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Climate change-induced firms' initiatives and investors' perceptions: evidence from Bursa Malaysia

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Abstract

Purpose – This research paper aims to empirically explore how stock market investors' perceptions are affected by extreme climatic events like El Nino and floods in Malaysia.

Design/methodology/approach – This study uses structural equation modelling (SEM) to analyse the empirical data gathered through a questionnaire survey involving 273 individual investors from Bursa Malaysia between January and June 2019.

Findings – Results reveal that companies' efforts, especially for agriculture and plantation-based industries, to adapt to climate change risk at the production, business and stock market levels significantly impact investors' behaviour and investment decisions. Moreover, stock market investors' climate change knowledge shows a significant moderating effect on corporate climate change adaptation initiatives and investors' decisions to invest in Malaysian agricultural and plantation industry stocks.

Practical implications – This research has significant implications for practice and policy, as it measures the stock market investors' level of awareness about climate change events and explores the companies' strategies to reduce climatic risks to their business model.

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Social implications – This study shows the way to adjust the climate change information in the stock market investment decision to improve market efficiency and sustainable stock exchanges initiative.

Originality/value – To the best of the authors' knowledge, this paper is the pioneer one to provide a comprehensive link between climate change events and business performances at production level, business level and stock market levels by drawing inferences from empirical data on investors' behaviours. This study also added value in investment theories and financial literature by observing the climate change as an important factor to determine the investors' decisions in the stock market.

Keywords Climate change, El Nino, Flood, Bursa Malaysia stock market performance, Sustainable stock exchanges, Sustainable finance

Paper type Research paper

1. Introduction

The Intergovernmental Panel on Climate Change's most recent report in 2023 emphasises the scientific evidence showing that global climate change now has significant ramifications for industries and the societies in which they operate (Cooper, 2023). Climate changes affect several areas, such as banking (Caby *et al.*, 2022), agriculture, horticulture, plantations, farming, etc. (Alam *et al.*, 2011a, b; Ibrahim and Alam, 2016; Alam *et al.*, 2012; Alam *et al.*, 2020; Arunrat *et al.*, 2022; Nguyen and Scrimgeour, 2022; Fragoso and Noéme, 2018); mangrove management practices (Agaton and Collera, 2022); smart cities (Huang-Lachmann, 2019); traffic accident (Islam *et al.*, 2019); water resources (Idrizovic *et al.*, 2020); and river flows (Sönmez and Kale, 2020).

Nevertheless, agriculture and plantation sectors are directly affected by climate change. Among different climatic phenomena, El Nino and floods are two critical issues related to agricultural production. The phenomenon known as El Nino Southern Oscillation (ENSO) changes the worldwide average temperature and produces oscillations in the temperature. A tropical eastern Pacific Ocean cyclone can trigger torrential rains and severe droughts in several places (Atems and Sardar, 2021; Bastianin *et al.*, 2018; Cirino *et al.*, 2015). It is also possible for floods to occur without warning, wreaking havoc on agriculture and infrastructure and leading to the deaths of people in landslides and mudflows (Alam *et al.*, 2020; Piao *et al.*, 2010).

When climate change events lead to a decline in crop production, it will damage the profitability of the relevant corporation. When the stock of an agricultural and plantation company is publicly traded, climate change-related occurrences will undoubtedly cause the stock price or market value of the company to rise or fall. Research shows that stock prices fall when there is terrible news about the environment and rise when there is good news about it (Beatty and Shimshack, 2010). Firm-level gains and costs from climate change are projected to vary, which will be reflected in stock prices. Short-term changes in stock prices should be influenced by information like this if the market is efficient (Beatty and Shimshack, 2010). Information on climate change is meant to be reflected in stock prices, according to the efficient market hypothesis (EMH).

Much research has been done on climate change and stock market performance, but most analyses were based on a single or a few climatic events to estimate the effects on stock market indices (Antoniuk and Leirvik, 2021; Alam *et al.*, 2020; Al-Amin and Alam, 2016). Similarly, studies indicate that El Nino has considerably impacted financial and derivatives markets worldwide, particularly on "soft" commodities like rice and wheat and hard commodities like gold and copper (Periasamy and Satish, 2016). Therefore, it is crucial to understand investor awareness of climate change and how this relates to the implementation of actions by corporations to reduce risks to their business model.

This study aims to assess how El Nino and floods affect the stock market behaviour of investors in Malaysia's agriculture and plantation corporations. There are some excellent justifications for conducting this study in Malaysia. The country's agriculture industry has heavily influenced Malaysia's history and economic development. A significant drop in rainfall during the dry season, known as the "El Nino effect" that occurs in Malaysia, a major Southeast Asian country, makes it vulnerable to this phenomenon. Extreme weather conditions wreak havoc on economic growth, GDP, industry, agricultural land use and production and consumption patterns (Jabin, 2015). As Parker *et al.* (1997) highlighted, Malaysia is prone to natural and artificial tragedies, including floods, droughts, landslides, pollution-induced haze, tsunamis and more. This is despite Malaysia's location outside of the Pacific Ring of Fire. The El Nino climate variability is not simply a threat to agriculture or plantations but to many other areas of the economy. Flooding is a joint event in Malaysia, and climate change has made flooding more unpredictable. MPOC (2018) reports that oil palm tree estates in Malaysia have been damaged by flooding, resulting in the loss of thousands of hectares of forested land (Diya *et al.*, 2014).

Consequently, the profitability, market share, market value and equity performance of plantation firms in Malaysia are all adversely affected by climate change. The impact of climate change on specific industries influences investors' decisions. The uncertainty, especially in the stock market, makes deciding investments challenging. This indicates the selection of stocks from various companies based on the data collected and analysed (Nofsinger and Varma, 2014). For Malaysia, Jaiyeoba and Haron (2016) used qualitative measurements in interviews to study investors' decision-making behaviours/actions in the stock market. As a result, it is critical to understand how individual investors in Malaysia's stock market make investment decisions and how climate change impacts the agriculture and plantation sectors. Our knowledge of this needs to be improved.

This study examines individual investors' decision-making behaviours from the Malaysian stock exchange – Bursa Malaysia, to fill this knowledge gap. As of October 2022, there are 753 companies enlisted under 13 sectors in the primary market of Bursa Malaysia. There are 41 agricultural and plantation companies indexed under the plantation sector, which is one of the oldest sectors maintaining data since 1970 (Bursa Malaysia, 2022). In Bursa Malaysia, individual investors are significant because this market is dominated by retail investors both in terms of market capitalisation and the amount of investment they make. Here, retail or individual investors have surpassed foreign and domestic institutional investors as the most significant buyers. To put things in context, individual investors traded shares worth RM32.3bn in June 2020, compared to RM14.6bn for foreigners and RM30.28bn for domestic institutional funds (Kana, 2020).

