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**Sustainability Risk Management:
An Exploratory Study**

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Sustainability Risk management: An Exploratory Study

Abstract

There have been significant environmental changes, including climate-related events that are affecting the businesses in India and the world. The impact of these events is estimated to cost the global economy by 20 percent of its GDP over the next few years with serious economic consequences for the business. In spite of such an alarming risk, very little is known on how corporates deal with sustainability in general and environmental sustainability in particular and their linkages to corporate risks in a strategy setting.

This exploratory study attempts to understand the state of environmental sustainability risk disclosures of a select 200 companies listed in the National Stock Exchange of India (NSE). We use content analysis to study the disclosures made in the Annual Report, Business Responsibility Report, Sustainability Reports and other allied reports presented by the companies to understand the levels of disclosures. Further, we study the extent of disclosures by the companies to understand the present state of engagement with environment sustainability and climate change and their integration with the main stream risk management.

Our findings suggest that almost all companies have some basic general disclosures on risks this can mainly be attributed to the mandatory nature of disclosures in the annual report. However, companies do not disclose more than 37% of the total risk categories identified by the research. Only financial risks are discussed in detail. Environment Sustainability risk disclosure is poor, and the quality of disclosure is also low. Disclosures on climate change risks were even more opaque. It appears that the changes in the weather patterns have either not emerged as a significant cause of concern to be disclosed in the risk section or they companies have generally not disclosed the same. We also find that environmental disclosures are not integrated in a more comprehensive in the risk reports. We also find that companies had not integrated sustainability risk into the risk management framework and strategy mainly due to lack of understanding of the direct business impacts (quantification), lack of regulations and stakeholder pressure. Moreover, firms have a short term outlook and are more focussed on quarterly results and profitability in the near term. Though reporting on environmental risks and climate change are weak, companies are taking initiatives on matters such as energy conservation, water, and waste management.

Keywords: Risk Disclosure; Risk Management; Sustainability Risk; Sustainability Disclosure; Climate Risk

“There is enough earth for everybody’s need, but not enough for everybody’s greed.”

Mahatma Gandhi

Introduction

In the last few years, there have been significant environmental changes, including climate-related events that are affecting the businesses in India and the world. The impact of these events is estimated to cost the global economy by 20 percent of its GDP over the next few years (Stern, 2007). In spite of such an alarming risk, very little is known on how corporates deal with sustainability in general and environmental sustainability in particular and their linkages to corporate risks.

The term 'sustainable development' was first discussed in 1987's Brundtland Report (World Commission on Environment and Development) from the United Nations. The report defined sustainable development as the “..development that meets the needs of the present without compromising the ability of future generations to meet their own needs”. Academic papers have used a similar definition in their work and have included the sustainable development aspects of the economy, social well-being, and the environment simultaneously (Breitstone et al., 2007; Krysiak 2009; Faris et al., 2013; Saardchom, 2013). The interconnectedness of financial, social and environmental sustainability is what allows society to satisfy its needs while supporting the ecosystem to continue to regenerate whatever necessary to meet future needs and not diminish the same (Morelli, 2011).

Environmental sustainability (ES) seeks to “sustain global life-support systems indefinitely” (Goodland, 1995) and includes natural resources that are essential to maintain human life such as atmosphere, water, and soil, air food, energy without which our existences is not viable. Environmental sustainability from a business perspective as described by Holland (2003), is a systemic approach that allows economic activity to be bounded by environmental limits. ES covers a gamut of issues ranging from increasing carbon emission (air), water crisis (water), loss of green cover (atmosphere), loss of biodiversity, and so on. ES has become a cause of concern resulting from indiscriminate development activities, large scale industrialization, increased greenhouse gas emission leading to the emergence of unpredictability of risks related to sustainability and growth (Bui & de Villiers, 2017; Intergovernmental Panel on Climate Change 2007).

Recognising the importance of the issue regulators around the world have mandated disclosures on environmental and social matters. The Non-Financial Reporting Directive (2014/95/EU) European Commission requires large public interest entities to disclose on environmental protection in their annual reports from 2018 onwards¹. The European Commission published guidelines to help companies disclose environmental and social information and additional

¹https://ec.europa.eu/info/business-economy-euro/company-reporting-and-auditing/company-reporting/non-financial-reporting_en

guidelines on reporting climate-related information. In March 2018 the Commission published the Action Plan on Financing Sustainable Growth, with the aim of reorienting capital towards sustainable investment, managing financial risks that arise from climate change and other environmental and social problems, and fostering transparency and long-termism in financial and economic activity. The UK's Companies Act 2006 (Strategic Report and Directors' Report) Regulations SI 2013/1970 requires companies to prepare a strategic report as part of their annual report. This report should recognize the environmental risks and uncertainties². The United Nations Sustainable development goals (SDG)³, are based on the perspective that the economic growth of a country cannot be achieved without ending poverty, hunger, and other deprivations. At the same time preserving our natural capital such as the oceans and forests and tackling climate change is an essential aspect of sustainable development (see SDG 13 on climate action; SDG 14; life below water; SDG 15 Life on land) as this will have a direct impact on the way we can achieve social and economic development.

In India, the Government has released the National Guidelines on Responsible Business Conduct, 2019 (NGRBC), building on the earlier National Voluntary Guidelines on Social, Environmental & Economic Responsibilities of Business, 2011 recognizing in it Principle 6, Businesses should respect and make efforts to protect and restore the environment. The emphasis on the environmental aspects such as pollution, biodiversity conservation, sustainable use of natural resources and climate change are in alignment with the Sustainable Development Goals. From a broader societal perspective, sustainability is the key driver for development. Social sustainability cannot be achieved if there are issues in the ecosystem that provides life-sustaining resources. Any sustainable development requires business transformation, particularly with respect to the way products and services are produced and sold.

One of the most significant risks of environmental sustainability is climate change. While businesses have reaped the benefits from nature, considerable strains have been put on the environment from its associated economic activities. Business activity and productivity require ecological inputs in the form of raw materials, energy, and the ecosphere's ability to absorb wastes and pollution generated (Ekins and Max-Neef, 1992). These economic activities create demand or need for resources on the one hand while on the supply side, there are challenges that will prevent the ability of nature to meet future demands (Soomro and Lai, 2017). The inability to meet future requirements creates a risk that can impact a company's profitability, success, and even its survival. Schulte and Hallstedt, (2017) find that some of the top business risks today are directly related to sustainability and yet they are not identified and managed. It is thus evident that a lack of sustainable practices could become part of corporate risk.

Corporate risk management (enterprise risk management) has received significant attention in recent years as a consequence of major corporate failures in the early part of the century and later the fall of investment banks, including Lehman brothers and others around 2008 (Linsey

² <https://www.icaew.com/-/media/corporate/files/technical/sustainability/tecp1n12453-eiafr-annual-report-2nd-edition-final.ashx?la=en>

³ <https://sustainabledevelopment.un.org/?menu=1300> accessed on 15 March, 2019

and Shrives, 2006; Power, 2004). Firms operate in a volatile, complex and uncertain environment, exposed to a variety of risks in technology, regulatory, strategic and operations risks affecting its financial performance. Risks are part of everyday business activity and structured risk management helps managers to understand risks in terms of its consequences and mitigation measures (Subramaniam et al., 2015).

Earlier on, firms primarily managed financial risks such as liquidity risk, interest risk, and foreign currency fluctuation risk and through a silo approach. In the recent times, companies have a more holistic approach through a framework called Enterprise Risk Management (ERM). ERM can be defined as the “The culture, capabilities, and practices, integrated with strategy-setting and its execution, that organizations rely on to manage risk in creating, preserving, and realizing value”⁴ ERM is driven by the board of directors and applied in strategy settings. It involves identifying and addressing potential risk events that may hamper the attainment of strategic objectives and adopt strategies to mitigate them. Implementing in a strategy-setting is the fundamental approach to risk management as most of the risks starts with the company’s strategy and its business objectives. A systematic approach to risk management helps an organization manage uncertainties and their impact on firms' economic performance in a better manner (Linsley and Shrives, 2006; Carlin & Mayer, 2003). Effective risk management also helps in reducing the cost of capital (Berry-Stölzle and Xu, 2016). Until recently, emerging risks in the areas of environmental, social and governance (ESG) (also referred to as sustainability) were not an integral part of the risk management framework and had received scant attention. However, recent events related extreme weather events, water crisis, draughts etc., have highlighted the importance of ESG risks and investors have realized the critical nature of the risks and how it will affect the performance of the business. With the effects of sustainability risks becoming more pronounced, the demand for information about how corporate activity exposes or contributes to long-term sustainability has become critical to the investors. Risk reporting by companies improves transparency, and it gives a complete (or 360-degree view) of the business and reducing information asymmetries (Szegő, 2002; Beretta and Bozzolan, 2004; Mohobbot, 2005) while assuring the investors that the risks are managed effectively (DeLoach, 2000). Further, the narrative disclosure helps investors to validate the financial numbers (Chungh & Meador, 1984), and also provide insights into the value drivers (Robb, Single, & Zarzeski, 2001). Investors need to understand the risks a company is exposed to and the firm’s action plan to capitalize on emerging opportunities. Investors, customers and other stakeholders in the advanced economies are demanding disclosure of ESG risks, particularly those relating to climate change. In 2015, regulators investigating Exxon Mobil, reprimanded them for not informing both investors and the public about its climate change risks posed by the company’s operations.⁵ Many regulatory bodies around the world have mandated risk reporting (e.g., SEBI,2001; ICAEW, 1997, 2011; SEC, 1997, 2010). There are guidelines available for sustainability reporting in the form of <IR> Integrated reporting, SASB’s Sustainability, Carbon Disclosure Projects (CDP) reporting,

⁴ www.coso.org accessed on 15 Sept, 2017

⁵ <https://www.nytimes.com/2015/11/06/science/exxon-mobil-under-investigation-in-new-york-over-climate-statements.html>

CDSB Framework for climate related financial disclosure in main stream reporting, and the National Guidelines on responsible business conduct, 2019 (India) . In this paper, we analyse the disclosures related to environmental sustainability in the annual report and other reports disclosed by the companies.

This paper explores the three facets of the sustainability viz. sustainability risk, sustainability initiatives and sustainability disclosures. Based on the annual report, interview and prior research, this paper aims to provide preliminary evidence on the extent to which firms identify, manage sustainability risks, and sustainability practices into their core operations and risk management framework. Prior research has found that sustainability and risk management processes have been implemented as disparate initiatives and have not been integrated as part of strategy (Beasley and Showalter, 2015). Our study is relevant in many ways. First, as a significant emerging economy, there are several differences in the context and the sustainability elements as compared to the developed nations (Boso et al., 2017) and hence a study of this nature will help frame future policies relevant to the country. Second we study the nature of environmental disclosure not only in terms of the items disclosed, but also evaluate the quality of the disclosures. We also attempt to capture the sustainability risks and try and create a matrix of its linkages with business drivers.

The paper addresses the following questions related to environmental sustainability risk management practices.

Specifically,

- a) What are companies reporting under risk management practices in their annual report and whether environment sustainability is included as part of the same?
- b) To what extent environment sustainability is an integral part of the business activity, and is it integrated into the strategic decision-making process?
- c) To understand if climate change is part of the sustainability discourse in the organization and the critical challenges for businesses to identify and report on the issue.

