

The efficacy of Climate Change on Sustainability of Supply Chain Management

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ABSTRACT

Natural hazards are the sudden catastrophic events which destructs the economy (Alcántara- Ayala, 2002) and the consequences of the same affects human system, natural environment and built environment (Beekharry, 2015). Climate change is the common disastrous event affecting human societies (Stern Review, 2006). As the change in climate directly affects supply chain management of products (Dasaklis and Pappis, 2013) and the market demand also fluctuates as well due to price competitive environment (Jena and Jog, 2016). Consequently, focus of this research is to analyze the impact of natural disasters on variables mainly supply chain management, precautions taken during disasters, Tourism Industry and market demand of goods and services. By employing exploratory research design with various statistical tools, it comes up with remarkable results and concludes that Supply chain management is considered as critical one as it is more vulnerable towards disasters and gets inefficient resulting into disruptive supply chain networks.

INTRODUCTION

Change in Environmental conditions like typhoon, heavy rainfall, volcanic eruptions etc. are the major concerns of the society as recognized globally by government as well as policy makers (Debanche, 1998). The natural hazards were geophysical events long time ago and were like volcanic eruptions, land sliding, earthquake, hurricanes or flooding etc. now been modified as natural disasters by humans are dangerous towards society and severity of endangerment is conditioned to natural as well as human vulnerability; can be minimized through building resilience, alleviation and post-event humanitarian actions (Cannon, 1994). Humans have no control over these deadly or triggering events and only sometimes are the cause of them like oil spills, structural failures, mechanical malfunctions etc. However, the extent of impact is measurable through vulnerability and dependent factor on disaster that is governed by the resilience, resistance, likelihood of danger, durability etc. and risk is associated with exposure of threatening or deadly events which leads to loss of human lives, destruction etc. (McEntire, 2001). Natural disasters happens on account of hydrological, hydro-meteorological, climatologic, geophysics or biological origins and they disapprovingly affect inborn as well as built environment (Mata-lima et al., 2012). Increase in these catastrophic events repetitively or calamitous disaster leads to either distressed lives or loss of human lives in different geographical regions resultant lower output growth of economy but at the same time expensive disasters with regard to destroyed capital emerges to improve the economy in a short run (Noy and Bang, 2010). The biggest challenge of such natural disasters especially climate change is very distinctive comparable to other challenges that the general public faces such as the changing principle of organization of the industrial economy ; low cost and ample energy (Paavola and Adger, 2006).

Climate change is considered among all disasters as one of the most common which specifically takes place due to global warming and is accepted universally due to its unavoidable repercussions on human lives, society at large, business units and the whole universe (Stern Review, 2006). It is regularly reasoned a matter of global interest despite being a debatable problem that how long and up to what level it has negative aftermaths (Karl and Trenberth, 2003). The business operations are to be operated in highly perilous environment after the calamities and it is necessary to distinguish and acknowledge the views of different institutions, supply chain and stakeholders (Kolk and Pinkse, 2007). Business can be affected in majorly three different ways such as risk towards the main activities, value chain and lastly, risks appears due to change in infrastructure and economy as a whole provided by (Sussman and Freed, 2008). While creating policies by companies to mitigate the losses after calamities, issues of market and their strategies should be scrutinized (Hoffman and Woody, 2008; Kolk and Pinkse, 2005). There is an

impression of transportation on the global climate too but is not restricted to emissions of vehicle due to distribution and production of fuel from oils, an approach of 'wells to wheels', which has good amount of greenhouse in it (Weiss et al., 2000). Various methods are available to know the influence of climate change against supply chain management but one of the best method available is to compare transportation system between regions with changing climatic conditions (Eddington, 2006). Most likely affected from Global climate change is urban infrastructure due to repetitive nature of extreme triggering events and increasing level of sea apart from global warming and rising temperatures (Schreider et al., 2000). The process of transportation in planning, designing, construction and maintenance are directly influenced by weather as well as climate factors in many ways (Mills and Andrey, 2002). Warehousing and related activities, such as trucking, have recently come to the forefront of a general discussion concerning economic development, land use and transportation and it can be described as facilities designed for the reception, delivery, consolidation, distribution, and Storage of retail goods (Brockmann, 1999).

REVIEW OF LITERATURE

The impact of climate change on supply chain management has been examined by various authors such as (Halldorsson and Kovacs, 2010; Dekker, Bloemhof and Malidies, 2012; Dasaklis and Pappis, 2013; Ghadge, Wurtmann and Seuring, 2019) and came up with remarkable results, some of them with global importance.

Global climate change which is most often the result of human actions are happening continuously and will keep affecting the society as a whole; where the shock orientate action is perceptible from decades (Burton et al., 2002). Despite being the uncountable inconveniences faced by the general public due to such global warming and threats, till there are people not able to acknowledge it due to their conceptual acknowledgment on paradigms and images within some well known culture (Mann, 2009). The elucidation of changing climatic conditions includes heavy rainfall, rising temperatures or extreme weather events like drought, floods, cold waves, heat waves etc and the expenses of these disruptive events are increasing over the time (Halldorsson and Kovacs, 2010). There is an existence of multiple effects of Climate change on socio-economic factors as well as on environment which also includes agriculture, resources of water, food security, health of human beings, biodiversity, coastal zones and so on. However, limited studies are available regarding how to mitigate the losses arise due to climate factors in agriculture supply chain management (Burke and Emerick, 2016). Natural disasters are describes as the impression on the socio-economic system of society of the natural environment (Alexander, 1993). The impact of disasters, in form of loss of livelihoods, premature death and disability, as well as costs to development, is badly understood (Cavallo and Noy, 2010). The Economy is getting deteriorated due to regular rise in temperature by more than 1 degree Fahrenheit globally over the decades (Brohan et al., 2006). As per the models of climate change and green house emission assumptions, it has been revealed that the food elevations and temperature changes over the century, however it is pointed out a rise in food elevation and the high flood's frequency (Rosenzweig and Solecki, 2001). It also various forecasting negative outcomes such as declining incomes which are already low, rise in diseases as well as death rates in a lot developing and developed countries like Asia, Africa and their mega deltas are affecting the most (IPCC, 2007).