Thus, this study makes several new contributions to the literature on climate change and stock market investors' perceptions. Firstly, to the best of the authors' knowledge, this is one of the first studies to assess how a specific climatic event (El Nino and associated floods) shapes stock market investors' perceptions. Secondly, this study does not consider the influence of climate change at the overall market level, but at the company level, especially for agriculture and plantation-based industries. Thirdly, this study empirically tests the issue using empirical data and modelling. Fourthly, potential investors will benefit initially from an improved understanding of how climate change risk adjustment affects agriculture and plantation stock market investors' behaviour and decisions. Investors who are more conscious of climate change issues would make better investment selections. For example, investors buying and selling stocks might cause changes in stock values. Thus, companies' managers or owners would know about El Nino and floods. For private sector investors, the timing and nature of El Nino and the subsequent floods can serve as a cautionary tale when

investing in plantation businesses' stock. Finally, this research provides investment planners with realistic steps to make informed decisions for their clients and a reference for other stakeholders, including investment analysts, financial advisors, institutional investors, scholarly and non-scholarly researchers, financial consultants and others interested in investment decision-making procedures and outcomes.

The rest of manuscript is structured as follows: In Section 2, we conduct a comprehensive review of the literature, explore relevant finance-based theories, and examine quantitative research related to investment decisions and classification. Section 3 outlines our data collection methods and research approach. Section 4 presents our research results along with a detailed discussion of our findings. Conclusions and implications for future studies are presented in the Section 5.

2. Literature review

2.1 Climate change in investment decisions

According to numerous studies, climate change is now affecting agricultural production and crop yields (Alam *et al.*, 2011a, b; Ibrahim and Alam, 2016; Alam *et al.*, 2012; Alam *et al.*, 2020; Arunrat *et al.*, 2022; Nguyen and Scrimgeour, 2022). Temperature and rainfall have been studied concerning palm oil crops and other significant crops (Sarkar *et al.*, 2020). Crude palm oil production yields in Malaysia mostly rely on the weather and can fluctuate dramatically (Song, 2018). Crude palm oil production and stock market prices are expected to decline during El Nino, but the price of crude oil palm is expected to rise by 10.2% due to Malaysia's shortfall. Plantation companies' industry performance suffers because El Nino triggers poorer productivity (Marengo and Espinoza, 2015). For this reason, the stock price fluctuates unfavourably (Spiele, 2017). Another climate phenomenon is a flood, which can strike quickly and cause extensive damage to or destruction of agricultural produce and infrastructure, as well as landslides, mudflows and even mortality (Alam *et al.*, 2020; Piao *et al.*, 2010).

As a result of ENSO, the global temperature might fluctuate, which is why it is essential to monitor this phenomenon. It has caused torrential rains and severe droughts in many areas because it started in the tropical eastern Pacific area (Atems and Sardar, 2021; Bastianin *et al.*, 2018; Cirino *et al.*, 2015). One country in Southeast Asia, Malaysia, is vulnerable to El Nino, which results in a lack of rainfall during the dry season (Alam *et al.*, 2020). Selvaraju (2003) states that El Nino significantly affects food grain production. According to research, El Nino is one of the most likely causes of climate change, which is directly linked to droughts and flooding, which have profound implications for agricultural production and the broader economy (Al-Amin and Alam, 2016; Alam *et al.*, 2020; Atems and Sardar, 2021; Cashin *et al.*, 2017).

Natural catastrophes can shape what happens in the financial market. Worthington and Valadkhani (2004) discovered a substantial correlation between bushfires, cyclones, earthquakes and equities market returns in Australia. Worthington (2008) discovered that floods could devastate the Australian stock market, making it more volatile and prone to collapse. It was found that climate change, particularly El Nino and floods, harmed the financial performance of the 33 firms registered on the Malaysian stock exchange from 2003 to 2016 (Alam *et al.*, 2020) based on a panel data set on the financial performance of Malaysian agricultural and plantation firms. It is clear from the data that climate change decreases a company's profit margin.

Recent academic studies examining how quickly stock prices are affected by natural disasters come to conflicting results. According to some studies (Worthington and Valadkhani, 2004), disasters brought on by climate change significantly disrupt stock

returns, whereas other studies argue that these events have little bearing on returns (Wang and Kutan, 2013; Worthington, 2008). In the study by Bourdeau-Brien and Kryzanowski (2017), the effect of the US disasters on the stock returns of firms based in the affected areas is examined on event windows more prominent than the typical one to five days to determine whether the negative results originate from a geographic or an event period duration story. The geographical and the more critical event period duration stories are consistent with the findings. Companies headquartered in catastrophe states typically have higher abnormal returns than those in neighbouring states. In brief event periods (one to five days), disasters do not produce abnormal returns after controlling for the expected percentage of falsely rejected hypotheses. However, when abnormal returns are investigated over a medium-term (two to three months) event period, 6% and 7% of the severe weather events significantly affect stock returns. Thus, Bourdeau-Brien and Kryzanowski (2017) discovered that the US stock market suffered from catastrophes. Local stock returns experience a significant increase despite natural disasters such as hurricanes, floods, winter storms and periods of excessive heat.

On the other hand, Luo (2012) discovered "astonishingly" moderate and insignificant outcomes on six national stock market indices. Asongu (2013) discovered barely any indications of a spillover into global foreign exchange markets. According to Koerniadi *et al.* (2016), disasters affect stock markets in various ways. For example, a hurricane, tornado or earthquake can negatively impact stock returns long term, while a flood or a volcanic eruption has only a minor impact.

According to Göçken *et al.* (2016), stock price fluctuations undoubtedly influence investors' decisions, and several elements go into this. For the ordinary stock investor, stock price fluctuations undoubtedly guide investors' decisions. For common equities investors, strong forecasting models are greatly desired for the financial decision-making process of investors due to the impossibility of reaching a correct conclusion given the complexity and unpredictability of stock market behaviour. On the other hand, as reported by Al-Tamimi *et al.* (2011) study in the United Arab Emirates, investors' behaviour in Dubai Financial Market and Abu Dhabi Securities Market is influenced by the overall market conditions at the time of the study. Estimated corporate income, stock brand value, past stock performance, holdings of the governing body and the growth of the structured finance market are the factors with the most considerable bearing on the structure in terms of importance. According to Ahmad (2017), the primary factors influencing investor behaviour in Pakistan include anticipated corporate earnings, dividend payments, stock saleability, the integrity of the financial declarations, anticipated dividends, current economic metrics, the stock's historical performance, financial adviser suggestions, the company's position in the industry and get-rich-quick schemes. Chong and Lai (2011) discovered that neutral information is positively connected to expected return, whereas accounting information is negatively related. When using accounting information to support their investment decisions, the participants' stock market experiences vary considerably. It has been observed that investors with 15 to 20 years and 5 to 10 years of stock market expertise rely primarily on accounting information to inform their investment decisions. For those who have been in the stock market for more than two decades, accounting information is more likely to be disregarded while making investing decisions.