The rest of the paper is organized as follows. In Section 2, we survey prior research on environmental sustainability and climate change and present the evidence on the business and societal impacts. In section 3, we discuss the methodology and data for the research. In section 4, we discuss our results, and in the last section, we offer some inferences and conclusion.

Section 2: Literature Review

2.1 Environmental Sustainability: The changing dynamics

Global awareness about sustainability has increased dramatically in recent years. As the consciousness of the negative impact on the earth has grown, so has a widespread recognition of the threat posed by maintaining unsustainable behaviours and processes. The ability of natural resources to sustain human life is threatened by human activities such as use of fossil

fuels and the consequent emission, extractive processes and generation of wastes. As a consequence, the ecological balance has been threatened and environmental risks have increased manifold. Since 2011, a cluster of interconnected environmental risks such as extreme weather events, natural disasters, failure of climate change mitigation and adaptation, water crisis, and social instability has consistently featured among the top-ranked global risks in the World Economic Forum's Global Risk Report.⁶

Scientific community has acknowledged that the climate change events have mainly been driven by increase in greenhouse gases (GHG) in the atmosphere, mainly carbon dioxide, methane etc. These emissions are as a result of burning of fossil fuels such as oil and gas and others such as deforestation.⁷ Fossil fuel is consumed for producing electricity, transportation, building and others which are the main sources of emission. The evidence on climate change and extreme weather events are overwhelming. Extreme abnormal weather is the difference between observed weather and its "normal value," which is calculated using the 30-year average (Jean & Miia, 2017). Globally extreme weather events are responsible for many significant impacts, in terms of both casualties and economic effect (CRED, 2015). As per Aon's (Weather, Climate & Catastrophe Insight 2017 Annual Report), the year 2016 was the 41st consecutive year of above-average global land and sea surface temperatures and the third-warmest year ever recorded in the last 135 years. The report further mentions that the global average temperature was 1 degree Celsius above the 1880–1999 average and that the five of the warmest years dating to 1880 have occurred since 2010. The report by Intergovernmental Panel on Climate Change (IPCC) states that the average temperature around the globe is stated to increase by 3 to 5 degrees celsius (IPCC 2013). Even more disturbing fact is that 18 out of the 19 warmest years have been registered since 2001 (other than the year 1998) (Aon, 2018). The report "The Human Cost of Natural Disasters 2015-A global perspective" by CRED(Centre for Research on the Epidemiology of Disasters) reported that the frequency of geophysical disasters (earthquakes, tsunamis, volcanic eruptions and mass movements) remained broadly constant throughout 1995-2014 period, but a sustained rise in climate-related events (mainly floods and storms) pushed total occurrences significantly higher (CRED, 2015). The World Meteorological Organization reports that the average global temperature was highest between the years 2013-17. Schilling (2018) found that a one degree of increase in a single day's temperature and for temperatures above 20 °C, causes ~70 suicides in the country⁸, also recognizing that high temperature may have caused several thousand suicides in India. While one may argue against the agricultural-based explanations, climate-related damages are real and here to stay. Recent research by Ricke et al. (2018) establishes that India will face considerable damage due to climate change apart from the US and Saudi Arabia. Globally, it is estimated that delays in addressing climate change will result in a financial risk of nearly \$1.2 trillion over the next 15 years. Climate change and extreme events such as Hurricanes Katrina, Rita, and Wilma in 2005, the four Florida hurricanes in 2004, and flooding in Europe, Africa, Central America and China are some examples of such events. Most recent

⁶ <https://www.weforum.org/reports/the-global-risks-report-2019>

⁷ https://science2017.globalchange.gov/downloads/CSSR2017_FullReport.pdf accessed on 20/7/2019

⁸ Mary Kaye Schilling <https://www.newsweek.com/2018/08/24/india-drought-suicides-climate-change-farmers-skulls-heat-disaster-1072699.html> accessed on 28/10/18

issues, such as the water crisis in Chennai⁹ or heat wave in Delhi and other parts of north India,¹⁰ the flash floods in Kerala are examples of how the environment can strike back.

Climate change is expected to increase the average temperature; risk of events such as flooding, storms, rise in sea levels, droughts, and heatwaves, pressure on water and food production, human health risks, mass species extinction, the acidification of the oceans and even making large parts of land uninhabitable (UNESCO, 2009; Hansen, 2009; Mann & Kump, 2015; Aon, 2018). These events not only affect individuals and business property, they also affect the way in which business is done.¹¹ Extreme weather events in both in India and the world are given in Annexure 1.

Prior research has indicated that firms focussing on environment sustainability reap benefits such as increased availability of finance, reduction in cost of capital and overall improved firm performance (Amankwah-Amoah, Danso, & Adomako, 2018; Golicic & Smith, 2013; Zailani, Eltayeb, Hsu, & Tan, 2012). In a developing economy where low-cost strategies are preferred, a proactive ES strategy also drives innovation, thereby enhancing the competitiveness of the business and resulting in better performance (Danso et al., 2019; Acquaaah, 2007). Many organizations are responding to climate change by focussing on reducing emissions, managing energy consumption, and in various areas such as water conservation/recycling, etc. Initiatives including those for attaining carbon neutrality are driven by cost reduction targets or for improvement of productivity rather than environment sustainability (Dauvergne & Lister, 2013). Major changes have also been initiated by regulation, rather than a firm's own view on environmental sustainability (Banerjee, 2003).

In spite of the initiatives, businesses have noted considerable challenges and conflicts that arise in the process of achieving sustainability. For example, what should be done and when should we take the action? Further, the idea of sustainability is based on ethical aspects of business raising question such as, (i) why should firms care about other species and future generations and (ii) who should bear the cost particularly when the benefits are enjoyed by many. Companies also perceive an increased cost in the short run when pursuing sustainable practices. Businesses often have to trade-off between short term and long term profitability, deal with insufficient information, and are unable to integrate environmental sustainability into the strategic decision-making process (Schulte and Hakkstedt 2017). If a firm has to choose between profitability and societal goals they would normally favour profitability goals (Van der Byl & Slawinski, 2015). There are certain aspects sustainability that cannot be expressed in quantitative terms as well. Firms believe that too much focus on the environment and social causes may affect the financial strength of the business and that may affect the future (Nidumolu et al. 2009).

⁹ <https://timesofindia.indiatimes.com/city/chennai/chennai-faces-acute-water-crisis/articleshow/56325453.cms> accessed on 30/6/19

¹⁰ http://timesofindia.indiatimes.com/articleshow/56325453.cms?utm_source=contentofinterest&utm_medium=ext&utm_campaign=cppst accessed on 28/5/18

¹¹ <https://timesofindia.indiatimes.com/city/chennai/no-water-work-from-home-it-cos-tell-staff/articleshow/69763283.cms> accessed on 28/6/19

While some businesses understand the critical nature of environmental-related risks that can impact a company's profitability, success and even survival, some business see the same as an opportunity for innovation to tackle the issue of carbon emission. Leveraging a company's risk management processes can identify, assess and mitigate environment sustainability risks.

2.2 Link between Sustainability and Risks

Corporate sustainability is linked to corporate risk. Companies that focus on sustainability are primarily engaging in activities that avoid future problems to themselves and act as a defence against adverse events. (Godfrey et al. 2009). Risk management allows more general and structured support to companies in order to prevent uncertain events affecting the organization in an adverse manner (Mejía, Núñez, & Martinz, 2017). A more integrated approach to measuring and managing risks is known as Enterprise Risk Management (ERM). ERM is a process that manages all risks in an integrated and holistic manner by controlling and coordinating risks throughout the company (Thomas, Berry, & Jianren, 2018). ERM helps companies manage their risks in a more systematic way and also bring issues to the attention of the board (Quon, Zeghal, & Maingot, 2012). The process of risk management includes identification, monitoring and managing on a continuous basis (Stulz, 2008).

Traditionally, companies have focussed more on financial risks and its management and scant attention paid to sustainability risks. A survey of institutional investors by Ernst and Young, revealed that companies have failed to consider environmental and social risks and opportunities as core to their business.¹² Companies have sustainability offices and professionals working to address environment sustainability, but they are still not integrated into risk management discussion. ERM frameworks had also not addressed sustainability issues unless they have been part of the financial or compliance risk.

Nevertheless, sustainability risk management has gained considerable attention recently, as it influences long-term firm performance (Anderson, 2006; Bui & de Villiers, 2017; Lenssen, A. Dentchev, & Roger, 2014). For example, sustainability assessment of the supply chain incorporates social, health and safety, environment and pollution control measures, and human rights aspects including assessing of risks related to climate, natural disasters and water scarcity (Giannakis and Papadopilos (2016) Many businesses have turned sustainability risks to their advantage as well (Saardchom, 2013).

There are some inherent challenges for integration. Sustainability risks are difficult to measure and the link between the long-term and the near term sustainability risks are unclear (Bromiley et al., 2015). Businesses are yet to take a proactive stand and approach to sustainability risks

¹² EYGM Limited. (2017). Is your nonfinancial performance revealing the true value of your business to investors? Retrieved from EY: [http://www.ey.com/Publication/vwLUAssets/EY_-_Nonfinancial_performance_may_influence_investors/\\$FILE/ey-nonfinancial-performance-may-influence-investors.pdf](http://www.ey.com/Publication/vwLUAssets/EY_-_Nonfinancial_performance_may_influence_investors/$FILE/ey-nonfinancial-performance-may-influence-investors.pdf)

and initiatives to avoid conflicts and lower threats and also create future business opportunities. In this paper we explore link between environmental sustainability and risk management.

2.3 Disclosures

The purpose of corporate disclosures is to communicate the firm's performance to investors and other stakeholders for effective decision making. There is no commonly acceptable definition of performance but, traditionally this has meant financial performance, mainly from a shareholder perspective. There is a growing recognition that disclosure of financial performance is necessary but not sufficient as the business needs to rely on social and environmental inputs for the business outcomes. Thus, resulting in companies wanting to disclose to the other stakeholders as well to demonstrate their legitimacy and good corporate citizenship. Legitimacy theory suggests that companies disclose information (or send other signals) on sustainability to ensure that their activities are acceptable to the larger society particularly, the firms response to environmental issues (Patten, 1992; Deegan and Rankin, 1996). Recent surveys of institutional investors including pension funds revealed a strong demand for increased corporate risk disclosure.

Given the importance of environmental sustainability and climate change, disclosure of information becomes relevant and important from two perspectives: i) Disclosures to reap benefits and ii) Disclosures to avoid litigation (particularly in countries such as the US).

Disclosures on sustainability risks and initiatives are useful as they help investors assess the future risks, and the initiatives taken will have an impact on the future performance of the business. Sufficient evidence exists that voluntary environmental disclosure quality is associated with firm value through both the cash flow and the cost of equity components (Plumlee et al. 2015, Clarkson et al. 2013). Shad et al. (2019) show that sustainability reporting has a moderating effect between ERM implementation and business performance. Non-financial risk management disclosures could also be valuable to investors as it reduces the information asymmetry (Miihkinen, 2013; Gordon et al., 2010).

Studies have stated that not only markets penalize a firm for their carbon emissions but also impose a penalty for non-disclosure of that information (Matsumura et al., 2014; Clarkson et al. 2013; DiMaggio & Powell, 1983). While there are associated benefits for disclosures, firms may not have an incentive to disclose as the information may be sensitive and may be subjected to more scrutiny (Suijs, 2007) and firms may believe that disclosures decrease the future value of the company.