Transportation and Logistics are the most affected significant factors post disastrous events for years and recently been viewed as necessary expense where the humanitarian relief organizations analyzed the importance of relief chain management and the relief is around 80% logistics, So it makes it clear that efficient and effective supply chain operations are significant to achieve this (Beamon et al. 2006). The number of casualties especially the severe one are growing gradually and the financial expenses, impression of the same are already underestimated (Miao and Banister, 2012). Interdependence among companies have increased because of the rise in outsourcing activities which leads to vulnerability as inefficiency in some of the parts of global supply chain leads to disruptive operations, However the checking and controlling of local firms have reduced over distribution as well as production links due to fragmented production (Kimura and Ando, 2005). Post disasters government take few necessary steps such cancelling of flights, closing of borders, shutting down of businesses it all leads to disruptive logistics and inefficiency in supply chain management of goods and services (Munim et al., 2015). As per the existing literature review, the post effect of climate change varies by region The Coastal areas emerges to be most affected due to rising sea level as well as coastal storms where as The Arctic region has been affecting differently but the major concern is related to cost of these impacts— extreme events leads to more loss of capital in a shorter period of time which ultimately need more requirement of investment to maintain capital replacement cycle (Cambridge Systematics Inc., 2009).

Small and Medium Enterprises are the revealed to be one with largest workforce therefore, provides more income opportunities but makes survival difficult of small businesses and entrepreneurs

seems to think that the regulations related to Environment destroys competition and due to which SMEs account 70% of total industrial pollution (Gandhi et al., 2013). Climate change have the larger capacity to reduce the revenues of government due to declining economic activities which also includes fall of imports and exports of government and they directly affects revenue generation process (Benson and Clay, 2003). As shareholders are now aware of the practices like weather risk management products and also expect companies to actively manage risks related to climate factors (Evershed, 2013). Hospitality and Tourism industry are one of the significant industry playing important role in making economic development of the economy but they also have their activities have own consequences on the environment (Graci and Dodds, 2008). Tourism emerges to be world's largest as well as fast improving industry where it's development also pose challenges for the environment (Persicivadinov and Blazevic, 2010). The business of Tourism can be described as the all those activities related to visitor's movement and accommodation due to aesthetic climate of some region (Orchiston et al., 2012). Many developed as well as developing countries have done research on impressions of Climate change on Tourism business such as USA, Canada, Austria, Switzerland, Australia, France etc. (Koenig, 1998). Multiple studies state that even at the time of happening of events, Winter tourism can be maintained with few strategies like artificial snowmaking and so on and some regions may also lose the same (Burki et al., 2003). The literature on climate change adaptation research seems less developed compared to other economic sectors, where the operators of tourism have less awareness of climate and so is the less strategic planning in forecasting the future changes (Scott et al., 2008). Tourism sector have more capacity to grapple with shocks post disaster such as terrorism attacks, the Asia tsunami etc., however, the level of grappling ability, societal ramifications and environmental impressions stays introductory (Scott and Becken, 2010). Climate change emerges to be the most critical concern of environment as well as the business challenge which creates opportunities as well as threats for firms (Stern, 2007). Rising climate change results in high risk of destructive property, blackouts etc and affect the farmers in many ways like crop failure etc. (Burnham, 2006). Among all issues, rising ocean temperature is not only the concern but the changing climate factor s and people's ability of being habitual about it (Levitus et al., 2005). Earlier, there was less focus on 'indirect' impact of disaster on livelihoods and the main focus was on declining exposure to covariate risk to decline the people's life (Benson and Clay, 2004).

Objective of the studies are as follows:

- 1) To analyze the impact of Climate change on supply chain management & Precautions
- 2) To analyze the relationship between Climate change, Tourism industry & Market demand

METHODOLOGY

The interconnection between natural disasters like climate change and supply chain management and its impact on the same due to the disruption in following activities like routing, scheduling etc. has already been established (Dasaklis and Pappis, 2013; Jaroszweski, Hooper and Chapman, 2014; Moretti and Loprencipe, 2018; Ghadge, Wurtmann and Seuring, 2019) and the necessary precautionary decisions are also required to be taken at the time of such events (Moretti and Loprencipe, 2018). Furthermore, the change in climatic conditions also pose multifaceted challenges towards Tourism Industry directly as well as indirectly and influences the same (Agnew and Viner, 2001; Mayer, Roberts and Barsade, 2008; Michev and Mochura, 2010; Soboll, Klier and Heumann, 2012). It also affects the market demand of goods and services (Jena and Jog, 2016). The existing interconnections among these variables along with recurring happening of such threatening events over the decades and their continuous influences makes it momentous for the researchers to scrutinize the aftermath of climate change on supply chain management, precautions, Tourims Industry and Market demand which is ultimatley the objective of this research.

Exploratory research design is followed by two stage process to carrying out this study. This research is focused more towards primary data which was gathered from various Small businesses like local level shops of Fast Moving Consumer goods (FMCG) products in various regions of Himachal Pradesh. Secondary data in the form of reports are taken into consideration to know the current scenario of Natural disasters. Hypothesis for the research are created and to be tested in this research considering significant six demographic variables.