Research on investment decision-making tends to focus on how cognitive aspects influence it, which is a quantitative approach to the issue. According to Kumar and Goyal (2015), an extensive review of the literature on investment decision-making undertaken over the past two decades aimed at detecting omissions. Overconfidence, disposition effect, herding bias and home prejudice emerged as prevalent in studies studying stock market

participants' investment decision behaviour, according to Kumar and Goyal (2015). They also state that an extensive selection of systems and methodologies are frequently used. Using interviews, Almujamed *et al.* (2013) examined the investment decision-making processes of 16 participants in Kuwaiti financial institutions, including investment firms and technical analysts. Technical and risk assessments are used by interviewees more frequently than fundamental analysis, according to the researchers, who rank them as the second and third most popular methods used by interviewees. For shortlisting stocks in this country, investors use a combination of pattern and trend searching, with the average daily rule primarily used in pattern and trend searching instead of the filtration technique. Masood *et al.* (2009) interviewed 81 bank risk supervisors in Saudi Arabia to learn more about the factors determining investment decisions. According to Saudi risk managers, personal experience and judgement are more important than statistical estimations and analytical algorithms when making investment decisions. In any case, the findings strongly suggest an intense desire for product safety, quality information and the company's efforts to respect the environment.

In the wake of storms and earthquakes, floods are the third most destructive natural disasters that can occur worldwide (Wilby and Keenan, 2012). On the other hand, a few studies look at how investors react when natural disasters strike. Zhou and Botzen (2017) indicated that typhoons and floods significantly impact short-term business growth. For organisations with higher financial limitations but no capital growth, typhoons and floods significantly influence labour and value-added growth more than capital growth. According to this study, firms with a limited budget are more likely to swap labour for capital during the rehabilitation phase following a disaster (Zhou and Botzen, 2017).

In Malaysia, floods have cost the country billions of dollars (Alam *et al.*, 2020). As a result of the hardships and massive damage that floods do to people's livelihoods, roads, food supplies and possessions, a significant threat to the nation's food security exists (Piao *et al.*, 2010). Mohamad bin Glanville and Perry (2015) found that firms in non-Western countries like Malaysia make investment decisions based more on convenience and habit than quantitative analysis. Investors' judgements can begin at the bottom or the top; what matters to Malaysian institutional investors is how they understand the market as a continual learning process. On the other hand, only a few studies examine how investors react when extreme weather conditions can dictate economic assumptions. To better understand Malaysian stock market participants, particularly retail investors, Jaiyeoba and Haron (2016) used qualitative metrics. Their study revealed that Malaysian retail investors tend to be nationalistic in their investment selections. Their decisions are based on a sense of security or habit rather than quantitative modelling. Psychological biases influence individuals despite their best efforts to remain objective.

Nevertheless, the study by Jaiyeoba and Haron (2016) did not consider the influence of climate change, so this present research fills that gap in our knowledge. Only a few studies have discovered a direct correlation between climate change and firm performance and how this relates to investors' behaviour when considering companies affected by climate change. Recently, according to Wardhani and Rahadian (2021), palm oil businesses in Indonesia and Malaysia still need to fully involve all stakeholders, governance and leadership or develop a clear strategy of what they want to achieve. Economic, environmental and social programs have yet to be implemented (or even considered) by palm oil corporations which affects investors behaviour towards investing in these companies. Even though the data show that environmental and social initiatives receive more attention than economic ones, these issues need adequate space and attention. Therefore, this comprehensive review shows the

importance of investors to the economy and stock markets and explains why it is worthwhile to research their investment behaviours.

2.2 Theoretical underpinning

This study refers to several financial and investment theories. The EMH assumes securities prices should always reflect all currently available information objectively, and returns should be consistent with investors' perceived risks (Naseer and Bin Tariq, 2015). When security prices respond quickly to the introduction of new information, a capital market is efficient. This study assesses the argument of this theory that investors are aware of the climate change news related to the relevant company aid in achieving market efficiency (EMH).

Moreover, behavioural finance theory says investors are only sometimes rational and irrational investors fail to analyse all essential facts while creating rational expectations. According to behavioural finance theory, many investors have the same overconfidence, overreaction and overrepresentation tendencies, and a significant investment group with similar behaviour causes price volatility (irrational systematic behaviour). Kumar (2017) asserts that this prevents a company's stock price from precisely reflecting the state of the economy. Therefore, this study checks the argument of this theory as if investors rationally consider the impact of climate change when investing in relevant companies.

On the other hand, The arbitrage pricing theory (APT) is a financial model used to calculate the anticipated return of an asset based on its exposure to various risk factors (Roll and Ross, 1980). It is an alternative to the capital asset pricing model (CAPM), which assumes that the market is the only risk factor influencing returns. The model suggests that investors can earn risk-free profits through arbitrage opportunities if the price of an asset deviates from its APT-predicted expected value. In general, the APT model may offer investors a framework for assessing the effect of climate change on investments to make sound choices based on risks and possibilities associated with climate change. By incorporating climate change considerations into their investment decisions, investors may attain higher risk-adjusted returns and contribute to a more sustainable future.

The cornerstone of signalling theory indicates that the signaller has more access to information that is either not publicly known or has not yet reached the receiver, with signal quality being of equal importance (Spence, 1973). Although there is a wealth of publicly available information, there must be more clarity between what is known and what may be deduced from new signals. According to signalling theory, negative or positive information communicated by a signaller is valuable to a receiver (Kirmani and Rao, 2000). Either the signal contains fresh information, or it augments previously held information. The signal is significant, but for it to be of interest to the receiver, it must possess significant quality (Connelly *et al.*, 2011). Due to the abundance of signalling and market noise and the hunt for authentic knowledge, a crucial quality aspect correlates directly with the signaller's reputation and/or prestige (Kreps and Wilson, 1982; Certo, 2003). The signal and the signaller's reliability must be sufficient for a receiver to act (Black and Owens, 2011). For instance, firm statements can reach multiple recipients and can be targeted to a specific stakeholder or investor, but the effect is decided by the sender's perceived credibility (Gomulya and Mishina, 2017). The main focal interest of the signal is the sender's reputation. The capability to control the signal depends on the sender's repute, and the signal's strength is directly proportional to the sender's trustworthiness (Kovács and Sharkey, 2014). Therefore, this study checks the argument of this theory concerning initiatives made by firms to make changes in stock market performance due to climate change and how that affects investors' decisions.

2.3 Hypotheses development

Due to the steps, it has taken to address the Southeast Asia financial crisis and stock market meltdown, Malaysia, one of the region's preeminent market forces, has attracted discussion and interest on a global scale. The Malaysian economy has successfully recovered thanks to institutional reforms and capital controls. Investor sentiment has increased, and individuals are spending again to boost the economy. Nevertheless, in the highly competitive market, the Malaysian stock market continues to encounter various external difficulties and changes in the global economy. For instance, foreign institutional investors have sold a lot to move their money to less expensive regional markets. Attracting long-term investment in Malaysia continues to be a challenge. As long as investors are thought to still respond to market rumours, economic developments and speculative political problems, the Malaysian stock market will not be deemed wholly evolved. Therefore, it is intriguing to learn how investors choose their investments in developing countries like Malaysia with the rise of global climate change impact on various firms such as agriculture and plantation-based industries in Malaysia. However, a few studies have used a quantitative technique, such as a questionnaire, to evaluate the investment behaviour of stock market investors in an emerging economy like Malaysia or elsewhere. Although these views may concern investors in Malaysia, they also need to be considered by publicly traded enterprises, government agencies and organisations that monitor agro-plantation companies that trade on the stock exchange. This study fills the knowledge gap by discovering how climate change influences investors' behaviour in Malaysia's agriculture and plantation industry and stock market by suggesting four hypotheses.