As the impacts of climate change become increasingly severe companies are incurring huge losses /expenses in the form of disrupted operations and other indirect impacts. Yet these vulnerabilities are not acknowledged by companies. A general argument on sustainability disclosure is focussed on other stakeholders but it is quite evident that these disclosures are equally important to the investors. When investors invest in such companies they are potentially ignorant about the risks that climate change pose for the company and thereby the

investments. Researchers have argued that climate risks are within the scope of mandatory disclosures and cautioned companies to disclose information to avoid fines and litigation (Wasim, 2019).

In India, the Business Responsibility Report (BRR) is mandated by the Securities Exchange Board of India (SEBI) for top companies listed in the Indian Stock exchanges to improve companies reporting on the environment, social and governance perspectives. Further, forming a risk committee of the board is mandated for top 100 companies listed in the stock exchange. The Companies Act 2013 mandates that the Board of Directors report should include a “statement indicating development and implementation of a Risk Management Policy for the company, including therein, identification of elements of risk, if any, which in the opinion of the Board may threaten the existence of the company”¹³. Conservation of energy also needs to be reported. Companies in India are disclosing information on sustainability in the Annual Report (AR) and the Carbon Disclosure Project (CDP) Sustainability Reports (SR), Integrated Reports<(IR> and other standalone documents. Arguably, there has been no standard format or content for reporting in some of the reports.

Most existing studies of risk-related disclosures are based on empirical evidence from Anglo-Saxon and other developed countries (Abraham and Cox, 2007; Carlon *et al.*, 2003; Deumes and Knechel, 2008; Kajüter, 2006; Lajili and Zéghal, 2005; Lajili, 2007; Linsley and Shrives, 2006) and very few studies have been undertaken with Indian data. A recent review of Indian companies has revealed that reporting of ESG risks is abysmal in India and lags significantly behind other companies in the ASEAN region.¹⁴ This paper investigates the state of disclosures on sustainability and risk management.

Conclusion:

Environmental sustainability is gaining considerable importance all over the world, particularly in developed nations. Recent research by academicians as well as intuitions like the World economic forum have indicated that risks related to environmental sustainability are among the top risks that businesses would face in the near future. Given the alarming sustainability challenges that the world will face (or is facing) inaction will only mean irreversible damages to the human existence. The best way for organisations to deal with sustainability is to link the same with main stream risk management framework. Disclosure are relevant and useful to investors, they demonstrate company’s good citizenship and the improve overall financial performance through better access to finance and reduced cost of capital. Sustainability risk disclosure needs further study.

¹³ Section 134 (3)(n) of the Companies Act, 2013

¹⁴ <https://www.irmagazine.com/reporting/indian-firms-must-do-more-sustainability-disclosure>

Section 3 Research Methodology

3.1 Methodology

The sample used for this research comprises data from companies listed on the National Stock Exchange of India for the year financial year 2016-17. The sample consists of Nifty 100 (LCAP) and Nifty Small Cap 100 (SCAP). Our final sample consists of 200 companies. Since annual reports are insufficient to meet non-financial disclosures, companies have been providing additional information through other reports (Adams et al. 2011; Cohen et al. 2012; KPMG 2011; Cohen et al. 2012, Simnett et al. 2009). The data on risk disclosures and environmental sustainability were hand collected from the company's Annual Report (AR) and Business Responsibility Report (BRR) and Carbon Disclosure Project (CDP) report on climate change risks from the CDP website. We also accessed information from the Sustainability Reports (SR), Integrated Reports (IR) and any other standalone documents available on the company's website. The Business Responsibility Report is mandated by the Securities Exchange Board of India (SEBI) for top companies listed in the Indian Stock exchanges to improve companies reporting on environment, social and governance perspectives. The Management discussion and analysis (MDA) in the annual report mandates "a statement indicating development and implementation of a risk management policy for the company including identification therein of elements of risk, if any". However, no particular format or content is mandated. Sustainability reporting is a voluntary approach rather than a mandatory requirement. Companies publish sustainability reports to showcase accountability to stakeholders and build confidence in global stakeholders (Mitra P.K, 2012). Companies that aspire to get listed in sustainability indices globally, like Dow Jones Sustainability Indices, also present the sustainability report on their website. The data collected by CDP is being used by various indices such as S&P BSE Carbonex Index, Dow Jones Sustainability Indices (DJSI), etc. These indices rank companies based on their sustainability performance and accelerate responsible investment (Abhishek Rajdeep, 2017). Major Indian banks (including SBI, HDFC, IndusInd Bank, IDBI), are signatories. The Integrated Reporting <IR> framework identifies six capitals; Financial; Manufactured; Intellectual; Human; Social and Relationship; and Natural (IIRC, 2013). <IR> is a voluntary initiative by companies, but is gathering momentum

Given that we have to hand collect the data from several reports, we have restricted our sample to one year i.e. the year 2017. A content analysis of the reports was undertaken to understand the degree of disclosure. Content analysis is widely used in the disclosure literature to identify and code data related to specific topics of disclosure, including environmental, social, and other qualitative disclosures (e.g., Guthrie & Parker, 1990; Milne & Adler, 1999; Zeghal & Ahmed, 1990, Lajili & Zeghal 2005). Content analysis is used to measure both the volume and extent of disclosure. Prior literature have used measures such as number of sentences or words or even number of pages to determine the level of disclosure (Linsey and Shirves, 2006; Lajii and Zeghal, 2009; Nelson and Pritchard, 2007). This method measures the quantity of disclosure rather than the quality of disclosure. We overcome this limitation by constructing (i) Risk Disclosure Index (RDI) that measures the overall disclosures and (ii) Environmental Sustainability Risk Disclosure index (ESRDI) based on the firm-specific disclosures on

environmental risk made in the various reports. The methodology is used by several researchers to measure the extent or quality of risk disclosures (Cabedo & Terado, 2009; Semper and Terado, 2014).

We first identify the general risk management disclosures items. These include stating the existence of risk management policy, board oversight, presence of risk committee, risk audit, risk framework, frequency of risk committee meeting. General disclosures indicate a formal process of risk management in the company and that top management is monitoring the risks. Second, we identify the categories of risks reported by the companies. Categorizing risks into different types can help a business in many ways, including managing risks by reducing the probability of occurrence or minimizing the impact. We identify risk categories based on prior academic research, existing risk frameworks and interviews with risk management professionals. Risk categories include strategic risk, operations risk, financial risk, and risks related to governance and compliance. Risk categories are listed in **Annexure 2**.

Next, we measure the degree of risk disclosure. Mere disclosure of the risk is not sufficient and therefore we measure the degree (or the depth) to which the disclosures were being made. We follow the method stated in (Cabedo and Tirado, 2009), we code the degree of disclosures on a five-point scale as described below.

Degree of Risk Disclosure

Score	Criteria
0	No Disclosure
1	Risks categories disclosed or with some minimum explanation
2	Description of the risk and how the risk affects the business (not company-specific)
3	Description of the risk with an explanation of how the company will be impacted
4	Description of the Risk Management process (that includes any two of (a) Identification, (b) impact and (c) mitigation measures).
5	Description of the Risk Management process in greater detail, including company-specific information (Identification, impact and mitigation measures).

The total risk disclosure score with twelve risk categories of risk and scores ranging from 0 to 5, thus, can take values between 0 and 60. The scoring pattern is such that the disclosure should be relevant to the company's activities and not mere general statements.

Next, we identify the twelve environmental risk categories. To develop the environmental risk categories, we use the definitions given in the introduction, prior literature (Dobler, Lajili & Zeghal (2014), sustainability frameworks (DJSI, 2018, WEF, 2018)¹⁵ and through interviews of risk management professionals. The list of categories related to environmental disclosures

¹⁵ SDG (2015), WEF Risk Report 2018

is given in **Annexure 3**. We code the environmental disclosure based on the scoring pattern explained above. The total risk disclosure score with twelve risk categories and code ranging from 0 to 5, thus, can take values between 0 and 60 and allows for rich variety of environment disclosures from this study.

To validate our analysis, we also floated a survey which was followed up with an interview of risk professionals and sustainability officers of ten companies. The questionnaire was prepared after discussion with academicians and risk professionals working in the field. The interviews of chief risk officers and academicians¹⁶ working in the area were to understand issues and challenges related to environmental risk identification, quantification and reporting, integrating environmental risk into enterprise risk management (ERM) and strategic decisions, and making it a board-level /top management issue.

All content analysis are subjective in nature and therefore needs to be reliable for valid conclusions. For this purpose, we use the approach taken by Krippendorff (1980, 2004), where three types of reliability are identified. Initial coding was done by a research associate with coding experience. The research objectives and risk management disclosures were discussed with the research associate. The stability of the data was tested by the coder repeating the coding process after a gap in time period (Jones and Shoemaker, 1994). The same subset of data was given to an external researcher to code to check for accuracy.¹⁷

3.2 Data

The data on risk disclosure was obtained from the Annual Reports (AR), Integrated Reporting (IR), Sustainability Reports (SR), Carbon Disclosure Project (CDP) reports, and Business Responsibility Reports (BRR). These reports reflect all the information on risks that companies disclose. There is no regulatory obligation to disclose risk information in any particular format or place, leaving it to the company to decide where and how much to present the information on risks. Reports published by companies giving risk details are given in Table 1.

Table 1: Reports published by companies

Reports	AR	BRR	IR	SR	CDP
Nifty 100 (LCAP)	99	90	5	38	26
Nifty Small Cap 100 (SCAP)	100 (97)	84	0	3	3

Sustainability reports are published by only 38 percent of LCAP and 3 percent of SCAP companies in the sample. CDP is published by only 26 percent of the LCAP and only 3 percent of the SCAP companies.

¹⁶ Faculty from Divecha center for climate change, Indian Institute of Science Bangalore.

¹⁷ To test the code derived from 3 methods for reliability, we perform the Krippendorff alpha (Hayes and Krippendorff, 2007) calculated between the coding sets was .8 indicating the reliability of the scores.

The sector representation is shown in Table 2. A total of 16 sectors has been identified in our sample. The largest representation is from the financial services followed by consumer goods.

Table 2: Sample composition by Sectors

Industry	LCAP	SCAP	Total	BRR	SR	CDP
Automobile	10	2	6%	11(5.5%)	4(2%)	2(1%)
Cement & cement products	5	3	8 (4%)	8(4%)	3(1.5%)	2(1%)
Chemicals	1	7	8 (4%)	4(2%)	1(.5%)	0
Construction	2	9	11(5.5%)	11(5.5%)	1(.5%)	2(1%)
Consumer goods	13	11	24(12%)	23(11.5%)	7(3.5%)	3(1.5%)
Energy	11	3	14(7%)	13(6.5%)	5(2.5%)	2(1%)
Fertilisers & pesticides	1	5	6(3%)	6(3%)	1(.5%)	0
Financial services	23	19	42(21%)	35(17.5%)	3(1.5%)	8(4%)
Industrial manufacturing	4	8	12(6%)	7(3.5%)	1(.5%)	0
Information technology	6	7	13(6.5%)	13(6.5%)	5(2.5%)	4(2%)
Media & entertainment	2	1	3(1.5%)	3(2.5%)	0	0
Metals	8	5	13(6.5%)	11(5.5%)	5(2.5%)	4(2%)
Pharma	8	4	12(6%)	12(6%)	1(.5%)	1(.5%)
Other services	3	6	9(4.5%)	7(3.5%)	2(1%)	0
Telecommunication	3	2	5(2.5%)	4(2%)	2(1%)	0
Textiles		8	8(4%)	6(3%)	0	1(.5%)
Total				174	41	29

Out of the sample, 87% of the companies publish the BRR report (being mandatory in nature). The CDP and sustainability reports are published by 21% and 14% of the companies respectively.

