down resulting in lower performance of markets.

Staple food may not be easily available in low income counties due to extreme weather caused damages to crops and high demand from the increasing population. Weak economies will suffer the most. Conditions prevailing in Haiti, the people do not have access to food, may appear in many parts of the world. Migration of fish will cause huge losses to the countries in equatorial and tropical regions. The extra tropical oceans may emerge as new fish zones. Snow covered land may become suitable for agriculture and other developments.

The warming reduces the growing period and the extreme weather events damage the crops resulting in loss in yields. The low yields affect sectors like manufacturing, transportation, which leads to implications for the low income for the community associated with agriculture. This in turn would affect the socio-economic systems. Most of the research work is focused on the impact of climate change on crop yield. There is limited work on the effects of climate change on the areas like agricultural markets, food processing, food storage, sales, and on support functions like sapling supply, insurance, etc.

Fungal diseases and insect infestations increase in higher temperature. Coffee and oranges are under the risk of attack of insects and pests. The drought and dry conditions are found to facilitate white stem borer [1]. It was noticed that, in lower elevations, the pests spread more rapidly in dry conditions.

Agriculture in Cold Climate

The crops which need low temperatures may shift to higher latitudes or to elevated places provided the soil is nutrient enough. There are some efforts in growing variety of apple in comparatively hot climate in Haryana, India. Such efforts may prove to be beneficial in climate adaptation. Maintaining quality, taste and nutrient value in such produces is a major issue. However some varieties of fruits may vanish, if they are not protected through the use of technology. In the polar climates the crops are not grown as the land is covered with ice. With the warming some land may come out of frost. This land may start producing crops,

Fruits and Vegetable Markets

Climate change is likely to reduce length of crop growing period, lowering the size of fruits and vegetables and thereby reduced production. There would be negative impact on growth and development of horticultural crops due to heat stress and low soil moisture. Due to climate change induced extreme weather may cause more damage to the horticulture crops.

The increased rates of respiration caused by warming lead to a use of more sugars by the plants. As a result the harvested product will have low sugar, which may reduce its market value. These effects are more serious as temperatures continue to rise at grain-filling or fruit maturation time [13]. Climate Change may result in lower quantities and lower quality of fruits and vegetables due to shorter period of growth, water stress and early ripening in a warmer climate. It will result in poor availability of the fruits and vegetables push the prices to high levels for good quality products.

Livestock Markets

Heat stress, higher frequency of extreme weather events and droughts may negatively affect animal health and their productivity. Livestock is likely to perform at lower capacity in warmer world. Because of low supply of feed and fodder, water, nutrients they will have not so good health affecting their production and working. The meat animals may not be sufficiently healthy resulting in lower quantizes of meat, eggs, etc. In case of intensified

drought a larger number of animals may be available for slaughtering so the meat prices may show downtrend. In drought the farmers sell their livestock due to low availability of feed, fodder, and water and also for their financial needs. The larger number of animals will be available for sale. Thus the prices of animals may go down.

Climate change may induce more incidents of outbreak of animal disease. Increase in number of incidents of animal disease may seriously impact the meat markets. In case of some disease the prices of animal products go down drastically as import of meat, eggs etc. are usually banned from the animal disease affected countries.

The milk exhibits a different behaviour. In drought the milk production initially goes up as farmers generally start taking more care of the milk animals, this being an alternate source of income to them. But in severe drought the milk production also goes down because of low supply of feed, fodder and water. The feed and fodder become costlier and thus income from these animals may go down. In the market the price of milk and milk products increase in hot season or drought. The climate change will simply enhance these effects.

Land Prices

The agricultural land is shrinking due to expansion of cities. The urban land is not easily available. Many people are forced to live in urban slums, having lack of basic amenities like water supply, toilets, sanitation etc. The unorganized and unplanned developments with waste dumping grounds near cities produce huge quantities of CH₄. The expansion of the cities generates demand for housing and it will continue to price rise. The urban land prices may not be affected by the climate change as it remains in high demand. However, the agricultural lands may become less productive due to warming and extreme weather events. Small holding farmers may have to shift to other activities for their livelihood. The prices of land in rural areas may not rise to beat the inflation.

Real Estate

The property prices may go down in the coastal areas due to warming induced SLR and more frequent flooding. The land prices may also go down in these areas to the extent that there may not be any buyer for frequently flooding properties. The places having low height above

mean sea level may lose its value. Protective methods like sea wall and wave breakers are being tried to reduce effect SLR and sea waves. The majority of economic centres in the world are located near the coasts. The properties in these cities having high business potential may not be affected. There are villages, cities and islands where people are being relocated due to flooding caused by SLR. The properties in these cities/ villages are being abandoned

Majority of people try to live in cities having temperatures in reasonable ranges and depending on the job potential, security, healthcare, educational facilities etc. The demand of property goes up in such areas and thus the prices of houses go up. If the cities start becoming hotter, liking of the people shift to cities having low temperature. The sector will create new business opportunities as weather resilient infrastructure will be required due to increased intensities of extreme weather events caused by climate change.