2.3.1 Companies' initiatives to make changes in production methods due to climate change and investors' decisions. There has been much discussion about how climate change affects industries. As many industries depend on temperature and seasonal circumstances, it is commonly acknowledged that agriculture and associated services are vulnerable to climate change hazards (Pinkse and Gasbarro, 2019; Sun *et al.*, 2020). Extreme heat has a detrimental effect on various non-agricultural activities, such as mining and public utilities (Dell *et al.*, 2012; Sun *et al.*, 2020) and agricultural firms' activities (Hertel and Lobell, 2014; Alam *et al.*, 2020). Risks originating from climate change will significantly alter the tourism industry, which is intimately tied to natural resources and the environment (Weir, 2017). The prevalence of natural disasters will force insurance firms to change their policies, invalidate legitimate insurance claims and make insurance more expensive.

Risks associated with climate change are difficult to detect in the early stages, and their severity increases as they progress. Because of this, most businesses rarely take timely, effective countermeasures to the serious hazards posed by it. As a result, businesses need to consider new opportunities and difficulties. Reducing risks associated with climate change is increasingly a crucial indicator of corporate social responsibility (Hossain and Masum, 2022). In addition, several research had already been carried out to investigate the effects of climate change on the production of agricultural goods (Aydinalp and Cresser, 2008; Bosello and Zhang, 2005; Collier, 2007). According to these studies conclusions, climate change's effects on agricultural production and crop yield are unfavourable. One of the reasons the company's profitability is going down may be the fall in crop yield. The nation of Malaysia's economy is supported to a large extent by its agricultural sector. Agricultural production contributes, on average, 10% to the entire gross domestic product of the nation. In addition, Malaysia is a world leader in exporting palm oil and rubber products. Therefore, businesses must improve their environmental protection and cost management strategies to increase their financial viability. Companies that actively implement environmental governance and protection measures over time can create a win-win situation for the environment and the economy (Yang and Wang, 2016). As a result, the following hypothesis is generated:

H1. Companies' initiatives to make changes in production methods due to climate change have a significant impact on investors' decisions.

2.3.2 Companies' initiatives to make changes in business due to climate change and investors' decisions. Numerous businesses, especially in industrialised nations, now have a better and more comprehensive understanding of environmental issues, allowing them to manage their operations with little emissions and waste production. These businesses may even develop a strategy to offer their clients products, services or technologies that do less environmental damage. These "cleantech" or pioneering businesses need a standardised method for calculating and publicising the environmental advantages of their projects. Experts have discovered tools for identifying the ecological impact of product systems. Scientists have used and expanded upon the idea of indirect unshackling impacts. The comparable overall measurement evaluates a (product) system's potential to be socially, environmentally and economically sustainable. According to research on green marketing, conveying the positive outcomes of products and services can be challenging. Ramirez *et al.* (2014) suggest more consistent communication of a sustainable product's financial benefits and favourable environmental effects to overcome credibility concerns. According to Cronin *et al.* (2011), explaining a product's environmental benefits is difficult as green marketing strategies must avoid "greenwashing" while addressing customer scepticism and uncertainty. Certain enterprises may find a substantial customer base comprising people who want sustainability (Patala *et al.*, 2016). For entry into this market, prospective sustainability benefits of products and services offers must be presented and communicated well and in detail (Pihkola *et al.*, 2010).

Numerous specialists stress the significance of altering the company's focus from minimising bad outcomes to maximising positive ones. In 2002, Dyllick and Hockerts introduced this concept; in 2006, Young and Tilley (2006), and, a decade later, in 2016, Dyllick and Muff examined the concepts of effectiveness and efficiency. Dyllick and Muff (2016) analysed the development of a "positive footprint" over the life cycle of a product as a step towards building a sustainable company, as opposed to pursuing efficiency, i.e. reducing footprint, without considering effectiveness (usually on a business basis). According to McDonough and Braungart (2002), the triple bottom line is a company strategy that seeks to integrate goals for social, ecological and economic sustainability with an emphasis on minimising adverse outcomes. They also propose an innovative idea known as "triple top line" that focuses on identifying new business prospects through generating positive outcomes or a "beneficial ecological footprint" (McDonough and Braungart, 2002). According to Dyllick and Rost (2017), businesses are more likely to positively regard their social impacts, such as job creation and employee well-being, whereas they view their environmental impacts negatively. These authors also assert that creating truly sustainable products requires considering and optimising products' positive impacts (their "handprint") rather than reducing their "negative footprints". Sala *et al.* (2013) state that lifecycle-based techniques for assessing product sustainability should be expanded beyond proactively avoiding negative repercussions to increasing positive benefits. Based on the overall discussion, the following hypothesis is generated:

H2. Companies' initiatives to make changes in business due to climate change have a significant impact on investors' decisions.

2.3.3 Companies' initiatives to make changes in stock market performance due to climate change and investors' decisions. A firm's "climate change impact statement" discloses if it asserts that climate change presents possibilities or challenges for the business. This metric demonstrates how much weight a company places on climate change in general and how vital it is for businesses to take the appropriate actions. Secondly, "released carbon reduction

measures" refers to business attempts to minimise CO_2 or CO_2 equivalents during manufacturing. This measure indicates whether a corporation reports on particular corporate initiatives implemented in response to climate change. Investors perceive corporations that publish their climate change responses as performing better environmentally than those that do not reveal anything.

Socially responsible investing (SRI), also known as ethical or sustainability trading, frequently includes audits of investment portfolios with a concentration on the health of the natural world (Renneboog *et al.*, 2008). The process of selecting assets based on criteria tied to social responsibility is referred to as this type of investment strategy. Therefore, SRI is based and operates on both social and environmental issues. In this context, "corporate social responsibility" (CSR) refers to social and environmental initiatives. However, the current research on the link between a company's financial performance and its environmental performance needs to provide a definitive answer (Guenster *et al.*, 2011), according to the findings of McWilliams and Siegel (2001), when one company adds a second CSR quality or feature that the market values, the net effect of this characteristic are neutral in equilibrium in a model with two companies that create products or goods/services that are otherwise comparable (McWilliams *et al.*, 2006).

One can use neoclassical microeconomics as a general rationale for a positive link between businesses' environmental and financial performance. According to Heal (2005), competitive markets and the government must adequately solve all issues involving external events and their consequences. If they result in external expenses, corporate environmental initiatives can replace missing markets (and thus lack regulations) and reduce conflicts between corporations and stakeholder groups such as non-governmental organisations. It may be asserted that diminishing these disputes increases firm profitability in the long run. This also increases the appeal of environmentally responsible enterprises to investors. Actions to reduce carbon emissions are more likely to have a positive link with the financial success of businesses than climate impact statements. This is because global climate reports do not, on the whole, result in an actual reduction in businesses' external expenses.