Section 4: Results

4.1 General Risk Disclosures

Almost all companies disclose some information on risks ie. General disclosure. We find that LCAP companies on an average disclose 77% of the parameters while SCAP companies disclose 65% of the items. Companies are disclosing at least one parameter of general item which indicates that risk management exists and top management is having a systematic process in place. Table 3A summarises the overall general disclosures of risk management parameters.

Table 3A. Overall General Disclosure

General Disclosures	LCAP	SCAP
Mean	0.77	0.64
Max	1	1
Min	0	0.16

Table 3B: Percentage of Companies making General Risk Disclosure (GD)

General Disclosures	LCAP %	SCAP %	TOTAL %
Risk Policy	77	79	78
Board Monitoring	63	71	67
Presence of Risk Committee	98	74	86
Internal Review /Monitoring	78	68	73
Meeting of Risk Committee	62	27	45
Use of Risk Frameworks	84	69	78
Disclosing at least one item	99	100	99.5

N= 200 (LCAP 100, SCAP 100)

Table 3B summarises the percentage of companies disclosing various items of the GD. The existence of risk committee and risk policy, frameworks are disclosed by most companies (Risk committees are mandatory for LCAP companies). This indicates that regulatory intervention is important for disclosures.

4.2 Disclosure of Risk Categories

Next we analyse the categories of risks disclosed by companies. We find that only 37.8% of the 12 categories of risks are identified and disclosed. Two companies have not made any disclosures. The maximum disclosure is 83.3% (i.e. 10 categories disclosed as against 12 categories). Overall the disclosure levels are low. Table 4A summarises the same.

Table 4A: Disclosure of Risk Categories

	LCAP %	SCAP %	TOTAL %
Mean	37.8	33.1	35.4
Max	83.3	91.6	91.6
Min	0	0	0
STDEV	19.6	19.4	19.6

Disclosure of various risk categories by LCAP and SCAP companies are given in Table 4B. We find that 98% of LCAP and 97% of the SCAP companies disclose at least one category of risk. Both LCAP and SCAP companies reported financial and operational risks as the top two risks. The number of companies reporting on risks related to environmental risks was only 56% for LCAP and 23 % SCAP. Risk category not identified by many companies are reputation, information and cybersecurity, Social, Governance & Ethics.

Table 4B: Disclosure of Risk categories

Risk Type	LCAP		SCAP		OVERALL	
	N%	Mean RCDI SCORE	N%	Mean RCDI SCORE	TOTAL %	Mean RCDI SCORE
Legal & Compliances	54	0.500	43	0.441	48.5	0.474
Operational	68	0.552	74	0.613	71.0	0.585
Strategic	55	0.567	53	0.562	54.0	0.565
Financial	97	0.810	84	0.909	90.5	0.856
Economic	32	0.506	41	0.478	36.5	0.490
Geopolitical	23	0.426	17	0.388	20.5	0.400
Technology	16	0.425	15	0.506	15.5	0.465
Social, Governance & Ethics	9	0.511	3	0.333	6	0.467
Environmental Risk	56	0.548	23	0.513	39.5	0.538
Information & Cyber Security, Data Protection	22	0.618	12	0.516	17	0.582
Reputation	5	0.400	9	0.333	7	0.357
Human Resource	16	0.600	23	0.443	19.5	0.508
No Risk disclosure	2		3			

N= 200, LCAP 100, SCAP 100

We further analysed the quality of these disclosures. For this, we used only those categories of risks that the companies have disclosed and used the scales of 0 -5 for measuring the same. From Table 4C below, we find that companies in on average have got a score of 57% (i.e., between 2 & 3), indicating that the quality of these disclosures is not adequate.

Table 4C: RCDI Score for companies

	LCAP	SCAP	TOTAL
Mean	0.573	0.606	0.594
STDEV	0.198	0.230	0.215

Conclusion:

Overall the companies give some general information on risk management. This can be attributed to the mandatory nature of disclosure on risks in the MDA. Financial risks are disclosed by most companies (97% of large-cap and 84% of small-cap), and the quality of disclosures is also high. The categories of risks disclosed by companies are weak. (Companies may not be affected by such risks, or they may not see the risk as necessary enough to disclose). More than 50% of the large-cap companies in the sample have disclosed operational risk, legal & compliance, strategic risks, and environmental risks. 74% of the small-cap companies have reported on operational risk. The overall quality of disclosures on various categories of risk is moderate.

4.3 Disclosures under Environment Sustainability Risk

Though the number of companies disclosing on environmental sustainability and climate change is low we analysed them further to understand what kind of information companies are disclosing. Companies that have disclosed environmental risks have identified climate change/vulnerability to disasters, water, and energy as the top three categories of risks. The most frequently disclosed risk is climate change/vulnerability to natural disasters (42) by LCAP and water (10) by SCAP companies. Small companies have really not disclosed their vulnerability to risks related to the environment. Table 5A gives the disclosures under different categories of environmental risks.

We analyse the categories of environmental risks disclosed by companies. We find that only 17% of the categories (out of 12) of risks are identified and disclosed by LCAP companies and 4% by SCAP companies. The maximum disclosure is 92% (i.e., 11 out of 12 categories disclosed). Overall the disclosure levels of various environmental risk categories are low.

Table 5B gives the environmental sustainability risk disclosures by categories. Overall, we find that the climate change risks has been recognized by 42% of the companies.

Table 5A: Disclosure of Environmental Risk Categories

	LCAP	SCAP	TOTAL
Mean	0.173	0.038	0.105
Max	0.916	0.500	0.916
Min	0	0	0
STDEV	0.239	0.089	0.281

N=200, LCAP 100, SCAP 100

Table 5B: Environment Sustainability Risk Disclosures

	LCAP		SCAP		OVERALL	
Environmental Risk	LCAP %	MEAN ESDRI	SCAP %	MEAN ESRDI	Total %	OVERALL ESRDI
Climate Change/ Vulnerability to disasters	42	0.662	8	0.525	25	0.640
Land/Soil	4	0.200		0	2	0.200
Water	24	0.267	10	0.460	17	0.324
Emission	18	0.267	3	0.333	10.5	0.276
Biodiversity	15	0.280	4	0.400	9.5	0.305
Energy	21	0.248	5	0.440	13	0.285
Natural Resources	20	0.370	4	0.500	12	0.392
Waste Management	19	0.295	3	0.600	11	0.336
Product Responsibility	7	0.314	1	0.200	4	0.300
Supply Chain (Sustainable)	9	0.333	1	0.200	5	0.320
Compliance	11	0.436	4	0.350	7.5	0.413
General/ Other Environmental Risk	18	0.267	3	0.533	11.5	0.305
No Risk Disclosed	44		87		66	

Next, we computed the quality of the environmental disclosures. The extent (quality) of risk disclosure was measured using a risk disclosure index. The scores were computed for only those categories of risks that the companies have disclosed. We used the scales of 0 -5 for measuring the same. Table 5C gives the overall scores. We find that companies on an average have got a score of 0.24 (a score between 1 & 2), signifying that the quality of the disclosure is poor. The quality of disclosure under each category is given in Table 5B.

Table 5C: ESRDI Score for companies

	LCAP	SCAP
Mean	0.250	0.111
Standard Deviation	0.307	0.234

n-200; LCAP 100, SCAP 100

4.4 Climate Change Risks

Climate Change risk is mainly disclosed in the CDP report. The CDP reporting framework categorized climate change risks are into three main groups; change in regulation, changes in physical climate and other climate related developments. Since the format is specified under the CDP disclosures companies have given details as per the format.

4.5 Sector-wise risk disclosure

We analyse the risk disclosures based on sectors (Industries) to observe trends if any, since each sector will have its own unique risks and some sectors may be affected more by certain risk events. Sector-wise data on each risk category disclosure is included in **Annexure 4**. All the sectors identify and disclose Financial Risk. There was no consistency in reporting other risks.

Table 6A gives the average score across different risk categories in each sector. Construction and Telecom sectors have identified the maximum number of risk categories (58% and 56%). Energy and Information technology sectors (SCAP) have identified with 44% and 48% of the risk categories, respectively. Sector –wise disclosure of environmental risk categories are given in Annexure 5. We find that the disclosures are quite low for all the sectors.

Table 6A. Sector-wise overall risk disclosures

Sectors	LCAP	SCAP		TOTAL		
	Risk Category Disclosed	ESR Category	Risk Category Disclosed	ESR Category	Risk Category Disclosed	ESR Category
Automobile	0.383	0.225	0.542	0.125	0.409	0.208
Cement & Cement Products	0.383	0.400	0.361	0.194	0.374	0.322
Chemicals	0.167	0.000	0.226	0.095	0.219	0.083
Construction	0.583	0.333	0.343	0.037	0.386	0.091
Consumer Goods	0.378	0.160	0.341	0.068	0.362	0.118
Energy	0.371	0.159	0.444	0.028	0.387	0.131
Fertilisers & Pesticides	0.333	0.333	0.333	0.017	0.333	0.069
Financial Services	0.268	0.058	0.303	0.009	0.284	0.036
Industrial Manufacturing	0.333	0.021	0.281	0.010	0.299	0.014
Information Technology	0.514	0.319	0.476	0.024	0.494	0.160
Media & Entertainment	0.417	0.000	0.333	0.000		

					0.389	0.000
Metals	0.500	0.406	0.283	0.033	0.417	0.263
Pharma	0.438	0.073	0.354	0.000	0.409	0.049
Other Services	0.278	0.111	0.319	0.055	0.305	0.074
Telecom	0.556	0.250	0.250	0.000	0.433	0.150
Textiles			0.333	0.021	0.333	0.021

To conclude, all sectors identify and disclosed financial risk. All other risks are poorly reported.

4.6 Disclosures (Non-risk) on Environmental Sustainability

While environmental risk disclosures itself are not high, it appears that companies are taking initiatives on the sustainability front. In this section we analyse the same. Environmental related disclosures in the Annual Report, BRR, IR and SR. A few companies have also shown the linkages between various risk and the outcomes. Some companies report on mitigation measures and initiatives taken by them. Disclosures on energy conservation initiatives are relatively high due to the requirement under Section 134 (3) (m) of the Companies Act, 2013. This was initially recommended by the National Action Plan for Climate Change in 2008. Companies have reported on energy, water, conservation and waste/effluent related initiatives as the top three themes.

Table 6A: Environmental Sustainability Disclosures (Non-Risk)

	LCAP	SCAP	TOTAL
Mean	0.50	0.38	0.44
Max	0.91	0.83	0.91
Min	0	0	0
STDEV	0.20	0.21	0.21

On average, companies seem to disclose at least 50% of sustainability indicators, i.e. measures or initiatives parameters. Small-Cap companies report only on 38% of the indicators, signifying that either they are not taking any initiatives or they are not disclosing the same. The quality of the disclosures measured in the form of an index is given in Table 6B.