Two schedules were prepared and pre-tested before administering these on the Small business units. In this research, probability sampling procedure is followed where in stratified random sampling is applied to stratify the heterogeneity in order to have a true representative of Universe and research universe has been finite in this research. Geographical region includes the various regions of Himachal Pradesh especially Kullu and Manali district. The sample size for the study comprises of 500 owners of small business including Tourism owners with different demographic profile, as per the concentration of

population by using stratified random sampling technique. Sample size has been selected on the basis of population proportion. Exploratory Factor Analysis has been employed identify the factors and the analysis of the study was presented based on data on several aspects in tabulated form, beside making use of simple Exploratory research and relative tools of statistics such as mean, percentage, standard deviation, correlation and appropriate hypothetical test, possible relationships revealed out through cross sectional analysis wherever necessary feasible.

Link between climate change and Supply chain management

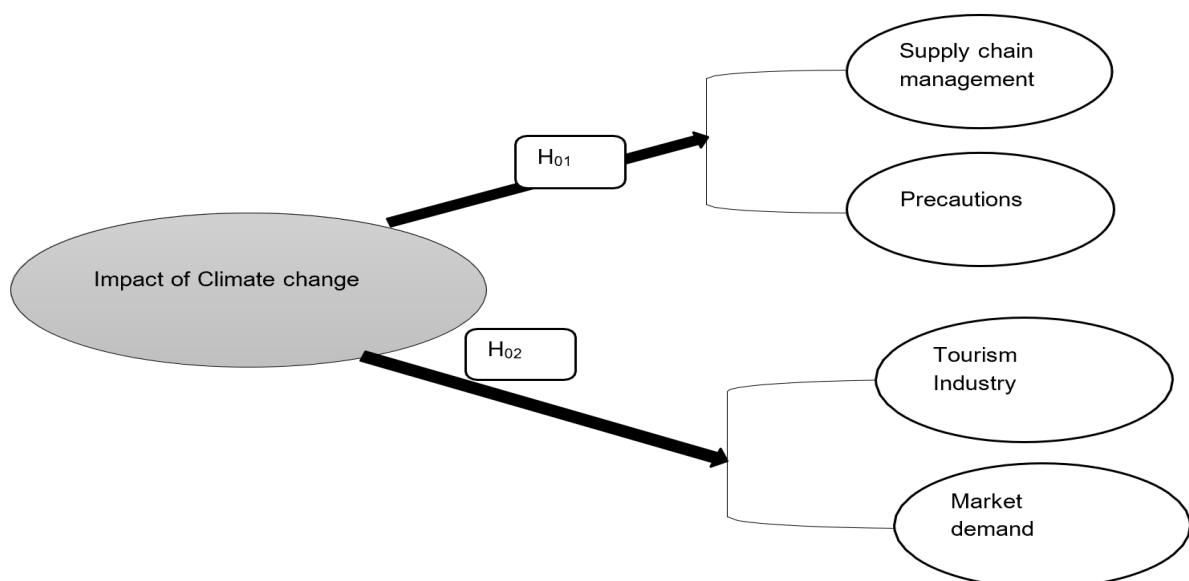
There is a strong link between climate change and supply chain as it is much vulnerable during disasters especially during climate change and many precautions are to be taken at the time of such menacing events (Jaroszweski, Hooper and Chapman, 2014). Supply chain is directly exposed to the weather conditions in most cases and results into its activities being subjected to different types of hazardous as well as disruptive weather (Thornes, 1992). The expectations of general public for safe, efficient and effective supply chain for the whole year was coined by (Thornes, 1992) and this trend was further observed by emphasizing more on declining travel time and therefore rising speeds (Banister et al., 2011). Supply chain emerges to be the most significant driver and promoter of globalized economy as well, allows the smooth flow to goods and services from one place to another (Eddington, 2006) and it is also considered as a social asset, specifically used for social networking among the places (Cress well, 2006). Nevertheless, change in climatic conditions which are hazardous in nature often impacts negatively the smooth and safe supply chain of goods and services and leads to disruptive supply chain management (Jaroszweski, Hooper and Chapman, 2014).

Link between Climate change and Tourism Industry & Market demand

(Taylor and Ortiz, 2009) suggests the strong link between Climate change and Tourism industry which ultimately affects the market demand of goods and services due to the negative impact on efficient flow on good's supply chain management. Tourism benefits the society as well as the economy in multiple ways and expenses on tourism industry brings a lot benefits, most importantly it generates employment opportunities for the public and hence increase their earnings and purchasing power. it is also suggested as the driver and facilitator for income and economic growth of the economy more specifically in the areas which deficits manufacturing density (Eugenio-Martin, Martín Morales and Scarpa, 2008). Furthermore, the expenditure incurred on Tourism related development is worthy as it improves the region's educational facilities, infrastructures, culture etc. (Mayer, Roberts and Barsade, 2008).

Tourism is highly dependent upon the infrastructure facilities after natural attractions therefore, it is necessary to prevent the regions from disasters either man-made or natural like climate change (Mayer, Roberts and Barsade, 2008). Due to the increased importance of tourism industry as it benefits society, regional economy and the economy of the whole nation and considering the high degree of dependency of economy on Tourism. Hence, it is significant to inspect the impact of climate change on tourism industry (Mayer, Roberts and Barsade, 2008; Soboll, Klier and Heumann, 2012)

Figure 1. Research framework



Source: own illustration

In contemplation of studying the impressions of Climate change on supply chain management of businesses, to inspect whether the interruptions or inefficiency in the same affects the business cycle or not is anatomized. The effects of climate change on Tourism Industry, market demand and precautions which are needed to be taken at the time of such disasters are also anatomized. For the purpose of performing research, null hypothesis are created and to be tested by taking into consideration the opinion of six significant components.