A company's strong reputation for disclosing its responses to climate change is another example of an intangible resource (Orlitzky *et al.*, 2003). Customers who care about these concerns might make larger purchases, boosting the company's profitability. If they can be monetised and are challenging for rivals to imitate, new technologies deployed due to purposeful, proactive corporate decarbonisation measures are an instance of a tangible or physical resource. Stakeholder theory and the resource-based view of the company, taken together, argue that disclosing corporate actions associated with climate change can raise profit forecasts among investors. The contributing variables also suggest these optimistic estimates may be more significant for carbon reduction efforts than assertions of climate effect. As a result, the following hypothesis is generated:

H3. Companies' initiatives to make changes in stock market performance due to climate change have a significant impact on investors' decisions.

2.3.4 Investors' awareness of climate change and their investment decision. Recent, thriving literature has investigated how climate risk affects financial markets (Hong *et al.*, 2020). Understanding climate change is crucial when making investment decisions. Arguably, capital shifts away from highly exposed investments must reflect an awareness of climate-related risk. According to a survey analysis by Krueger *et al.* (2020), investors consider climate risks when making investment decisions because those concerns may impact their investments. Although the level of interest in making changes takes this into account to some extent, we contend that proving an explicit connection between adaptive capacity and

awareness of climate change—even though we could never ascribe causality—would make it possible to implement many innovative methods to deal with the symptoms of climate change. Therefore, the following hypothesis is generated:

H4. Investors' awareness of climate change has a significant impact on their investment decisions.

2.4 Research framework

Based on these theoretical discussions and a review of the literature and hypothesis development, this study developed a study framework based on four hypotheses, as depicted in Figure 1. The framework implies that an individual investor's investment decision is related to certain things, such as the investor's awareness about climate change impacts on related business (moderating variables) and companies' initiatives to adjust climate change risk at three levels:

(1) firstly, make changes in production level;

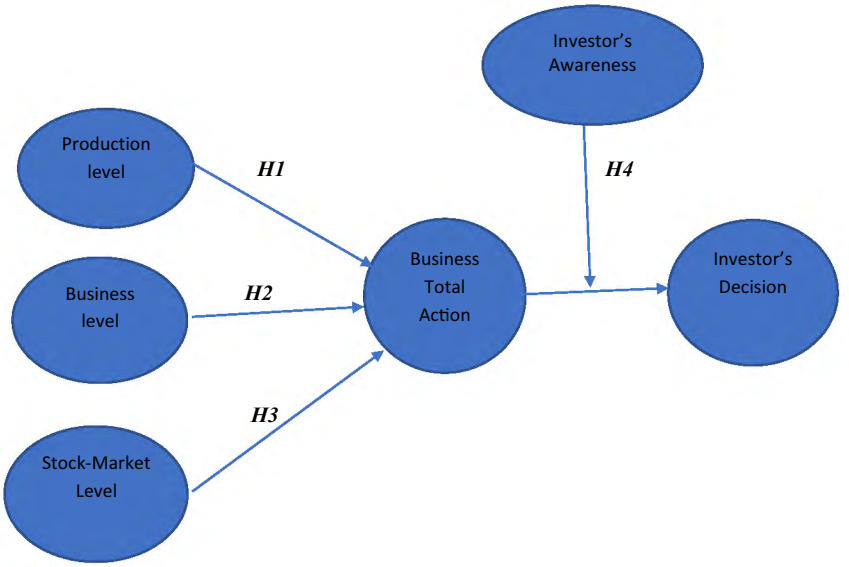
(2) secondly, make changes in business level; and

(3) thirdly, introduce changes at the stock market level.

3. Research method

3.1 Data and sampling

More than 800 individual investors of the Bursa Malaysia stock exchange participated in an online questionnaire survey between May and June 2019. Our questionnaire was distributed to several brokerage houses, and data was obtained by random selection from those



Source: Created by authors

Figure 1.
Study framework

institutions. Three hundred twenty responses were received, of which 273 were used for analysis.

In contrast to Jaiyeoba and Haron's (2016) study, which used interviews to develop six exploratory questions, five constructs were measured to inspect the issue of climate change and how investors' decision-making behaviour is affected by the stock market performance of agriculture and plantation companies in Malaysia. Appendix Table A1 contains information on the variables and constructs used in this study. An ethics committee reviewed the questionnaire, which was subjected to a pre-test study before it was finalised. The questionnaire was pilot-tested prior to fine-tune its parameters. A five-point Likert scale was used, with 5 indicating the highest rating and 1 indicating the lowest.

The following is an example of a demographic profile of our survey participants. The percentages of males and women in the 273 total included for analysis were nearly identical, with men at 52.7% and women at 47.3% (Table 1). Of the responders, 90% have a Bachelor's degree or higher, while the rest have a certificate/diploma and secondary education. Only 8.8% of respondents were between 15 and 25, while most respondents (53.1%) were in the 26–35 age bracket. The remaining participants were between the ages of 36 and beyond. Of the participants, 45.8% had just started operating their business and had only 0–5 years of experience, 22.3% with 6–10 years, and 9.2% still needed to disclose how long they had been

Table 1. Demographic profiles of the stock market investors

Parameter	Criteria	No. of participants	%
Gender	Male	144	52.7
	Female	129	47.3
Education level	Secondary	16	5.9
	Certificate/Diploma	12	4.4
	Graduate and tertiary	245	89.7
Age group	15–25 years	24	8.8
	26–35 years	145	53.1
	36–45 years	51	18.7
	46–55 years	44	16.1
	56 and above	9	3.3
Involved in share trading	0–5 years	125	45.8
	6–10 years	61	22.3
	11–15 years	14	5.1
	16–20 years	33	12.1
	21 years and above	15	5.5
	Missing	25	9.2
Total investment	Below RM5,000	189	69.2
	Below RM25,000	35	12.8
	Below RM100,000	40	14.7
	Below RM500,000	9	3.3
Stock market income	Below RM1,000	165	60.4
	Below RM5,000	88	32.2
	Below RM10,000	20	7.3
Total income	Below RM1,000	15	5.5
	Below RM5,000	99	36.3
	Below RM10,000	86	31.5
	Below RM20,000	37	13.6
	Below RM50,000	22	8.1
	RM50,000 and more	14	5.1

Source: Created by authors

active in the stock market. The rest had been in the stock market for more than 11 years. About 70% of those who responded invested less than RM5,000 in the stock market, while 12.8% invested up to RM25,000, just 3.3% and 14.7% of respondents invested more than RM500,000 and less than RM100,000, respectively. Of those who responded, 36.3% reported an annual income of RM5,000 or less, while 31.5% claimed they had an annual income of RM10,000 or more.