Table 6B: ESDI (Non Risk) Score for companies

	LCAP	SCAP
Mean	0.557	0.387
Standard Deviation	0.232	0.019

The quality of disclosures also seem to be better as compared to disclosures from a risk perspective

Summary of the analysis

Even though in a recent KPMG survey, a good number of Indian CEOs have ranked climate change and environmental regulation as a top risk (KPMG,2018), this study shows a lack of disclosures or minimal disclosures on environment sustainability risks. Disclosures themselves raises a key point as to whether reporting is seen as more symbolic and being compliant than being substantive and being more responsible (Michelon, Pilanato, Ricceri 2015). The disclosures related to initiatives taken on various environmental sustainability measures, seem to be much better than risk disclosures. This indicates that the companies do understand the risks and have taken measures to address them. Additionally, the initiatives are not linked to risks in a more formal way.

4.7 Validation of Results

In order to validate our results, we presented our findings at a Roundtable on sustainability that involved the participation of Risk professionals, civil society organizations and partners from consulting firms to seek their inputs in ESR. Further, we conducted an in-depth interview with a few Risk Management professionals of large companies and a few board members to understand their perspectives on ESR. We focussed on three major questions:

- Is Environment Sustainability Risk integrated into its strategy and the risk management framework?
- Are companies recognizing Environmental sustainability and to what extent?
- What are the challenges for identifying and reporting ESR?
- What is the evidence of climate change in India? Are companies focussing on climate change as a part of their operations and strategy?
- Is Sustainability and Risk Management monitored by the top management? If not, the reasons for the same.

1. Is Environment Sustainability Risk integrated into the strategy and the risk management framework?

Companies/Risk professionals stated that most companies have not yet integrated sustainability risk into the strategy. Most respondents stated that their company is not prepared for addressing environmental sustainability and mitigation measures on ESR.

While companies are undertaking sustainability initiatives, they have not integrated the Sustainability and Environmental risks within their risk management framework.

2. Are companies taking initiatives on sustainability, and to what extent?

Our discussion with the senior risk professionals and with a few board members revealed that companies are taking several initiatives towards environmental sustainability (Annexure 6 gives examples and the score).

The sustainability initiatives were driven (or not driven) due to the following factors:

- a. ESR is currently driven internally rather than external pressure from stakeholders. Lack of shareholder pressure is evident from the fact that a lack of interest from most of the investor community apart from foreign institutions. Consumers are not realizing the externalities while they buy the products. For example, customers are only concerned about the cost and to some extent, quality and ignoring the environmental impacts of packaging, product life end disposal, etc.
- b. Of late, the increased interest of investors and customers in sustainability has made it necessary for some companies to move in that direction. Strategic investors are also particular that Environment, Social & Governance due diligence is undertaken. Increased regulatory pressure on extended producer responsibility such as on E-waste, Plastic, etc., and awareness of local communities has increased the awareness to engage in sustainable practices.
- c. Companies also have a Sustainability office(r) working on sustainability initiatives such as water management, energy, reduction of carbon footprint, etc.
- d. Many of these initiatives have a direct bearing on the cost reduction and therefore has buy-in from the senior management.

3. What are the challenges for identifying and reporting ESR?

While organisations are aware of and recognise climate change and environmental risks as essential and may have long-run consequences. The key challenges identified by the top management are as follows:

- a. Quantification of ESR is often a challenge as compared to other risks, mainly as ESR outlook timeline is longer than that of traditional risks
- b. Lack of understanding of how the event will impact the business
- c. Many organisations perceive that ESR risks has no direct impact on the company but has a direct impact on people and society and hence not an immediate concern to companies.
- d. There are no tools/frameworks and history to help measure, predict, monitor, and manage ESR. This has also been cited by other researchers (Høgevold et al., 2014; Schulte and Hallstedt, 2017)
- e. The board-level outlook is usually short term, and they are not focussed on the long term, particularly with respect to the externalities.
- f. Lack of regulation on disclosure.
- g. Lack of interest from the stakeholder community, unlike in the developed nations.

- h. Companies disclose impacts of environmental risk as risks to the company's business objectives, growth, and budget rather than the root cause such environmental issues/events. For example, regulation BS-VI impacts vehicle production, but the root cause of such a regulation is carbon emission.
- i. ESR is not part of the company's key performance indicator
- j. There are companies in India that are measuring the impact and are not disclosing since the moment you disclose, you become accountable to external pressure and hence disclose minimum information.
- k. Contrary to this, some companies think disclosing is a good practice as it will give them competitive advantage, makes business sense and can be used as a marketing tool. This could be the reason for variation in the quality of disclosures. This mainly found in developed economies (Foreign parent companies of Indian subsidiaries)

4. What is the evidence of climate change in India? Are companies focussing on climate change as a part of their operations and strategy?

- a. As per the experts working in this area¹⁸ in India, overall weather patterns have not changed, but the change in precipitation patterns in terms of intensity, duration, and geography has changed. Also, extreme cold and heat events are on the rise in India in the recent past. Carbon emission (a significant contributor to climate change) has a cumulative impact on global warming, and hence climate change is not a distance issue and will affect businesses.
- b. Globally the net impact of climate change will be negative with a positive impact on northern latitudes, mainly temperate zone due to an increase in growing seasons. For example, Russian agriculture will have a positive impact., but tropical countries will be negatively impacted.
- c. Since most of the country fall under tropics, India will receive a lot of rainfall in short duration and hence leading to droughts, floods and cyclone, and water scarcity. Indian coasts will be hit due to sea-level rise, leading to extreme weather and loss of coastal lands.
- d. Changes in weather patterns and the rise in sea levels are difficult to predict since it is a complex issue. More scientific studies are required to understand this change. Currently, since there no region-specific data it is difficult to predict location-specific information.
- e. When companies are evaluating environment risks subconsciously, they think that the company is not the only risk owner for the environment, especially climate change risks.
- f. Despite climate change not being a distant event, companies are not explicitly focussing on climate change risks. Nonetheless, they do consider climate change as real because there have been some business disruptions due to these events.
- g. Events during 2017/2018, have made information technology industry realise the importance of climate change, after the extreme precipitation in Chennai, Mumbai and Kerala.
- h. Without a regulatory framework, it will be "business as usual."

Other reasons why companies did not have any focussed approach to ESR:

- i. Companies have mitigation measures in place

¹⁸ Interview with Professors in Divecha Center for Climate change at the IISC.

- ii. Internally, there is often a lack of collaboration between sustainability, risk management, and the strategy team.
- iii. ESR may not have a direct linkage with business drivers or financials.

5. Is environment sustainability risks monitored by the top management? If not, the reasons for the same.

- a. Currently, ESR is not a board-level or top management issue. The main reasons for this are lack of awareness and board room ability to understand the gravity of the issue.
- b. There is a lack of clarity on the linkages among risks, sustainability, and direct business impact.
- c. Challenges in measuring and tracking the ESR to be able to report to the board.
- d. Companies are not sure of investments required to transition to a low-carbon economy.
- e. Sustainability is not integrated into strategy and hence not a focus.
- f. Quarterly (short term) mindset of corporates and lack of external pressure from stakeholders.
- g. ESR is not part of the company's culture, as the founder promoter or the majority shareholder themselves don't perceive the risk (see also Pan, Y. et al. (2017).)

Section 5: Discussion and Conclusion

The primary objective of this study was to understand the quality of disclosures related to Environmental Sustainability Risks of companies listed in the NSE Large Cap 100 and Small Cap 100 indices. We hand-collected the data from the Annual Report, BRR, SR, CDP and IR reports. BRR is mandatory though specific contents are not mandated. CDP report, on the other hand, has clear headings on which the companies need to report. Our research addresses the three questions on Environment Sustainability Risk management. i) What are companies reporting under risk management practices in their annual report and whether environment sustainability is included as part of the risks? ii) To what extent environment sustainability is an integral part of the business activity, and is the same integrated into the strategic decision-making process? iii) Do companies report on climate change as part of the sustainability disclosures and critical challenges for businesses to identify and report on the issue?

Our findings suggest that almost all companies have some disclosures on risks (e.g., existence of risk management, policy, and framework, or risk management committee). This can mainly be attributed to the mandatory nature of disclosures in the annual report.

Most companies (99%) disclose at least one risk category, mainly financial risk. Other top risk categories identified are operational and strategic. The disclosure scores are .378 (37%), indicating that companies disclose 4 to 5 categories of risk as against 12 categories. The quality of disclosures are also weak with a score of 0.57, indicating that within the risks disclosed the details provided are minimal. Only financial risks are discussed in detail. Environment Sustainability risk disclosure is abysmal, and the quality of disclosure is also low. Disclosures on climate change risks were minimal. It appears that the changing weather patterns have either not emerged as a significant cause of concern to be disclosed in the risk section or they are generally not disclosed. Top management is generally aware of climate change risks (as

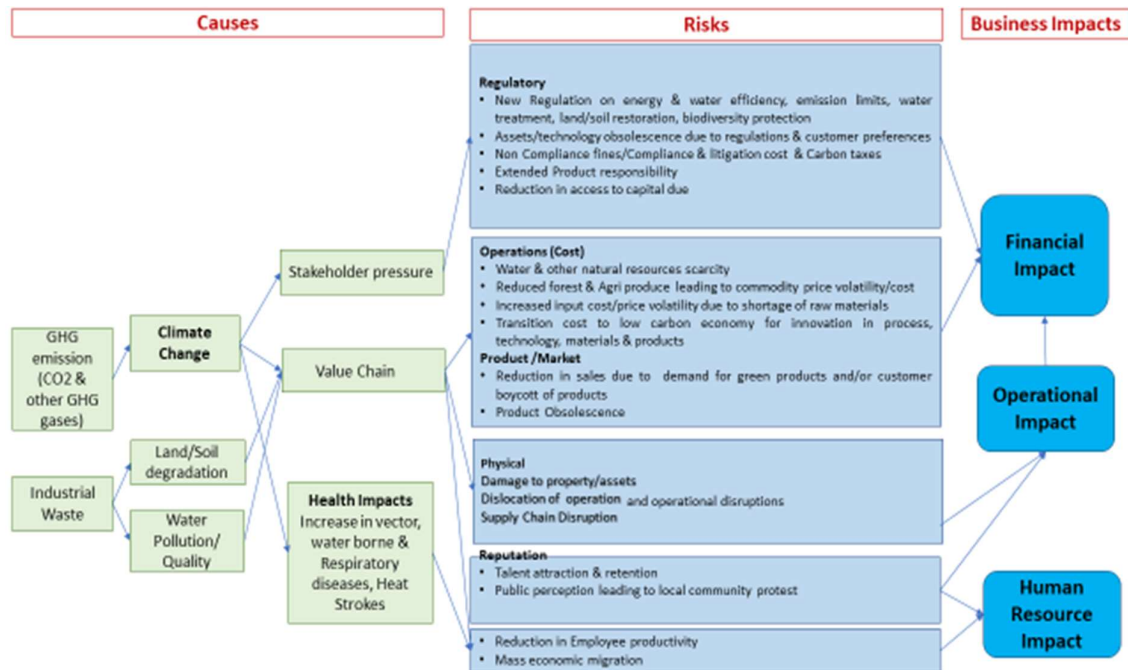
identified in the Chairman's statement in many companies). We also find that disclosures are not integrated in a more comprehensive way and in a single report for the investors and others. Though reporting is weak, most companies disclose sustainability initiatives taken by them, including those in the areas of energy, water conservation, and waste/effluent management. Many companies have sustainability department and /or a sustainability officer working on these areas.