Health Care

Mosquitoes can multiply in numbers more than ten times with every 0.1 °C warming [9]. Malaria may expand to high altitudes earlier free from the disease. It is likely that 260-320 million more people may be at risk of malaria by 2080. As egg, larvae, and pupae development rates increase at higher temperatures it may enhance and expand dengue in new territories. SLR can influence salinity tolerant Aedes in coastal areas. It is estimated that by 2085, 5–6 billion people would be at risk of dengue. Increase in temperature, humidity, rainfall and run-off can increase cases of diarrhoea. 1°C rise in temperature may cause 3-16% increase in diarrhoea cases.

Climate change may have adverse effects on health due to overheating of buildings, air pollution, biological contamination, flooding, water contamination, vector born disease etc. Because of increased health risk, healthcare demand will increase and it will require development and manufacturing of more effective medicines and healthcare facilities. Thus the sector will have opportunities to do more business. Poor economies in the equatorial and tropical regions will suffer more due to heat related stresses.

White Goods

White goods are generally bought by the people when they have surplus money. In disasters or reducing income scenario the white goods market may be seriously affected. The area where the income increases due the climate change the demand of such goods will increase. These are sectors which would be benefited by the climate change. People working in healthcare sector, security and defence may have increased benefits and may be able to spend more on white goods. In the areas where income of people is low or likely to go down due to climate change, will cause reduction in the demand and so the sales of white goods.

Online Shopping

In the earlier time facility of on-line shopping was limited. But now almost everything is available on-line. In disaster people prefer the products delivered to them. This will result in reduction in volatility of the prices in the local markets. Delivery of products from far off places is possible after a few days of the disaster as soon as the transportation is restored. Thus the local markets which might have become volatile may stabilized early in the presence of active online shopping. In prolonged disasters like COVID-19 people are inclined to online shopping. The on-line business will increase; the business in step in markets may decline.

Financial Markets

In the short and medium run, climate change may benefit rain-fed agriculture as CO₂ fertilization makes plants drought resistant and cost on heating may go down. The negative impacts of climate change are likely to offset these benefits in long run. The negative impacts will be substantially large in poor, hotter, and low lying countries. Climate change may affect the growth rate of the economy and may trap more people in poverty.

The economic system consists of two main components: (i) households which save funds and businesses which invest these funds. The climate change would reduce money flow into the market resulting in reduced availability of funds increasing interest rates and lower liquidity. There will be increased demand of loans, financial markets may circulate more money and grow faster under the influence of climate change.

Stock Market

Stock markets perform on the basis of performance of the industry. The sectors like healthcare, housing, food and associated industry may see growth. Ups and downs are part of the bull and bear cycles. Some companies may be badly affected by the climate change by loosing business while others may get huge business [8], [14].

In natural disasters, the negative impact is observed in the post-event period. As the climate change would impact the disaster intensity and also terrorist activity, the stock markets would react to these situations for a few days and then go the bull-bear run as usual.

Insurance

Insurance Markets may grow due to the increasing demand for risk cover by more and more people. In some countries the Governments are promoting crop insurance schemes to help farmers. The insurance has very large growth potential. The climate change will boost the demand for insurance due to increased risks in many sectors.

Security

As climate change damages natural resources and crops, the people fight for resources causing conflicts and wars. The more number of youth in the countries where terrorist groups operate join these groups and there would be increase terror attacks. This demands better security arrangements. It needs scanners, cameras, professionals, arms, bullet proof vehicles, bullet proof jackets, specialists to handle explosives etc. The Mumbai terrorist attack has resulted in tightening security everywhere. It resulted in strengthening Government security forces and development of security and intelligence agencies. It has created very large employment and business in private sector too.

Some Benefits of Climate Change

The climate change may benefit the some parts of the world. Land may come out of the snow covered area. The cold climates will require less energy. The fish migration into cold ocean waters may benefit the countries having cold climate. Arctic Ice melt may open new shipping routes of short length connecting counties in the northern parts of northern hemisphere.

Conclusion

Though it looks to be very small change in temperature over a period of 50-100 years, there would be large changes in the food availability and demand. Growth of cities would cause further problems. It is likely to impact almost every sector that depend on weather e.g. the agriculture, food, water, animal resources, fisheries etc. and ultimately impact all the sectors of economy. The markets will respond accordingly in terms of variations in the prices.

As climate change is taking place and will occur the world has to remain prepared for the impact on extreme weather events and intensified disasters. The mitigation of climate change would generate opportunities for business. In developing countries, the planned development is limited. In the unplanned development the heat island effect is more severe. Improved rescue, response and recovery approaches need be developed. Approaches for energy, water, waste and waste water treatment, health, food, fodder water and cooling requirements through newly designed systems would generate new opportunities for businesses.

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