3.2 Analytical procedure

The partial least squares structural equation modelling (PLS-SEM) approach, with a two-step process, was used to reach relevant conclusions in this study. The measurement model was analysed in the first study, while the path coefficient was examined in the second (Ramli *et al.*, 2018). When complex models, a limited sample size and a violation of normality are involved, PLS-SEM is frequently used. Participants (investors) tend to overestimate their investment actions to meet societal expectations, which is of primary importance. In this case, PLS-SEM is the best method due to the high skewness of the responses. PLS-SEM can handle relatively small sample sizes. However, as advised by Cohen (1992), we did a statistical power study to identify the minimal sample size. The validity and reliability of data and models have also been examined using a variety of diagnostic tests, such as those that assess internal consistency, indicator reliability, convergent validity and discriminant validity, among others.

4. Result and analysis

4.1 Descriptive statistics and correlation analysis

Climate change and how it affects investors' decision-making behaviour in Malaysia were examined using five variables or constructs. As El Nino and floods significantly impact the country's agriculture, this study included them as climatic variables when evaluating investors' views on climate change. Investors' Climate Change Sensitivity was assessed using a five-item questionnaire (Appendix Table A1). Only a tiny percentage of respondents believed climate change had a detrimental influence on Malaysia's agriculture and plantation industries, even though most respondents thought that climate change was severe. According to the survey, 78% of respondents agree that climate change increases production costs and curtails profitability in the agriculture and plantation sectors, as well as increases their vulnerability.

Based on five items, the construct Reflection of Climate Change on Investment Decision was measured. An overwhelming majority (49%) of Malaysians agree that climate change raises questions about the financial viability of the country's agriculture and plantation businesses. A close percentage (39.5%) agree that investing in agriculture and plantation businesses creates an expectation of more risk premium. However, only a small group of respondents (24.9%–29.7%) feel climate change is a big enough issue to cause an increase in the volatility of share prices. As a consequence, businesses should provide them with an additional dividend payout.

In addition, five items served to measure the construction of Companies' Initiatives to Make Changes in Production Methods based on Climate Change. Consequently, only 41.4%–46.1% of those respondents believe that Malaysian agriculture and plantation companies take initiatives to alter their production methods with crop rotation and infrastructure like crop storage and irrigation systems, invest heavily in research and development and get financial support from various stakeholders and agencies. Most of them also disagreed that different types of stakeholders are getting involved at all levels of the adaptation process of climate change.

Furthermore, five parameters were used to measure the construct of Companies' Initiatives to Make Changes in Business due to Climate Change. Among the individual investors, 84.8% believe that Malaysian agriculture and plantation industries are taking the initiative to limit risks, such as substantial insurance coverage and hiring experts. Moreover, 68.1%–76.6% of respondents believe that companies are adjusting their accounting system, such as maintaining a reserve fund, allocating a climate budget, altering financial dealings and reporting systems to reflect climatic changes, diversifying asset portfolios involving non-agricultural business sectors and looking for alternative sources of capital to deal with climate change.

Finally, the Companies' Initiatives to Make Changes in Stock Market Performance due to Climate Change construct were measured by five items. Data shows that 64.8% of respondents believe that agriculture and plantation corporations adequately communicate with their investors and shareholders about climate change, whereas 61.5%–62.7% of investors show their expectations that companies take into account climate change risk, take the initiative to reduce volatility in their stock price and pay higher dividends to retain their investors' loyalty despite climate change risks.

The strength of the variables' relationship and descriptive statistics are noted in Table 2. A correlation of 0 suggests no association, but a correlation of ±1.0 shows a perfect relationship, according to Joseph (2010). According to Cohen (1988), a correlation between ±0.1 and ±0.29 implies no association, while a correlation between ±0.30 and ±0.49 indicates an average relationship, while a correlation more significant than ±0.50 suggests a firm/solid connection. As a rule, correlation coefficients fall below the significance threshold of 0.70. Hair *et al.* (2011) state that the correlation matrix should not surpass 0.70 to ensure the multicollinearity problem is not present. Table 2 shows the strongest association between investment choice and awareness at 35.7%, followed by production planning and awareness at 31.0%.

4.2 Assessment of structural equation model

In bootstrapping, random samples are taken from the original data set (with replacement). Subsamples of the PLS path model are then used to estimate the path model. This process is repeated until many randomised subsets are obtained (e.g. 5,000). This large number of evaluations from the bootstrapping subsets (e.g. 5,000) computes the standard errors for PLS-SEM findings. As a result, bootstrapping with 5,000 samples for the actual sample size of 273 was used to do SEM (Ringle *et al.*, 2015). According to the findings, a company's climate change adjustment efforts include production, business and stock-market initiatives. Path coefficients 0.480 and p0.001 considerably impact investment decisions when

Table 2.
Correlation matrix and descriptive statistics

Variables	Awareness	Product level	Business level	Stock market level	Investment decision	Mean	SD
Awareness	1					4.0205	0.67684
Production level	0.310***	1				3.4440	0.65874
Business level	0.243***	0.205***	1			4.1377	0.80115
Stock market level	0.235*8*	0.135***	0.216***	1		3.7524	0.84153
Investment decision	0.357***	0.548***	0.397***	0.276***	1	3.1766	0.74481

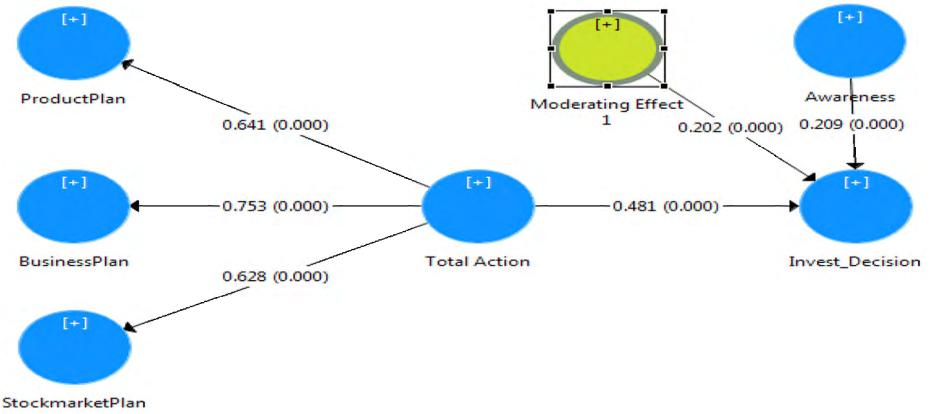
Note: ***Correlation is significant at the 0.01 level (two-tailed)
Source: Created by authors

considering these factors. The findings confirm that investors' understanding of climate change significantly benefits the relationship between companies' climate change actions and investors' decisions (path coefficient 0.201 and *P*-value 0.001). The structural equation model's path diagram is depicted in Figure 2, while the direct hypotheses' actual values are shown in Table 3.

4.3 Model diagnostic tests

As part of the validation and reliability process, PLS-SEM looks at the factor loading, Cronbach's alpha and the average variance extracted (AVE) (Henseler *et al.*, 2017). In this study, the requirements for determining convergent validity were all met, as shown in Table 4.