The Hypotheses of the research are:

- H01: There is no significant impact of Climate change on supply chain management & Precautions (Jaroszweski, Hooper and Chapman, 2014; Moretti and Loprencipe, 2018).
- Ha1: There is significant impact of Climate change on supply chain management & Precautions (Jaroszweski, Hooper and Chapman, 2014; Moretti and Loprencipe, 2018).
- H02: There is no correlation between Climate change and Tourism industry & Market demand (Soboll, Klier and Heumann, 2012).
- Ha2: There is correlation between Climate change and Tourism industry & Market demand (Soboll, Klier and Heumann, 2012).

(Tol and Vellinga, 1998) has provided a remarkable summary of conceptual framework on enquiring the aftereffects of climate change process by emphasizing on methodological details and created a holistic vision. it assessed the impact of climate change on given sectors and neglected the supply chain which is considered by (Jaroszweski, Hooper and Chapman, 2014).

The natural disaster are such disastrous events which affects whole region especially Tourism industry and the result of such events has been examined due to the increased importance of this industry (Yeoman and McMahon-beattie, 2006). The impact of climate change is so destructive that it creates the price competitive environment in selected regions on and often results in changing Tourism pricing which ultimately seems to have a great influence on the market demand (Jena and Jog, 2016).

ANALYSIS AND INTERPRETATION

Analisis dan Interpretas

For the purpose of checking reliability analysis of scale and inner consistency of extracted factors, Cronbach's alpha coefficient has been calculated and presented in Table 3. The value alpha value of data set is 0.544 considered as acceptable indication of Scale reliability. When the Kaiser-Meyer- Olkin Measure of Sampling Adequacy (KMO) value of data set is .6 or above, it is considered as appropriate for using factor analysis where as the value of Bartlett's Test of Sphericity must be significant with .05 or less. In the current research, the Kaiser-Meyer-Olkin Measure of Sampling Adequacy (KMO) value is .597 and the value of Bartlett's test of Sphericity is significant at $\chi^2 (10) = 256.885$, $p = .000$ which ultimately indicates that correlation matrix is not an identity matrix, therefore Factor Analysis is appropriate.

Table 1 and Table 2 represents the analysis for above null hypotheses "There is no significant impact of Climate change on supply chain management & Precautions" and "There is no significant impact of Climate change on Tourism industry & Market demand" and uses Karl Pearson coefficient of correlation to establish the relationship of different demographic variables with the aftereffects of climate change on selected variables. Furthermore, hypothetical test like chi-square test has been employed, which is commonly used for testing the independence between two categorical variables. The demographic variables taken in this research mainly are Age, Gender, Experience, Monthly Income, Impact of Aesthetic climate, highest impact of climate change. The opinion of respondents with different age group ranging from 0-35 to above 65 years, different years of experience ranging from less than 1 to above 15 years of experience, different sets of monthly income from 5,000 per month to 60,000 per month are considered along with the opinion on impact of Aesthetic climate and highest impact of climate change. After using cross sectional analysis on all selected variables, the results are analyzed and

presented. As per the analysis of Table 1, the Karl Pearson coefficient of correlation is either positive or negative and either highly or slightly significantly correlated. As the Calculated value of Chi square is less than the Tabulated value in all cases except in the case of the highest impact of climate change on supply chain management. It expresses the contrasting views of few respondents, some specifies that the impact of aesthetic climate is enjoyment where as some responded attractiveness of site and so on and the highest impact of climate change is on different areas as per few respondents who responded that it is on hotels and lodgings, tourism industry, warehousing and transportation, food and beverages etc. As per the analysis of Table 2, the Karl Pearson coefficient of correlation is calculated and resulted with highly or slightly correlation among the selected variables and considering the high Tabulated value over calculated value, all null hypothesis are accepted except experience on Tourism industry and Highest impact of climate change on Market demand as the views regarding both cases are contrasting.

Climate Change being an outcome of global warming recognized globally as a disaster affecting environment, society at large in multiple ways (Stern Review, 2006). The most vulnerable ones from such disruptive events are poorer households due to low incomes along with poor quality housing and informal settlements in low lying with flood-prone areas (Maletha, Phondani and Bhatt, 2017; Patankar, 2020). Apart from poorer households, Micro, Small, and Medium (MSME) enterprises and Small businesses are the one gets affected more disproportionately as compared to larger firms which are having more resources and strategies to sustain and they should be the one to get assistance just after the crisis since they contribute towards the livelihood and wellbeing of local community (Villarroel, 2013). Climate change impacts drastically the environment and the outcomes of threatening events like demolition, death, traumas and wrecking of economy are generally the punishments of disregarding the environment's continuously changing natural processes (McEntire, 2001). There are either intentional disasters like Technological disasters or unintentional like biological where in the former one technological disasters can arise due to the more dependency on technology and not using it with precautionary measures can cause risk (McEntire et al., 2010). Change in climatic conditions such as high temperature, floods, landslides etc. always have a significant negative impact on the operations of businesses as well as the supply chain management of goods and services due to destruction of roads, infrastructure etc. (Arkell and Darch, 2006) and so is the aim of this research. Among all other disastrous events, the most extreme one is air temperatures such as heat waves and harsh winter weather which becomes the challenge for smooth supply chain function (Christodoulou and Demirel, 2018). Climate change impacts are not simply a function of meteorological events, but also the vulnerability of the network they are impacting upon (McEntire, 2001). This changing vulnerability of the network and meteorological hazards interrupt the network of supply chain up to a great extent. Climate change affects the network of supply chain and therefore, necessary precautions must be taken to prevent from such events (Moretti and Loprencipe, 2018). Supply chain systems are also vulnerable due to interference in fuel and electricity supply, along with communication inefficiency subject to climatic stresses. Variability and Climate change suppose to change in designing operation and planning of management of supply chain. Climate change emerges to be one the most recognized and important among many processes which affect vulnerability.