Subsequent interviews with risk professionals revealed that companies had not integrated sustainability risk into the ERM framework and strategy. The main reasons stated for this are lack of understanding of the direct business impacts (quantification), lack of regulations and stakeholder pressure. Companies are not able to project the ESR into the future for example how the scarcity of water will impact factories/workplace say five years from now. Respondents perceived that climate change impacts such as changing weather patterns and the rise in sea levels are difficult to predict in terms of its occurrence (timing) and magnitude of impacts, and it is a complex issue. Businesses are unable to foresee the overall impacts of climate change and extreme weather events as these developments are more pronounced over a longer time frame.

Sustainability and climate change are still not a board-level issue due to short term outlook, lack of awareness, and the ability to understand the gravity of the issue though there is a heightened awareness as evident from the chairman's statement. Lack of tools/framework and history to measure, predict, and monitor sustainability risks are additional challenges faced by companies. Further, specific regional data on climate change are not available, and hence, the impacts are not entirely understood. Many respondents felt that the scientific community in India should disseminate more information about the changing weather patterns etc.

The linkages of risks, climate change, related impacts, and financial impacts can be seen in Figure 1 below. To illustrate the linkage we take an example. The Indian government is promoting electric vehicles, which is a natural choice alternative to conventional vehicles. The regulatory decision (when implemented) will impact the automobile industry including auto ancillaries. Further, there will be a significant impact on the non-renewal energy resource (diesel and petroleum) companies. These companies will have to change business strategies for the future. There will also be a downside pressure from the circular economy on petrochemicals. Internationally, countries like Saudi Arabia are considering diversifying their portfolio from energy resources such as diesel and petroleum to others.

Figure 1: Linkages



Source: Developed by authors

Extreme weather events leads to damage in agricultural production, leading to the food security problem. This, in turn, will impact the companies that are dependent on agriculture as their inputs. The infrastructure industry will also be affected adversely. They will have to move to a more climate-resilient infrastructure to prevent corrosion and other effects due to high temperatures, cyclones and flooding. Industries that will be affected directly are depicted in Annexure 7

Experts working on climate change in India, predict that climate change is not a distant event and will impact India adversely. Even though climate change is a critical issue with high business impacts, Indian companies are either complacent or leaving it to externalities to resolve the issues. Companies recognize the risk to its business objectives, and risks to growth, but do not recognise risk as to the root cause but as an impact; hence, sustainability risk disclosed is more in the nature of impacts or consequences. We find that the discussion in the annual report on sustainability (water, energy conservation) is neither integrated into the risk management framework nor to the strategic decision-making process.

Way Forward

This exploratory study attempts to understand the challenges and issues in environmental sustainability risk management of BSE large-cap and small-cap companies. Our research finds that companies are taking initiatives on sustainability; however, they fall short of addressing

the challenges faced by society today. More importantly, sustainability has not been integrated with the enterprise risk management framework in a strategy setting.

The disclosures on environment sustainability risk are still scattered in different reports and again lacks integration. Disclosures on climate change and its impact on business notably are still missing for most companies.

One of the challenges faced by organisations is the measurability of environmental sustainability risks due to the lack of frameworks or tools. Unless these risks are measured they cannot be monitored nor managed as part of the Enterprise Risk Management. Though in recent years many guidelines have been formulated for both measurement and disclosures.

Our research concludes with the following plan of action for organisations;

- Companies have to demonstrate their intention to engage with sustainability by articulating the same in their vision, mission and as an integral part of their strategy. The mission is going beyond the traditional corporate mission to becoming a sustainability mission. Top management recognition of the issue and involvement are absolutely essential to drive sustainability into mainstream discussion. Board-level engagement and developing competencies on climate change and other environmental risks are absolutely critical, though today, there is some awareness of the issue. The sustainability mission must translate into specific indicators and measures that can be monitored and managed. Key performance indicators can be developed in various dimensions of environmental sustainability. These measures should focus on positive contributions rather than just limiting the negative externalities.
- Senior management is in a vantage position to address climate change issues through technological and market innovation (Stern, 2007) and thus converting sustainability risk into sources of competitive advantage (Saardchom, 2013). Identifying and engaging with the stakeholder groups is essential for successful sustainability performance. Currently, ESR knowledge is limited to a few groups leading to pockets of excellence¹⁹. Some companies/groups have built competencies though not uniformly across industry. Building awareness across industries and stakeholders is the key. Government level commitments must cascade to industry, and industry bodies should come together to create awareness. Recently, Committee of Sponsoring Organizations of the Treadway Commission (COSO) and the World Business Council for Sustainable Development (WBCSD) have issued guidelines on “Applying enterprise risk management to environmental, social and governance-related risks” to facilitate the integration of sustainability into mainstream risk management framework.²⁰
- Lately, stakeholders, including investors, are taking an active interest in sustainability by asking for social, environment & governance due diligence. More, financial institutions should adopt equity principles whereby they commit to not provide finance for projects that

¹⁹See some examples of Global companies at <https://www.cdsb.net/tcf-good-practice-handbook>

²⁰ https://docs.wbcsd.org/2018/10/COSO_WBCSD_ESGERM_Guidance.pdf accessed on 25/1/2019

are unable to comply with social and environmental policies and procedures like in some other institutions.²¹

- There is a lack of integration between material issues discussed in the Sustainability Report and risk identified in Annual Reports, CDP reports, and BRR. Regulating an appropriate format or formally adopting: (a) Climate-Related Financial Risk Disclosures as recommended by TFCF (Taskforce on Climate Financial Disclosure). This report specifies actual and potential impacts of climate-related risks and opportunities on the organization's businesses, strategy, and financial planning Risk Management (b) SASB's Sustainability standards in the US can be used (c) Companies can also explore a more cohesive reporting such as Integrated reporting <IR>, that will help companies to include these risks as part of their strategy and hence disclose on these parameters. The gradual transition to integrating reporting will bring integration between risks, impacts, and initiatives led by integrated thinking.

Indeed, engaging with sustainability and climate change is a challenging task given the complexity and uncertainty of the events. The looming crisis requires changes in the way how businesses, governments, and society functions. Businesses are the primary creators of GHG emissions in the global economy and the irony is that they are also in the best position to bring in innovation and market-based solutions to engage with decarbonisation and avoid climate change impacts. More importantly, the senior leadership in businesses must look at long term viability beyond the present assumption of business-as-usual and short term quarterly results. Regulatory intervention is critical in countries like India for bringing about changes, including a levy of penalty. Investors and financial institutions have also a major role to play and are in a vantage position to urge the management to consider sustainability as part of the company's strategic decisions. Civil society must also exert pressure on business to be more sustainable. The movement galvanized by the Swedish teen activist Greta Thunberg at the World Economic Forum, Annual Meeting 2019, where she demanded the world business leaders to act on climate change crisis is an example of such pressure that may only increase in future. Nobody can predict the ferocity of damages and destruction that faces the human race, but we need to act today to save our future.

²¹ To date, there are 76 financial institutions in 32 countries officially adopted the equity principles, counted for over 70 percent of international project finance debt in emerging markets (The Equity Principles Association, available online at: <http://www.equator-principles.com/>)

ACRONYMS

AR	Annual Report
ASEAN	Association of Southeast Asian Nations
BRR	Business Responsibility Report
BSE	Bombay Stock Exchange
BS VI	Bharat stage emission standards VI
CDP	Carbon Disclosure Project
CDSB	Climate Disclosures Standards Board
CEO	Chief Executive Officer
COSO	The Committee of Sponsoring Organizations of the Treadway Commission
CRED	Centre for Research on the Epidemiology of Disasters
DISCL	Disclosure
DJSI	Dow Jones Sustainability Indices
ERM	Enterprise Risk Management
ESR	Environmental Sustainability
ESRCDI	Environmental Sustainability Risk Category Disclosure Index
ESR	Environmental Sustainability Risks
ESRM	Environmental Sustainability Risk Management
GD	General Risk Disclosures
GH	Green House Gas
ICAEW	<i>Institute of Chartered Accountants in England and Wales</i>
IIRC	<i>International Integrated Reporting Council</i>
IPCC	Intergovernmental Panel on Climate Change
IR	Integrated Report
LCAP	Large CAP
MDA	Management discussion & analysis
RCDI	Risk Category Disclosure Index
RDI	Risk Disclosure Index
S&P	Standard & Poor's
SASB	Sustainability Accounting Standards Boards
SCAP	SMALL CAP
SDG	Sustainable Development Goals
SEBI	Securities and Exchange Board of India
SEC	Securities and Exchange Commission
SR	Sustainability Report
TFCD	Task Force in Climate Related Financial Disclosures
UNESCO	United Nations Educational, Scientific and Cultural Organization
WBCSD	World Business Council for Sustainable Development
WEF	World Economic Forum

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Annexures

Annexure 1 Global Extreme Weather 2005-2018

Year	Event	Countries	Deaths	Loss or Damage	Economic Losses
2018	Hurricane-Florence & Michael (3)	USA (3)	102(3)		\$ 49 billion (3)
	Drought (3)	Uruguay & Argentina (3)		Heavy losses to summer crops (3)	Agricultural loses \$ 5.9 billion (3)
	Wildfires (3)	Paradise & California USA (3)	93 (3)	185800 hectares & 1604 structures affected (3)	\$ 24 billion (3)
	Hailstorms (3)	Dallas & Denver (3)			\$ 3.3 billion (3)
2017	Fires-Heatwave (3)	U.S.A-California (3)	54(3)	The area affected 46 percent above the 2007-2016 average. (3)	\$ 18 billion (3)
	Hurricane Irma (3)	Northern Caribbean Islands (3)	44(3)	Destroyed buildings, and leaving many without essential supplies (3)	\$10 billion (32)
	Hurricane Irma (3)	U.S.A-Florida (3)	4(3)	No power for 64 percent of the state and produced record storm surges (3).	\$52 billion (3)
	Hurricane Harvey (3)	Texas -The U.S. A (3)	> 82 (3)		\$180 billion (3)
	Hurricane -Maria (3)	Puerto Rico & Dominica (3)		No power and most cell phone service, drinking water crisis, & food shortages (3)	\$100 billion (3)
	Wildfires (3)	The U.S. A (3)		Acres burnt about 500,000 across the nation (3)	\$2.153 billion (3)
	Floods (3)	Peru (3)	>75(3)	Significant crop production losses, particularly maize. (3)	Damage \$3.1billion & reconstruction cost \$9 billion (3)
	Cyclone – Enamo (3)	Madagascar (3)	81(3)	Extensive damage to houses, infrastructure and crops. (3)	Agricultural loss \$207 million (31)
2016	Floods (3)	China- The Yangtze basin and Beijing region (3)	310(3)		\$ 14 billion (3)
	Floods (3)	The USA (3)	13(3)	Businesses damaged or destroyed: 20 000 (3)	\$ 10 billion. (3)
	Hurricane Matthew (3)	Haiti, Eastern Cuba & the Bahamas & South Carolina (The USA) (3)	546 (3)	Worsened the existing issues of food insecurity and disease in the country (3)	> \$ 15 billion (3)
	Cyclone Winston (3)	Fiji (3)	44 (3)		\$ 1.4 billion (3)
	Wildfires (3)	Canada (3)		Hectares burnt: 590 000 (3)	Insured losses \$ 3 billion (3)
	Wildfires (3)	Portugal (3)	3 (3)		€ 60 million (3)
	Hailstorms (3)	Netherlands (3)			€500 million (3)
2015	Floods (3)	China (3)			\$ 25 billion (3)

