
Review

Unpacking climate disclosure: A multi-level integrated framework for understanding the corporate sustainability disclosure landscape

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Supplementary

Appendices and Supplemental Materials

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Appendix 1 – Research Construct Codes.

Research Construct	Second-level Code Name	Second-level Code Description	First-level Code Name	First-level Code Description	Literature Sources
Climate Change Risks	Risk Management Challenges	Firms or nations do not uniformly experience the impacts of climate change risks. This is due to differences in risk sensitivity or dependence on the natural environment. A possible solution is to develop a more robust framework for climate change risks. Yet, climate change risks do not operate independently of other economic and social risks, creating the potential for their compounding. Thus, a universal management framework might become overly complex in attempting to account for multiple risks alongside the niche aspects of firms and nations.	Climate change risks could exacerbate other risks	Climate change risks do not exist in isolation from other risks, like pandemic risks, and the interactions between different risk types or sources need to be considered.	D’Orazio, 2023
			Transition risks are not uniform	There can be variability in the impacts, severity, or type of transition risk across geographical areas or industries.	Di Febo et al., 2023
			Climate change risks are not uniform	The impacts and severity of climate change risks across subnational economic regions and national economies can be variable. There could also be variability in the impacts at the firm level due to firms' unique features impacting their sensitivity to those risks.	Sun et al., 2020, 2023; Wu et al., 2023
			A universal climate change risk management framework is needed	The development of a new framework that integrates climate change risks, macroeconomic modelling, company exposure assessment, and stress testing should be considered to address the complex impacts of climate change.	Fabris, 2020

Financial Stability	Challenges with Integrating Climate Risks into Policy	Climate change could adversely affect the financial stability of global economies. As such, these risks should be considered within financial policies and by policymakers. The banking sector is a critical factor in financial policy development and implementation, as its actions can facilitate the diffusion of green or climate-related economic policies within a national economy while also influencing the stability of economic systems. Yet, the adoption of climate-related financial policies at the national level may be influenced by a nation's exposure to climate risks and the fiscal space or financial leverage available at the time. Furthermore, nations may need to consider integrating regulatory interventions or standards to	Financial policy needs to include climate risks	Financial stability requires the inclusion of uncertainty for physical and transition risks within financial policy. This includes the adoption of modern macroprudential policy and the precautionary principle. Also, financial policy should consider climate change risks in general. These types of financial policies can moderately aid in reducing the impacts of climate change by promoting emissions reduction	Chenet et al., 2021; Dafermos & Nikolaidi, 2021; D'Orazio, 2021; Lamperti et al., 2021; Li, 2023; Ramos et al., 2022
			Banks' stability can impact systemic stability	Climate change could impact the stability of banks, which in turn would lead to further instability into the broader economy.	Lupu & Criste, 2023
			Central banks should adopt climate risks within their operations and policies	Central banks should incorporate climate change risks since this aligns with their existing mandate of supporting the effectiveness of financial markets and is material for the economy's financial stability.	Campiglio et al., 2018
			Central banks' green policies can support financial stability	The development of green (climate-focused) monetary policies by banks could enhance the financial stability of the national economy. This is due to the	Lamperti et al., 2021; Ünüvar & Yeldan, 2023

		encourage broader adoption. Even if such policies were adopted, it is important to remember that climate-related financial policies are inherently focused. Besides the economic issues, promoting or achieving sustainable development outcomes might not occur with such financial policies.		influence central banks have on the economy.	
			Adoption of climate-related financial policies depends on risk exposure	The adoption of climate-related financial policy can be impacted by the degree of risk exposure the nation faces. Nations with higher climate risks could be more likely to implement climate-related financial policies.	Gupta et al., 2023
			Adoption of climate-related financial policies depends on the available fiscal space or the financial leverage of the nation	A nation's fiscal space could influence its adoption of climate-related financial policy. Nations with low fiscal space are more likely to adopt those policies. The impact of climate change is also influenced by the nation's level of financial leverage.	Gupta et al., 2023
			Climate-related financial policy may not result in ecological or sustainable policy outcomes	Although a climate-focused financial policy could help mitigate climate change risks, there is no guarantee that it will yield outcomes that fully support sustainable development.	Li, 2023
			Climate change risk disclosures may not lead to financial stability without regulatory intervention	To ensure economic stability, governance bodies should be involved in setting regulatory standards or implementing other interventions.	Christophers, 2017