Tourism industry has also been considered as significant source of global economic development as brings employment in developing economies and regions which considers tourism as a n ultimate driver of national income (Bigano, Hamilton and Tol, 2007). Although, it is mostly contingent upon the changing climatic conditions (Amelung, Nicholls and Viner, 2007). As per the Stern's report on Economics of Climate change, the small change in temperature leads to welfare of economy. However, if doesn't get checked on time could lead to 20% decline in per capita consumption of the century (Stern Review, 2006).

This research discusses about the change in climatic conditions in different regions of hilly areas and its impact on Tourism industry, market demand of products which subject to fluctuation post disasters. The analysis uncovers various facts and states that many types of environmental change or climate change like heavy rainfall, cloud burst, floods, landslides, heavy snowfall, increasing water level of

rivers have the capability of affecting the livelihood of the people who are residing in these fragile areas like the regions of Himachal Pradesh, India. Basically, state like Himachal Pradesh totally depends on the Tourism due to its Aesthetic climate and in case of heavy rain and heavy snowfall, the average speed of vehicles may affect due to low visibility which ultimately is the reason of declining. Warehousing of products, which is a part of distribution network also gets influenced in extreme weather conditions like heavy rainfall, Cloud bursting etc. Necessary commodities which are daily essentials of general public are either Perishable or non-perishable goods, raw materials also suffer by these climate changes. It is one of the known phenomenons that transportation of goods performs worse under such adverse events due to breaking down of Infrastructure facilities. This is basically true in densely populated regions, such as many areas of kullu and Manali district, where one single event often results in chain of reactions that affects large parts of the transportation as well as distribution system.

In order to analyze the impact of such adverse events on supply chain management as well as on tourism, the proposed relationship summary examines that the results for Supply chain, precautions, tourism, market demand factors on significant parameters like age, gender, experience, monthly income, impact of aesthetic climate and highest impact of climate change. While considering initial factor, it found that majority of the age group who are in between 35 to 50 years agreed that market demand of products is affected due to trade blocks. The relationship between age and precautions as making decision about changing climatic condition shows the less significant negative correlation which means that there is an inverse relationship between these two variables which again shows that increase in age of respondents leads to change in perception of respondents towards another variable. The remaining variables like supply chain, market demand and Tourism Industry shows the less significant positive correlation with the other variable age which means that they are in favor of the statements regarding impact of climate change on these variables. In gender, It shows that relationship between genders and precautions as decision making shows the less significant negative correlation that shows the inverse correlation. That simply states majority of the people are not in favor of precaution in making decision about changing climatic condition. The remaining other variables supply chain management, market demand and Tourist Industry shows the less significant positive correlation with the other variable gender which means that they are in the favor of the statements. There is also a relationship between experience and different components of supply chain management factor we see that only precautions variable has a less significant negative correlation with the other variable experience. There is no impact of experience on precautions in making decision about changing climatic condition. The remaining other variables shows the less significant positive correlation with the other variable experience which means that they are in the favor that precautions as decisions must be taken during such adverse events. Table 2 also depicts the relationship between monthly income of the respondents and market demand is affected due to trade blocks shows the less significant positive correlation which means that when the monthly income of respondents increases their perception about market demand is affected due to trade blocks will remain in favor. The other variables shows the less significant negative correlation with the other variable monthly income. There is an inverse relationship between above mentioned variables and monthly income of the respondents which means when the monthly income increases their perception will also change. The proposed relationship summary shows the relationship between impact of aesthetic climate change and other supply chain factors. The remaining factors namely supply chain management, tourism industry and market demand and precaution in making decision about changing climatic condition have a less significant positive correlation which means impact of aesthetic climate is favorable. Lastly, it depicts the relationship between highest aftermaths of climate change with the all factors of supply chain. It shows that there is a less significant positive correlation between highest impact of climate change precautions. Highest aftermaths of climate change is on hotel & lodging industry so there is a favorable influence of climate change on precautions in making decision about changing climatic condition. The remaining other variables shows the less significant negative correlation with the other variable that is, highest impact of climate change which means there is an inverse relationship between these variable and highest impact of climate change.

CONCLUSION

Weather is one of the noteworthy factor impacting the convenient life of economy and it is been revealed that poor countries are more vulnerable rather than hot countries towards Weather (Tol, 2020). It also plays an important role in convenient life of Infrastructure as well as supply chain management where the maintenance of the same is indispensable to ensure their long life. Inefficiency or interruptions in supply chain performance shows negative trend with increased climatic conditions (Kara, Ghadge and Bititci, 2020). It often leads to trade blocks which ultimately lowers the market demand of commodities. For example, the weather conditions like cold winter, heavy rainfall, heat stress results into deterioration on e.g. rail tracks and road pavement which is needed to get repaired on a regular basis to ensure convenient flow of goods and services. The climate factors affect the health of tourists as well with communicable or non- communicable diseases for which precautions are needed to be taken on time (Semenza and Ebi, 2019). In contemplation of numerous significant variables, the influence of Climate change on supply chain management, precautions to be taken at the time of changing climatic conditions, Tourism Industry and Market demand is being anatomized and encountered with remarkable outcomes. As per the analyzes, the relationship of all components is tested and proves that the views of all respondents with respect to all components is similar which means respondents have same opinion regarding the impact of Climate change on different variables. Null hypothesis; "There is no significant impact of Climate change on supply chain management &Precautions" and "There is no correlation between Climate change and Tourism industry & Market demand" are rejected on the basis of sub hypothesis tested through above parameters and it concludes 'There is a significant impact of Climate change on supply chain management, market demand and precautions as well as Tourism Industry'. It also reveals further that all transport infrastructures like roads, railways etc. gets impacted negatively by extreme weather conditions especially in hilly areas as more vulnerable towards disaster and further result in supply chain interruptions and inefficiency of transportation, destructing its management of products. Supply chain management is emerges to be significant for economic and social well-being and interruptions as well as inefficiency in the same leads to negative consequences on social and economic well-being of a nation. Change in weather conditions influence the Tourism industry which ultimately results in low market demand of goods and services. People with different age group and experiences agree that there is an impact of natural disaster when they are extreme and interrupts the supply chain management of products, which also lead towards declining Market demand of products as trade gets blocked and results into less revenue generation. Other factors also exist which causes change in the market demand of products like price violation due to availability of less stock, low income of people as they suffer more comparatively with the people having higher level of income at the happening of such terrific events. How greatly the disasters can impact the selected variables is dependent upon their endangered and the bleak Impact of climate change can be minimized through building adequate infrastructure facilities and resilience. It also influences the attractiveness of site as respondents with view of attractiveness of site supports the perspective that there is an effect of climate change on supply chain management, Tourism industry as well as market demand of products and precautions taken during natural disaster.