	Drought (3)	European & Asian part of the Russian Federation (3)		Crop failures over more than 1.5 million hectares (3)	About 9 billion roubles (3)
	Fires (3)	North America (3)		Hectares burnt: 400 fires burnt over 728 000 in Alaska (May) (3)	\$14.3 billion in real estate damage (29)
2014	Drought (3)	South Africa(3)			S\$ 170 million (3)
	Floods (3)	Bosnia and Herzegovina, Croatia and Serbia (3)	51(33)	In Bosnia, the severe and widespread rains triggered over 3,000 landslides. (33)	UN-EU Recovery (43.2 million €) (4)
	Drought (3)	Southern China (3)		Hectares of Farmland affected: over 8 million (3)	\$ 7.7 billion (3)
2013	Drought (3)	Brazil (3)			> \$ 8 billion (3)
	Heavy Rain (3)	Canada-Calgary & vast areas of southern Alberta (3)			\$ 6 billion (3)
	Typhoon Haiyan (3)	South-East Asia, and the Philippines (3)	>6200 (3)		>\$ 850 million (3)
2012	Drought (3)	China- Yunnan Sichuan province (3)		Hectares of Crops damaged: Over 1 million (3)	\$ 780 million (3)
	Drought (3)	Western Russian Federation and western Siberia (3)		The dry conditions caused crop failure or damages, resulting in nearly. (3)	\$ 630 million (3)
	Floods (3)	Western Russian Federation (3)	200 (3)	Homes Damaged/Destroyed :50 homes. Homes Flooded: 5 500 (3)	\$ 630 million (3)
	Drought (3)	Hungary (3)			\$ 1.8 billion (Agri) (3)
	Floods (3)	Western Finland (3)			\$ 8 million (Agri and infra) (3)
2011	Fires (3)	Canada (3)		Town of Slave Lake, Alberta	Insurance claims of about \$ 700 million
	Cyclone Washi (3)	Thailand, Cambodia, and parts of Vietnam (3)	1000	Causing significant losses from property damage and disruption of industry(3)	Thailand US\$ 45 billion (the World Bank), about 70 percent (manufacturing sector) (3)
	Floods (3)	Eastern Australia (3)			\$ 1.3 billion (Victoria) (3)
	Cyclone Yasi (3)	East coast of Australia (3)	1 (3)		Property damage > US\$ 1 billion (3)
	Cyclone Irene (3)	North-eastern USA(3)			\$ 7 billion (3)
	Floods (3)	Pakistan (3)	1500 (3)	In terms of the number of people affected, the United Nations rated the flood as the greatest	\$ 3,730 million (5)

				humanitarian crisis in recent history.(3)	
	Storm (Xynthia) (3)	North-western Europe- western France, Spain, Belgium, the Netherlands, Switzerland, and Austria (3)	60 (3)		Insured losses in France and Germany exceeded \$ 4 billion (3)
	Hailstorms (3)	Australia – Melbourne & Perth (3)		Most Significant hailstorms on record in terms of both hail size and impact (3)	\$ 1 billion (3)
	Hailstorms (3)	Canada- Calgary (3)			\$ 400 million (3)
2010	Floods (3)	Colombia (3)	47 (3)		Relief \$227 million (7)
	Heavy Rain (3)	Western Africa (3)	300 (8)		\$9.7 billion (9)
	Cyclone-Giri (3)	Myanmar (3)	150 (3)	Houses Destroyed: 20,380. Agriculture Lands Affected: 17,500 acres (34)	Aid \$ 9950000 (6)
	Floods (3)	Australia-North-East, Queensland (3)	16 (3)		\$6 billion (10)
	Tropical Storm Agatha (3)	Central America (3)	320 (3)		\$163 million rebuilding infrastructure (35)
2009	Drought (3)	Guatemala (3)	25 (11)	50 % reduction in the harvest of staples such as maize and beans (11)	\$ 117 million (11)
	Floods (3)	Brazil (3)	120(24)		\$500 million (15)
	Floods (3)	Burkina Faso (3)	8(25)		UN \$ 18 million & WHO \$200,000(26)
	Heatwave (3)	Australia (3)	374(13)		\$800 million (12)
	Typhoon Morakot (3)	Taiwan (3)	614 (3)	Homes Destroyed:10000 (3)	\$390 billion (14)
2008	Floods (3)	Brazil (3)	84 - 118(15)		\$400 million (15)
	Drought (3)	Argentina, Paraguay and Uruguay (3)		Significantly affected agriculture. (3)	Uruguay \$ 900 million (16)
	Cyclone Nargis(3)	Myanmar (3)	84,530 (17)	600,000 hectares agricultural land damaged (17)	Recovery needs \$1 billion (17)
2007	Flood (3)	Mexico (3)	19 (18)		\$5 billion (18)
	Winter storm Kyrill (3)	Northern Europe (3)	50 (3)	Most widespread and extensive damage in more than 30 years. (19)	Insured loss > \$ 7 billion. (19)

	Storm (3)		3000 (3)		\$ 1.1 billion (20)
	Floods (3)	South Asia (3)		> 100,000 caught water-borne diseases) (21)	\$1 billion (21)
	Floods (3)	Australia (3)			\$2.15 billion (22)
2006	Heat Wave (3)	California (3)	140 (3)	Burnt: over 9.8 million acres (1)	\$ 1.9 (billions) (1)
	Tropical cyclone Larry (3)	Australia (3)	65 (3)	121,500 households and businesses were without power. (23)	Insured losses between \$300 & \$400 million. (27) Agriculture Loss - \$300 million(23)
	Wildfire (3)	USA (3)	140 (3)	191,000 acres burnt (2)	\$1.8 Billion (28)
2005	Floods (3)	Southern China (3)	170 (3)		\$2.45 billion (30)
	Winter storm (3)	Sweden, Denmark & Latvia (3)		Economic damage to forest industry (3)	US\$ 2.3 billion (3)

Source:

- 1 <https://www.ncdc.noaa.gov/billions/events/US/1980-2017>
- 2 <https://www.infoplease.com/world/disasters/natural/worst-us-forest-fires>
- 3 World metrological reports
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Annexure 1B: India Extreme Weather 2005-2018

Year	Event	Areas	Deaths	Loss or Damage	Economic Losses
2018	Cyclone-Titli (1)	AP(1)	85 (1)		\$920+ million (2)
	Floods (1)	Kerala (1) & other parts	535 (3)	Worst since 1924. Rainfall for August was 96% above the long-term average (1)	\$ 4.3 billion (1)
	Cold Wave (1)	UP(1)	279 (3)		
2017	Floods	Across India (1)	>600 (4)	Gujarat- 6.44 lakh farmers in 17 districts impacted (8)	Gujarat crop damage INR 867 crore (5)
2016	Droughts (1)	Spread across 10 states (1)		Phalodi - 51C highest in India since records began(1)	\$100 billion (10)
2015	Heatwaves (1)	Odisha, Telangana and coastal AP (1)	2500 (1)	Heat wave is the fifth deadliest in world history (6)	
	Floods (1)	WB, Assam, TN & Coastal AP (1)	300(1)		\$3 billion of damage (11)
2014	Floods (36)	J & K (7)	268(7)	Srinagar city submerged under many feet of water (12)	\$2.2 billion (13)
2013	Floods (1)	Regions in North West (1)	5,700(1 2)	19,590 business establishments devastated (12)	\$250 million recovery and resilience project (14)
	Heat Wave (1)	Nagpur, AP, Punjab, Haryana, Rajasthan (1)	2700 (1)		
	Storms- Phailin, Lehar and Madi (1)	Odisha and AP (1)	53 (214 & 15)	2.56 lakh houses damaged & over 42.60 lakh hectares of agriculture land affected (17)	INR 89,020 million (17)
2012	Heatwave (1)	Uttarakhand, UP, Bihar, Jharkhand, parts of Orissa, WB & coastal AP (1)	>500(1)		
	Floods (1)	Assam (1)	120(1)	Affected 70,000 hectares of crop land. (18)	
	Heavy Rain (1)	Uttarakhand (1)	70(1)	Washed away houses (1)	
	Heavy Rain & Flash floods (19)	HP (19)	29(19)	88,693 hectares of agricultural cropped area was affected(22)	INR 961.32 crore (19)
2011	Cyclone –Thane (1)	East Coast(1)	50 (1)	q176,000 hectares of agricultural crops were destroyed. (20)	INR 1,500 to Rs 2,000 crore. (20)
2010	Floods(1)	Ladakh & Leh (1)	248(12)	71 towns and villages affected, 76 people missing (12)	204 crores (12)
2009	Heavy Rain(1)	Southern states (1)	300 (1)	2.5 million people were homeless (1)	
	Cyclone –Aila (1)	WB	149(12)	175,000 homes destroyed 270,000 houses damaged (12)	1500 Crores (12)
2008	Koshi Floods(22)	Bihar (22)	527(22)	Impacted 500,000 farmers affecting paddy & maize crops (21)	\$1215.3 million in reconstruction cost (21)
	Cyclone Nisha (22)	TN (22)	204 (22)	20 lakh people displaced (23)	
2007	Floods (1)	Assam, UP, Bihar, & Orissa (1)	121(24)	Damaged 262,743 houses (24)	\$320 million spent by Government (24)
2006	Cold Wave	North India (1)	150 (25)		
2005	Floods (1)	Parts of western & southern India & Mumbai (1)	1800 (1)	550,000 hectares of agricultural land damaged. Stock exchange could work only partially.	\$ 3.5 million. (1)
	Floods (1)	South-Eastern parts (1)	300(1)	Adverse socio-economic impacts. (1)	
	Floods (1)	Gujarat (1)	202(26)	Worst flood in Indian history. 2.96 lakh evacuated and 7,717 villages affected (26)	Industrial losses estimated at 15,000 crores. INR 500 crores spent on relief (26).

Source:

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Annexure 2: Risk Category Definition

	Risk Category	Definition
1	Legal & Compliances	Refers to risk related to regulatory changes/compliances/litigations. Non-compliance with laws, regulations, contracts are covered in this category
2	Operational	Refers to risk resulting from inadequate or failed internal process/operations/controls.
3	Strategic	Refers to the risk associated with an organisation's long-term scalability and sustainability of the organisation
4	Financial	Refers to organisational ability to manage the debt and fulfill the financial obligations that they incur to finance company operations.
5	Economic	Refers to the risk associated with effect of general global and local economic changes on the business. Economical changes such as slower global economic growth, high levels of unemployment, reduced levels of capital expenditure, government deficit reduction and other challenges can affect the operations of the company adversely.
6	Geopolitical/Political	Refers to risk associated with unexpected political changes in terms of policies and trade barriers and conflicts. Unrest and instability in countries of operation can significantly impact the business.
7	Technology	Refers to risk from emerging technology & technology obsolescence
8	Social, Governance, & Ethics	Refers to risk arising from failure to identify and manage local concerns and expectations, leading to social unrest, failure of corporate governance, and ethics.
9	Environmental Risk	Refers to the actual or potential threat on the environment by the business through effluent discharge, harmful emissions, improper waste management, and resource depletion such as water and natural resources. Climate Change leading to extreme weather events such as cyclones, floods, droughts, and changes in temperature.
10	Natural Disasters	Unexpected natural disasters events such as floods, earthquake, etc., any of which could adversely affect production and/or costs and effectiveness and efficiency of economy
11	Information & Cyber Security, Privacy/Data Protection	Refers to risk from the theft or damage to the hardware, the software, and to the information residing on them, compromising the confidentiality, integrity, and availability of corporate and client data.
12	Reputation	Risks from events that can negatively impact on the company
13	Human Resource	Refers to risk arising from the non-availability of adequate skill sets and competencies, depleting manpower in key /leadership positions and talent retention of crucial resources/leadership pipeline.