The Fornell–Larcker criterion and the heterotrait–monotrait ratio (HTMT) were also used to verify discriminant validity. This requirement is met when the correlation between the variables does not exceed AVE square root (see Table 5). For the most part, this is how PLS-SEM research proceeds (Ramli *et al.*, 2018). No factors correlate with other variables greater than 0.85, according to Table 5. Discriminant validity can be supported by this conclusion, which suggests that all variables are unique (Henseler *et al.*, 2017; Ramli *et al.*, 2018). SEM can proceed if the study variables have high convergent validity and reliability.



Source: Created by authors

Figure 2. Path coefficient and *p*-value in structural equation model

Path	Original sample (O)	Sample mean (M)	SD (STDEV)	T-statistics (|O/STDEV|)	*p*-values
Climate change awareness moderating effect → Investment decision	0.201	0.204	0.034	5.947	0.000
Company total action → Investment decision	0.480	0.480	0.051	9.442	0.000
Total action → Adjustment in business level	0.753	0.754	0.038	19.613	0.000
Total action → Adjustment in product level	0.641	0.637	0.075	8.536	0.000
Total action → Adjustment in stock market level	0.628	0.624	0.078	8.090	0.000

Source: Created by authors

Table 3. Structural equation model for climate change and stock market investors' behaviour

Variables	Item	Outer loading	Cronbach alpha	Average variance extracted (AVE)
Awareness	B-1	0.615	0.864	0.565
	B-2	0.624		
	B-3	0.774		
	B-4	0.812		
	B-5	0.971		
Product plan	B-11	0.797	0.903	0.647
	B-12	0.834		
	B-13	0.887		
	B-14	0.728		
	B-15	0.767		
Business plan	B-16	0.829	0.948	0.783
	B-17	0.931		
	B-18	0.825		
	B-19	0.849		
	B-20	0.980		
Stock market plan	B-21	0.933	0.933	0.731
	B-22	0.876		
	B-23	0.880		
	B-24	0.787		
	B-25	0.790		
Investment decision	B-6	0.829	0.835	0.505
	B-7	0.633		
	B-8	0.699		
	B-9	0.636		
	B-10	0.737		

Table 4.
Construct reliability and validity for stock market investors' behaviour model

Source: Created by authors

Test	Variables	Awareness	Invest decision	Product plan	Business plan	Stock market plan
FL criterion	Awareness	0.751				
	Investment decision	0.443	0.711			
	Product plan	0.376	0.632	0.804		
	Business plan	0.271	0.443	0.222	0.885	
	Stock market plan	0.261	0.314	0.142	0.235	0.855
HTMT	Awareness					
	Investment decision	0.427				
	Product plan	0.361	0.627			
	Business plan	0.271	0.44	0.22		
	Stock market plan	0.264	0.313	0.144	0.232	

Table 5.
Diagnostic test for stock market investors' behaviour model

Source: Created by authors

5. Findings and discussions

The descriptive analysis shows that most stock market investors are aware of the climate change risk, but their level of awareness needs to be adequately reflected in their investment decision. It is plausible that the potential threat of climate change has already been considered in the form of increased profits or dealt with through adaptation measures. Moreover, the findings from the empirical model confirmed that the adjustment of climate

change risk at all levels of a company's production operations and business practices, as well as at the stock market level, have statistically significant impacts on stock market investors' behaviour or decision to invest in agricultural and plantation companies. Moreover, based on the findings, stock market investors' climate change knowledge exerts a statistically significant positive moderating effect on corporate climate change adaptation initiatives and investor behaviour or decision to invest in agricultural and plantation companies.

In terms of production, the country's agriculture and plantation corporations reduce climate change risk by adapting to new crop cycles, implementing new technology and production approaches such as crop rotation and strengthening infrastructure, among other things. Alam *et al.* (2011a, b; 2020) and Ibrahim and Alam (2016) found that climate change impinges on agricultural production, reducing revenues and profits for agricultural and plantation corporations. The positive reaction of these companies to climate change may reduce business losses and, to some extent, investors' concerns about potentially terrible financial performance. So, it is more appropriate to reduce the impact in advance to prevent investors from suspecting problems with such firms before they spend their money on them.

Further, Malaysian agriculture and plantation companies take initiatives to reduce climate change risk at their business level with comprehensive insurance coverage, employing specialists, adjusting in accounting system such as maintaining a reserve fund, allocating a climate budget, altering financial dealings and reporting systems to reflect climatic changes or diversifying asset portfolios. An examination of the investing habits of Greeks conducted by Merikas *et al.* (2003) revealed that investors rely on numerous criteria rather than just one. Similarly, to tackle this problem, companies are also tying best to improve their environmental, social and governance ratings in Malaysia (Atan *et al.*, 2018; Alam, *et al.*, 2022). According to Epstein (1994), people are very interested in learning about the environmental preservation efforts of companies such as agriculture and plantations. This is good because climate change is a genuine problem. This can alleviate investors' pessimism.

Finally, Malaysian agriculture and plantation companies take initiatives to adapt to climate change risk at the stock market level by adequately communicating with their investors and shareholders about climate change, initiating to reduce volatility in their stock price due to climate change risk and paying higher dividends to retain their investors' loyalty despite climate change risks. According to Kadiyala and Rau (2004), investors appear to under-respond to prior knowledge when they react to corporate management announcements. Small- and medium-sized investors can only keep up with company business plan changes if they have suitable information conduits. This is in keeping with the findings of Beatty and Shimshack (2010), Harjito *et al.* (2021) and Alam *et al.* (2020, 2021), who argue that stock values decline in response to unfavourable news but rise when positive or hopeful news arrives. Therefore, shareholders should be reassured by management's defensive or pre-emptive actions against climate change risk. This could reduce the volatility of the stock price and the amount of trading that goes on.

These communications should predict short-term changes in stock prices if the market is efficient. Companies' managers or owners should take preventative measures to reduce uncertainty about climate change risk and stabilise investors' sentiments through better production methods (change timing, use of new technologies, etc.), business practices (extensive insurance coverage, hiring experts, adjusting climate budget, etc.) and stock market practices (communicating with investors and shareholders on climate change events (Beatty and Shimshack, 2010).

6. Conclusions and implications

This study aimed to find out how El Nino and floods - two climate-change-related phenomena – improve investor awareness in agricultural and plantation companies in Malaysia by raising their climate-change risk knowledge. The effects of climate change adversely shape the performance of these businesses. People who rely on the market, such as investors, company managers and others, will begin to understand how climate change guides investors' behaviour and investment decisions. To our knowledge, no study of how climate change impacts Malaysia's agro- and plantation companies' stock market investors' behaviour has yet to be conducted. This is despite El Nino and floods being blamed for increasing corporate awareness of climate change mitigation efforts. This study has thus made a substantial contribution to the body of knowledge. Agriculture and plantation companies' senior executives will benefit from the findings and especially understand investors' views on their financial performance on Malaysia's stock market. So, executives will have to monitor any threats to the financial health of their company and take proactive measures to strengthen the company's position.

Moreover, the study has made some theoretical contributions whereby the study observed and strengthened the efficient market hypotheses, behavioural finance theory, stakeholder theory, APT and signalling theory by observing that climate change is an important factor to determine the investors' decisions in the stock market. Furthermore, the findings show that Malaysian investors are aware of climate change and its impact on the market, which will help future researchers to investigate these theories and extend them to other multidisciplinary arenas such as sustainable stock market, sustainable finance, climate change finance, green finance and green economy.