The views of respondent on the highest footprints of climate change towards supply chain management and market demand are contrasting and wind up on showing that it has impact on various other areas as well like hotels and logging services, food and beverage industry, travel and tourism industry, market demand of products and so on. Precautions and necessary steps should also be taken during the occurrence of such destructing and menacing events. Natural disasters like climate change are the sudden, unexpected menacing events happen due to natural causes are capable enough to destroy the economic and social well-being of a nation, have a strong impression on businesses especially their supply chain management, market demand and precautions taken during disasters.

REFERENCES

- Alcántara-Ayala, I. (2002) 'Geomorphology, natural hazards, vulnerability and prevention of natural disasters in developing countries', *Geomorphology*, 47(2–4), pp. 107–124. doi:10.1016/S0169-555X(02)00083-1.
- Agnew, M. D. and Viner, D. (2001) 'Potential impacts of climate change on International Tourism', *Tourism and Hospitality Research*, 3(1), pp. 37-60. doi: 10.1177/146735840100300104
- Alexander, D. (1993) *Natural disasters*. London: UCL Press, pp. 632.
- Amelung, B., Nicholls, S. and Viner, D. (2007) 'Implications of global climate change for tourism flows and seasonality', *Journal of Travel Research*, 45(3), pp. 285–296. doi: 10.1177/0047287506295937.
- Arnell, B. P. and Darch, G. J. C. (2006) 'Impact of climate change on London's transport network', *Proceedings of the Institution of Civil Engineers: Municipal Engineer*, 159(4), pp. 231–237. doi: 10.1680/muen.2006.159.4.231.
- Banister, D., Anderton, K., Bonilla, D., Givoni, M. and Schwanen, T. (2011) 'Transportation and the Environment', *Annual Review of Environment and Resources*, 36, pp. 247–270. doi: 10.1146/annurev-environ-032310-112100.
- Beamon, B. M. and Kotleba, S. A. (2006) 'Inventory modelling for complex emergencies in humanitarian relief operations', *International Journal of Logistics Systems and Management*, 9(1), pp. 1-18. doi:https://doi.org/10.1080/13675560500453667
- Beekhar, D. (2015) *Risk in Emergency Management*. Master's Thesis. University of South Australia. doi:10.13140/RG.2.1.3306.8241
- Benson, C. and Clay, E. (2003) *Economic and Financial Impacts of Natural Disasters: An Assessment of Their Effects and Options for Mitigation*, Synthesis Report. London: World Bank and Overseas Development Institute, pp. 120.
- Bigano, A., Hamilton, J. M. and Tol, R. S. J. (2007) 'International tourism : A simulation study', *The Integrated Assessment Journal*, 7(1), pp. 25–49.
- Burnham, C. and Holmes, R. (2006) 'A Guide to Climate Change for Small- to Medium-sized Enterprises', *The Canadian Chamber of Commerce and Pollution Probe*, pp. 56.
- Burton, I. (2002) 'From Impacts Assessment to Adaptation Priorities: The Shaping of Adaptation Policy', *Climate Policy*, 2(3), pp. 145-159. doi:10.1016/S1469-3062(02)00038-4
- Bürki, R., Elsasser, H. and Abegg, B. (2003) 'Climate Change - Impacts on the Tourism Industry in Mountain Areas', *Economic Geography*, pp. 9.
- Burke, M. and Emerick, K. (2016) 'Adaptation to Climate Change: Evidence from US Agriculture', *Economic American Journal: Economic policy*, 8(3), pp. 106-140. doi: 10.1257/pol.20130025.
- Brohan, P., Kennedy, J.J., Harris, I., Tett, S.S.B., Jones, P.D. (2006) 'Uncertainty estimates in regional and global observed temperature changes: A new dataset from 1850', *Journal of Geophysical Research*, 111(D12), doi: https://doi.org/10.1029/2005JD006548
- Brockmann, T. (1999) 'Twenty-One Warehousing Trends for the Twenty-First Century', *IIE Solutions*, 31(7), pp. 36-40.
- Cavallo, A. and Noy, I. (2010) *The economics of natural disaster*. Inter-America Development Bank (IDB), Working paper series no. IDB-WB-124. pp. 49.
- Cambridge Systematics, Inc. (2009) *Transportation Adaptation to Global Climate Change*. Washington D.C: Bipartisan Policy Center, pp.61.
- Cannon, T. (1994) 'Vulnerability Analysis and The Explanation Of ' Natural ' Disasters', *Disasters, Development and Environment*, pp. 14-30.
- Christodoulou, A. and Demirel, H. (2018) *Impacts of climate change on transport - A focus on airports, seaports and inland waterways*. Luxembourg: Office of the European union, pp. 55. doi: 10.2760/378464.
- Dasaklis, K.T. and Pappis, P.C. (2013) 'Supply chain management in view of climate change: an overview of possible impacts and the road ahead', *Journal of Industrial Engineering and Management*, 6(4), pp. 1139-1161. doi: <http://dx.doi.org/10.3926/jiem.883>
- Deban, K. S. (1998) *The challenges of sustainable management for small island*. Available at: <http://www.insula.org/islands/Small-Islands.html>