Annexure 3: Environmental Sustainability Risk (ESR) Categories

Sl. No	Risk Category	Definition	Examples
1	Climate Change	Relates to the impact of climate change due to global warming that is beyond an individual firm's control. It includes risk of natural disasters, seasonality and extremer weather conditions etc.	
2	Land/Soil	Risk faced due dumping waste or pollutants onto the soil; percentage of impervious area. Restoration of the land used (in case of mining industry)	Sustainable mining practices Post use restoration of mines/Mine closure, Reclamation & Rehabilitation
3	Water	Risk faced due to shortage of water and quality of available water.	
4	Air/Emission	Risk faced by companies due to greenhouse gas emission and other pollutants to the air. Industry being a major contributor there would be new regulation, compliance and litigation risk in this area.	
5	Biodiversity	Natural resources that businesses depend on are based on an intact functioning system of biodiversity. The loss of biodiversity therefore directly endangers the resources of all businesses (www.business-biodiversity.eu, 2019).	
6	Energy	Decarbonization the energy sector is the major mitigation measures adapted globally since energy is the major contributor towards the CO2 emissions. Industry being one of the major consumers of energy there would be new regulation in terms energy efficiency and use of renewables.	
7	Natural Resources	Risk faced by the companies due to shortage of natural resources.	
8	Waste/Effluent	Risk faced by companies in terms of regulation and compliance related to waste and	

		effluent treatment requirement and litigation risk faced in this area	
9	Product Responsibility/Green Products	Refers to risk arising from the following Customer or community perceptions turning against firms who are perceived to be contributing to environmental degradation risk in terms of product responsibility. Shifts in supply and demand for certain commodities, products, and service. Preference of customers environment-friendly or green products.	
10	Sustainable Sourcing/Supply Chain	Supplier social and environmental responsibilities are becoming a larger factor in assessing risk in a supply chain as product safety regulations continue to be proposed and passed into law.	
11	Regulatory/Compliance	With Industry being major contributor towards environmental degradation such as climate change, air pollution, water quality, emissions etc. policy actions targeting businesses will continue to evolve globally	
12	Other general environmental risks		

Source: Dobler, Lajili & Zeghal, 2014

Annexure 4: Sector wise risk category disclosures index

Industry	LCAP											
	LC	OPR	STR	FIN	ECO	GP	TECH	SGE	ER	CDS	REP	HR
Automobile	.500	.300	.500	1	.600	.400	.300	.200	.500	.200		.100
Cement & cement products	.600	.800	.800	1	.400				.800			.200
Chemicals				1			1				1	
Construction	1	1	.500	1	1.0	.500			1		.500	.500
Consumer goods	.538	.692	.615	1	.307	.380		.080	0.615	.230		.080
Energy	.636	.727	.360	1	.363	.180	.090	.090	0.636	.270		.090
Fertilisers & pesticides			1	1					1			1

Financial services	.261	.783	.350	.913	.086	.040	.090	.040	.347	.170	.090	.040
Industrial manufacturing	.500	.500	.250	1		.250	.750		.250			.500
Information technology	.667	.667	.833	1	.500	.330	.330		.833	.667		.330
Media & entertainment	1	1	1	1	.500				.500			
Metals	.750	.750	.625	.875	.375	.380	.130	.380	.875	.380	.130	.380
Pharma	0.750	0.750	0.750	1	.375	0.625		.130	.375	.250		.250
Other services	.333	0.667	0.667	1			.330		.333			
Telecom	1	0.667	1	1	0.667		1		1	.330		

SCAP

Industry	LC	OPR	STR	FIN	ECO	GP	TECH	SGE	ER	CDS	REP	HR
Automobile	.500	1	1	1	1	.500	.500		.500			.500
Cement & cement products	.333	.667	.667	1	.667	.333			.667			
Chemicals	.143	.429	.286	.857	.286		.143		.429			.143
Construction	.333	.667	.667	.778	.667	.333		.111	.222			.333
Consumer goods	.545	.818	.455	1	.273	.182	.091	.455				.273
Energy	.333	1	.333	.667	.667	.667		.333	.333	.333	.333	.333
Fertilisers & pesticides	.600	.600	.600	1	.600				.200	.200		.200
Financial services	.316	.947	.421	.947	.158	.053	.105	.053	.053	.211	.211	.158
Industrial manufacturing	.375	.625	.375	1.000	.375	.125	.250		.125			.125
Information technology	.571	.571	.714	.714	.286	.429	.857		.143	.571	.429	.429
Media & entertainment	1	1	1	1								
Metals	.400	.800	.400	.800	.200	.200			.400		.200	
Pharma	.750	.750	.750	.750	.250	.250				.500		
Other services	.500	.667	.500	.500	.667	.167			.333			.500
Telecom		0.500	0.500	0.500	0.500		1					
Textiles	0.625	0.750	0.750	0.625	0.750				.125			.375

LC: Legal and Compliance :OPR: Operations Risk STR: Strategic Risks FIN: Financial Risks ECO: Economic Risks GP: Geo political risks TECH: Technology risk SGE: Social and governance ER: Environmental Risks: CDS Cyber

Annexure 5: Sector wise environment risk category disclosures

Industry	LCAP											
	CC	LS	WTR	EM	BD	ENG	NR	WS	PR/GP	SCM	RC	GER
Automobile	.300		.200	.400	.300	.200	.300	.200	.200	.200	.400	
Cement & cement products	.600	.200	.600		.400	.400	.800	.400		.200	.400	.400
Chemicals												
Construction	.500		.500			.500	.500		.500	.500		1.000
Consumer goods	.462		.308		.076	.154	.231	.231	.154	.077		.077

Energy	.364		.273		.091	.273	.091	.182				.364
Fertilisers & pesticides			1	1	1.000			1.000				
Financial services	.261		.043	.087	.043	.087	.043	.043	.043			.043
Industrial manufacturing	.250											
Information technology	.833		.500		.333	.500	.333	.333		.167	.333	.333
Media & entertainment												
Metals	.875	.375	.500	.375	.250	.375	.500	.500	.125	.250	.250	.500
Pharma	.375						.125			.125	.125	.125
Other services			.333			.333		.333				
Telecommunication	1		.333		.333	.667		.333				0.333

SCAP

Industry	CC	LS	WTR	EM	BD	ENG	NR	WS	PR/GP	SCM	RC	GER
Automobile				.500	.500	.500						
Cement & cement products			.333		.333	.333	.667	.333			.333	
Chemicals					.143	.286	.143	.143	.143	.143		.143
Construction	.222		.222									
Consumer goods	.182		.182				.091	.091			.182	.091
Energy				.333								
Fertilisers & pesticides												
Financial services	.053		.053									
Industrial manufacturing			.125									
Information technology	.143		.143									
Media & entertainment												
Metals					.200						.200	
Pharma												
Other services	.167		.167	.167		.167						
Telecommunication												
Textiles	.125		.125									

CC: Climate Change LS: Land and Soil WTR: water EM: Emission BD: Bio-diversity ENG: Energy NR: Natural Resources WS: Waste Management; PR:Product Responsibility SCM; Sustainable Sourcing; RC: Regulatory Compliance GER: General Risk

Annexure 6: Sustainability Initiatives**6A: Environmental Sustainability Disclosures (Non-risk)**

Environmental Indicators	LCAP	SCAP	Mean	Mean
			LCAP	SCAP
Climate Change / Vulnerability to Disasters	48	60	0.475	0.525
Land/Soil	13	2	0.492	0.000
Water	71	35	0.661	0.460
Emission	61	28	0.629	0.330
Biodiversity Conservation	43	14	0.669	0.400
Energy	91	87	0.758	0.440
Natural Resources	31	15	0.638	0.500
Waste/Effluent Management	86	77	0.590	0.600
			0.579	0.200
Product Responsibility/Green Products	67	61		
Sustainable Sourcing/Supply Chain	60	58	0.579	0.200
General/Other Environmental	19	22	0.589	0.350
No Disclosure	3	5		0.533

Annexure 6B: Examples of sustainability initiatives

Indicators	Examples
Emission	<ul style="list-style-type: none"> • Reducing the clinker factor by using fly ash or slag at the final grinding stage means less limestone to be mined, crushed, ground and burnt in cement kilns which together directly result in lower CO2 emissions. • The use of AFR essentially serves to move away from dependence on fossil-based fuels and other mineral resources. • In 2016, various energy efficiency/ conservation initiatives were undertaken which enabled lower energy consumption and subsequently contributed to reduce our CO2 footprint on account of thermal and electrical Savings. • Reduce the carbon footprint level of the plant by installation of 120 CFM compressor • This significant reduction has been achieved through increase in usage of liquid biofuels and solid biomass for process heating, renewable electricity through solar power purchase agreements and onsite solar photovoltaic (PV) installations. • Freezer cabinets that use hydrocarbon (HC) refrigerants instead of Hydrofluorocarbons refrigerants. • Conference rooms have been enabled with audio and video for Skype group meetings thereby reducing travel foot print • Installation of an Ultraviolet system for air-handling units to improve quality of air; solar panels on terraces to provide electricity to office areas and power to streetlights
Energy	<ul style="list-style-type: none"> • Scheduling and maximizing green power from the captive wind power generation sources contributed considerably on this front. • Commissioned roof top solar plants at different units • Installation of energy efficient LEDs • Power Trading through Indian Energy Exchange • Installation of waste steam recovery system • Optimization of Air conditioning system • Maximization of waste heat recoveries from flue gases. • <u>Air dehumidification using refrigeration heat pump for drying application</u>
Water	<ul style="list-style-type: none"> • Reduction of freshwater intake by lowering water demand in process and non-process areas • Process optimization and upgradation to water efficient technologies wherever feasible • Installation of Sewage treatment plants (STP), Effluent Treatment Plants (ETP), Zero Liquid Discharge (ZLD) systems for effective reutilization of wastewater. • Conservation of water by rainwater harvesting in plants, mines, colonies, community areas and sustained water harvesting measures. No water body is affected by our withdrawal
Biodiversity	<ul style="list-style-type: none"> • All our plants follow comprehensive plans and undertake rehabilitation of spent mines in a well-organized and safe manner in order to protect the biodiversity and nature around. • Tree plantation: .5 lakh trees were planted with average survival rate >80%. • Top soil preservation: This is a general practice adopted at each plant where top soil is preserved for future use during afforestation and plantation activities.
	<p>Reduce waste from manufacturing We maintained the status of 'zero non-hazardous waste to landfill'</p> <p>Reusable, Recycle or compostable plastic packaging</p> <p>Energy from Waste</p> <p>Waste collection and segregation at source with partnering from NGO's</p> <p>Reuse Packaging</p>

Annexure 7: Industries that will be directly affected by climate change