As a result of this study, in terms of practical contribution, the government can better inform enterprises and the broader public about climate change events, giving them more time to take precautionary measures for agriculture and plantation industries. These businesses might have more time to take precautionary steps if the government increases its warnings about climate change events. Moreover, the government should offer businesses subsidies, such as funding for more advanced and environmentally friendly equipment. When deciding whether to invest in agricultural and plantation enterprises, institutional and individual investors should pay closer attention to climate change news. Additionally, they should focus more on corporate and government initiatives to mitigate the effects of global warming. One appealing alternative is to increase the dividends given to shareholders. Findings from this study might also help other emerging markets and potential investors understand how climate change information is manipulated to fit the stock market's needs. Investors will make better decisions if they are more informed about climate change.

This study concentrates solely on the Malaysian market, which may restrict its applicability to other markets. Different regulatory frameworks and investor preferences may distinguish the Malaysian market from other markets. Consequently, the outcomes of this study may not be relevant to other financial markets, and additional research must be conducted to verify the findings in other contexts. Furthermore, the study does not consider the effectiveness of these climate change initiatives, which may differ significantly between companies and influence their impact on investors' perceptions.

Therefore, to overcome the limitations of this study, future research might investigate discovering more clear evidence on whether climate change and different types of investor behaviour in other economies or industries have a substantial relationship. Our findings can be generalised to other stock market conditions if similar investigations are undertaken. As a further indicator of climate change, this study looked at investors' views on El Nino and floods. Other climate change variables can be used to double-check the findings. Similarly,

further study could focus on the investors' views about climatic risk and expectations about related risk premiums. Finally, considering this is a pioneer study on a relatively new but significant problem, more research is needed to ascertain the report's validity.

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Further reading

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Appendix

Table A1.
Parameters for measuring stock market investors' perceptions about climate change and firms' initiatives

Variables/Construct	Parameters/Items	Number of respondents 1	2	3	4	5	(1 and 2) (%)	(4 and 5) (%)	Mean Score
Investors' awareness about climate change	B-1 Climate change events (especially El Nino and flood) negatively impact on the Malaysian agriculture and plantation sectors	4	19	57	95	98	8.4	70.7	3.97
	B-2 Climate change causes an increase in production costs in the Malaysian agriculture and plantation sectors	4	11	45	131	82	5.5	78	4.01
	B-3 Climate change causes reduced productivity of crops in the Malaysian agriculture and plantation sectors	0	11	41	147	74	4	81	4.04
	B-4 Climate change leads to less profitability in the Malaysian agriculture and plantation sectors	2	6	50	136	79	2.9	78.7	4.04
	B-5 Climate change causes an increase in the vulnerability of the agriculture and plantation sectors in Malaysia	0	9	55	124	85	3.3	76.5	4.044
Reflection of climate change in investment decision	B-6 As a shareholder and investor in the stock market, I am concerned about the impact of climate change on the financial performance of agriculture and plantation companies	1	44	117	76	35	16.5	40.6	3.37
	B-7 When buying or selling agriculture and plantation company shares, I consider the issue of climate change	12	46	134	53	28	21.2	29.7	3.14
	B-8 Climate change risk causes an increase in the volatility of share prices of agriculture and plantation companies	7	40	152	48	26	17.2	27.1	3.17

(*continued*)

Table A1.

Variables/Construct	Parameters/Items	Number of respondents 1	2	3	4	5	(1 and 2) (%)	(4 and 5) (%)	Mean Score
	B-9 As a shareholder, I expect to get an extra risk premium for investing in agriculture and plantation companies due to climate change risk	9	27	129	70	38	13.2	39.5	3.37
	B-10 As a shareholder, I expect to get a larger dividend for investing in agriculture and plantation companies due to climate change risk	36	59	110	50	18	34.8	24.9	2.84
Companies' Initiatives to make changes in production methods due to climate change	B-11 Malaysian agriculture and plantation companies update production methods like crop rotation, timing, using new technologies, to adapt to climate change	0	9	146	95	23	3.3	45.2	3.48
	B-12 Malaysian agriculture and plantation companies improve their infrastructure like crop storage system and irrigation systems, to adapt to climate change	1	30	116	100	26	11.4	46.1	3.44
	B-13 Malaysian agriculture and plantation companies involve stakeholders at all levels when adapting to climate change	0	30	130	89	24	11	41.4	3.39
	B-14 Malaysian agriculture and plantation companies invest large amounts of money into R&D to adapt to climate change	5	30	114	96	28	12.8	45.5	3.41
	B-15 Malaysian agriculture and plantation companies look for financial support and subsidies from different stakeholders and agencies to adapt to climate change	0	9	142	100	22	3.3	44.7	3.49

(*continued*)

Table A1.

Variables/Construct	Parameters/Items	Number of respondents 1	2	3	4	5	(1 and 2) (%)	(4 and 5) (%)	Mean Score
Companies' initiatives to make changes in business due to climate change	B-16 Malaysian agriculture and plantation companies make changes in their accounting systems like maintaining a reserve fund, allocating a climate budget, to adapt to climate change	1	4	59	98	111	1.8	76.6	4.15
	B-17 Malaysian agriculture and plantation companies take enough initiative to reduce the risk, like extensive insurance coverage, hiring experts, to adapt to climate change	1	11	57	81	123	4.4	84.8	4.15
	B-18 Malaysian agriculture and plantation companies adjust their financial dealings and reporting systems to adapt to climate change	0	5	82	68	118	1.8	68.1	4.1
	B-19 Malaysian agriculture and plantation companies diversify asset portfolios including non-agricultural business wings to adapt to climate change risk	0	4	52	99	118	1.5	79.5	4.21
	B-20 Malaysian agriculture and plantation companies find alternative sources of capital to reduce cost of capital due to climate change risk	0	22	50	85	116	8.1	73.6	4.08
Companies' initiatives to make changes in stock market performance due to climate change	B-21 Malaysian agriculture and plantation companies are concerned about shareholders' expectations regarding climate change risk	6	17	79	111	60	8.4	62.7	3.74
	B-22 Malaysian agriculture and plantation companies take enough initiative to adjust to climate risk in the stock market	0	26	79	103	65	9.5	61.5	3.76

(*continued*)

Variables/Construct	Parameters/Items	Number of respondents					(1 and 2) (%)	(4 and 5) (%)	Mean Score
		1	2	3	4	5			
	B-23 Malaysian agriculture and plantation companies take the initiative to reduce climate change-induced stock market price volatility	0	18	87	105	63	6.6	61.6	3.78
	B-24 Malaysian agriculture and plantation companies properly communicate with investors and shareholders on climate change news	5	15	76	106	71	7.3	64.8	3.82
	B-25 Malaysian agriculture and plantation companies pay larger dividends to retain investors' loyalty in spite of the climate change risk	10	28	67	106	62	13.9	61.5	3.67

Source: Created by authors

Table A1.

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