- Eddington, R. (2006) Climate Change and Agriculture in Europe: Assessment of Impacts and Adaptations, Research Report No. 9, Environmental Change Unit, University of Oxford, Research Report No. 9.
- Eugenio-Martin, J. L., Martín Morales, N. and Scarpa, R. (2008) 'Tourism and Economic Growth in Latin American Countries: A Panel Data Approach', SSRN Electronic Journal. pp. 28. doi: 10.2139/ssrn.504482
- Freed, J.R. and Sussman, F.G. (2008) Adapting to Climate Change: A Business Approach. Pew Center on Global Climate Change, pp. 1-41. Available at: <https://www.c2es.org/document/adapting-to-climate-change-a-business-approach/>.
- Gandhi, S., Gupta, A. and Sethi, S. (2013) 'Extreme Weather Events and Climate Change Impact on Construction Small Medium Enterprises (SME's): Imbibing Indigenous Responses for Sustainability of SME's', Journal of Earth Science and Climate Change, 5(1), pp. 173.
- Ghadge, A., Wurtmann, H. and Seuring, S. (2019) 'Managing climate change risks in global supply chains: a review and research agenda', International journal of Production Research, 58(1), pp. 44-64. Available at: <https://doi.org/10.1080/00207543.2019.1629670>
- Graci, S. and Dodds, R. (2008) 'Why Go Green? The Business Case for Environmental Commitment in the Canadian Hotel Industry', Anatolia: An International Journal of Tourism and Hospitality Research, pp. 251-270. doi: <https://doi.org/10.1080/13032917.2008.9687072>
- Halldorsson, A. and Kovacs, G. (2010) 'The sustainable agenda and energy efficiency: logistics solutions and supply chains in times of climate change', International journal of physical distribution and Logistics Management, 40(2), pp. 5-13.
- Hoffman, A. and Woody, J. (2008) Climate Change: What's Your Business Strategy?.Massachusetts: Harvard Business press, Boston, pp. 115.
- IPCC. (2007) Climate Change 2007: The Physical Science Basis. Fourth Assessment Report of the IPCC, S. SolomonD. Qin, M. Manning, Z. Chen, M. Marquis, K. B. Averyt, M. Tignor, and H. L. Miller, (eds). Cambridge, U.K.: Cambridge University Press, pp. 996.
- Jaroszweski, D., Hooper, E. and Chapman, L. (2014) 'The impact of climate change on urban transport resilience in a changing world', Applied Meteorology and Climatology, 38(4), pp. 448– 463. doi: 10.1177/0309133314538741.
- Jena, S. K. and Jog, D. (2016) 'Price competition in a tourism supply chain', Tourism Economics, 23(6), pp. 1235–1254. doi: <https://doi.org/10.1177/1354816616674611>.
- Karl, T.R. and Trenberth, K.E. (2003) 'Modern global climate change : Science ', 302(5651), pp. 1719–1723. doi: 10.1126/science.1090228
- Kara, M., Ghadge, A. and Bititci, U. (2020) 'Modelling the impact of Climate change on Supply chain performance', International Journal of production research, pp. 1-19. doi: 10.1080/00207543.2020.1849844.
- Kimura, F. and Ando, M. (2005) 'Two-dimensional Fragmentation in East Asia: Conceptual Framework and Empirics', International Review of Economics and Finance, 14(3), pp. 317–348. doi: <https://doi.org/10.1016/j.iref.2004.12.005>
- kolk, A and Pinkse, J (2007) ' Multinationals' Political activities on Climate change', Business and Society, 46(2), pp. 201-228. doi: <https://doi.org/10.1177/0007650307301383>
- Koenig, U. (1998) Tourism in a Warmer World: Implications of Climate Change Due to Enhanced Greenhouse Effect for the Ski Industry in the Australian Alps. Zurich: University of Zurich, pp.28.
- Levitus, S., Antonov, J. and Boyer, T. (2005) 'Warming of the World Ocean, 1955– 2003, Geophysical Research Letters, 32, L02604. doi: 10.1029/2004GL021592.
- Maletha, A., Phondani, P. C. and Bhatt, G. C. (2017) 'Socio-ecological vulnerability: assessment and coping strategy to environmental disaster in Kedarnath valley, Uttarakhand, Indian Himalayan Region', International Journal of Disaster Risk Reduction. pp. 46. doi: 10.1016/j.ijdrr.2017.09.002.
- Mann, M.E., Zhang, Z., Rutherford, S. and Bradley, R. S. (2009) 'Global signatures and dynamical origins of the Little Ice Age and Medieval Climate Anomaly', Science, 326(5957), pp. 1256-1260. doi: 10.1126/science.1177303

- Mata-lima, H., Alvino-Borba, A., Pinheiro, A., Mata-Lima, A. and Almeida, J. A. (2013) 'Impacts of Natural Disasters on Environmental and Socio-Economic Systems: What makes the difference?', *Environmental Quality Management*, 16(3), pp. 45-64.
- Mayer, J. D., Roberts, R. D. and Barsade, S. G. (2008) 'Human abilities: Emotional intelligence', *Annual Review of Psychology*, 59, pp. 507-536.
- McEntire, D. A. (2001) 'Triggering agents, vulnerabilities and disaster reduction: Towards a holistic paradigm', *Disaster Prevention and Management: An International Journal*, 10(3), pp. 189-196. doi: 10.1108/09653560110395359.
- McEntire, D., Crocker, G. and Peters, E. (2010) 'Addressing vulnerability through an integrated approach', *International Journal of Disaster Resilience in the built Environment*, 1(10), pp.50- 64. doi: 10.1108/17595901011026472.
- Miao, X. and Banister, D. (2012) *Coping with natural disasters through resilience*, Oxford: University of Oxford. Working Paper No. 1059. Available at: <http://www.tsu.ox.ac.uk/>.
- Mills, B. and Andrey, J. (2002) 'Climate change and Transportation: Potential Interactions and Impacts'. pp. 12.
- Moretti, L. and Loprencipe, G. (2018) 'Climate change and transport infrastructures: State of the art', *Sustainability*, 10(11). pp.18. doi: 10.3390/su10114098.
- Munim, Z.H., Azmat, M. and Dorfer, B. (2015) 'Impact Of Man-Made Disasters On Commercial Logistics', *International Journal of Economics, Commerce and Management*, 3(6), pp. 128.
- Noy, I. and Bang, T. (2010) 'Journal of Asian Economics The economics of natural disasters in a developing country: The case of Vietnam', *Journal of Asian Economics*, 21(4), pp. 345-354. doi: <https://doi.org/10.1016/j.asieco.2010.03.002>
- Paavola, J. and Adger, W. N. (2006) 'Fair adaptation to climate change', *Ecological Economics*, 56(4), pp. 594-609. doi: <https://doi.org/10.1016/j.ecolecon.2005.03.015>
- Patankar, A. (2020) 'Impacts of Natural Disasters on Households and Small Businesses in India', *SSRN Electronic Journal*, 603 pp. 38. Available at: <http://dx.doi.org/10.2139/ssrn.3590902>
- Persic-Zivadinov, I. and Blazevic, B. (2010) 'Sustainable Hotels: Sustainable Life Cycle Practice In Croatian Hotels', *Tourism and Hospitality Management*, pp. 161-177.
- Rosenzweig, C. and Solecki, W.D. (2001) 'Climate change and a global city: Learning from New York', *Environment*, 43(3), pp. 8-18. Available at: <https://pubs.giss.nasa.gov/abs/ro07800y>.
- Scott, D. and Becken, S. (2010) 'Adapting to climate change and climate policy: progress, problems and potentials', *Journal of Sustainable Tourism*, 18(3), pp. 283-295. doi: <https://doi.org/10.1080/09669581003668540>
- Scott, D., Freitas, C. D. and Matzarakis, A. (2008) *Adaptation in the tourism and recreation sector*. In: *Biometeorology for adaptation to climate variability and change* [K. Ebi, I. Burton and G. McGregor (eds.)], Dordrecht, Springer, Netherlands, pp. 171-194.
- Schreider, S.Y., Smith, D.I. and Jakeman, A.J. (2000) 'Climate change impacts on urban flooding', *Climatic Change*, 47, pp. 91-115.
- Semenza, J. C. and Ebi, K. L. (2019) 'Climate change impact on migration, travel, travel destinations and the tourism Industry', *Journal of Travel Medicine*, 26(5). doi:10.1093/jtm/taz026.
- Soboll, A., Klier, T. and Heumann, S. (2012) 'The prospective impact of climate change on tourism and regional economic development: a simulation study for Bavaria', *Tourism Economics*, 18(1), pp. 139-157. doi: 10.5367/te.2012.0103.
- Stern, N. (2007) *The economics of climate change. The Stern review*, Cambridge : Cambridge University Press, pp. 576.
- Stern, R. (2006) 'Stern Review on the Economics of Climate Change', HM Treasury, Cabinet Office. Available at: http://webarchive.nationalarchives.gov.uk/+/http://www.hmtreasury.gov.uk/stern_review_report.htm.
- Taylor, T. and Ortiz, R. A. (2009) 'Impacts of climate change on domestic tourism in the UK: a panel data estimation', *Tourism Economics*, 15(4), pp. 803-812. doi: <https://doi.org/10.5367/000000009789955161>
- Thornes, E. (1992) 'The impact of weather and climate on transport in the UK', *Progress in Physical Geography*, 16(2), pp. 187-208. doi: <https://doi.org/10.1177/030913339201600202>

- Tol, R. and Vellinga, P. (1998) 'Climate change, the enhanced greenhouse effect and the influence of the sun: A statistical analysis', *Theoretical and Applied Climatology*, 61(1–2), pp. 1–7. Available at: <https://doi.org/10.1007/s007040050046>.
- Villarroel, M. I. (2013) 'Title: small business Impact of Disasters and building resilience', *Journal of Visual Languages & Computing*, 11(3), p. 112. Available at: [https://www.mculture.go.th/mculture_th/download/king9/Glossary about HM King Bhumibol Adulyadej's Funeral.pdf](https://www.mculture.go.th/mculture_th/download/king9/Glossary%20about%20HM%20King%20Bhumibol%20Adulyadej's%20Funeral.pdf).
- Weiss, M.A., Heywood, J.B., Drake, E.M., Schafer, A., Au Yeung, F.F. (2000) *On the Road in 2020 – A life Cycle Analysis of New Automobile Technologies*. United States: Massachusetts Institute of Technology. Available at: <http://web.mit.edu/energy/energy/pubs/el00-003.pdf>
- Yeoman, I. and McMahon-beattie, U. (2006) 'Practitioner Paper Understanding the impact of climate change on Scottish tourism', *Journal of vacation Marketing*, 12(4).