	Widespread Stability Impacts	Both physical and transition risks can negatively influence the global economy and encourage instability. These risks could flow from the household level to the business or financial intermediary level to the systemic economic level. Suggesting the material importance of climate change risks for firms and nations. The transient nature of these risks has effects at all three levels, potentially undermining the stability of the broader system. However, it is important to remember that climate change risks do not affect financial stability alone; other economic or social risks may intersect with and interact with climate change risks. Additionally, changes to global temperature, positive increases or negative decreases, can impose shocks	Climate change risks can influence adverse economic events	Climate change could cause adverse economic events to become less predictable and more frequent. This means current interest rates and asset values may also fluctuate.	Karydas & Xepapadeas, 2022; Lamperti & Roventini, 2022
			Temperature shocks (physical impacts) could impact stability	Physical changes in the temperature of the climate could result in decreasing financial stability	Song & Fang, 2023
			There are multiple pathways by which climate risks could impact financial stability	Climate change risks could impact an economy's financial stability through direct and indirect channels. Risks impact households and corporations, which are then passed on to financial institutions and, finally, the financial system, resulting in market volatility. Additionally, the impacts of climate change could be influenced by how actors perceive these risks.	Battiston et al., 2021; Chabot & Bertrand, 2023
			Climate risks can impact financial stability	Both transition risks and physical risks can impact financial stability. This is because emissions and climate variability impact both financial institutions and the financial system.	Chabot & Bertrand, 2023; Fabris, 2020; Li, 2023
			Addressing physical risks could improve financial stability	Reducing the impacts of physical risks could help improve the stability of the economy since the	Malik et al., 2023; Mandel et al., 2021

		to the economic system, which could enhance instability.		direct impacts (e.g., weather and natural disasters) are lessened.	
			Financial stability is impacted by climate risks and other risks	Although climate change risks can negatively impact financial stability, those risks do not operate in isolation from other risks.	D’Orazio, 2023
			Transition risks can influence financial stability via investor attention	Transition risks could influence investors' attention, which then impacts the financial stability of a market. As investors become more aware of transition risks, they impose additional expectations on the market or change their behaviour towards carbon-intensive assets or market fluctuations.	An et al., 2022
			Financial stability could be impacted by both positive and negative climate shocks	Both positive and negative shock types could have implications for financial stability. Whereby positive shocks, in the form of physical risks, could increase instability due to these risks becoming more impactful. Negative shocks, in the form of transition risks, could increase instability due to the restrictions they impose and the litigation they generate.	Z. Liu et al., 2021
			Climate change is material for systemic	Both the transition and physical impacts of climate change could adversely impact	Lamperti & Roventini, 2022

			financial stability	the stability of the economy. Physical impacts would be exacerbated, while transition risks could increase financial costs and hamper economic growth.	
			Climate change risks are material for firms because they impact financial stability	The financial stability of firms can be impacted by climate change risks, meaning there is a real material impact on the firm.	Migliorelli, 2023
	Climate Change Policy May Reduce Stability Impacts	Several aspects can be considered when addressing the impacts of climate change on financial stability. First, the ability of economic actors to participate equitably in the financial system is a crucial consideration. Improving access to essential financial services may strengthen actors' resilience to climate change risks and increase the system's overall resilience. Second, applying a dual materiality perspective may improve system stability, as various actors, such as firms,	Financial inclusion is an important factor in financial stability	Financial inclusion could mediate the linkage between environmental sustainability and financial stability. This is because access to essential financial services is equitable for all economic actors.	Malik et al., 2023
			Double materiality could support financial stability	The integration of double materiality into corporate disclosures could help improve stability since systemic risks are accounted for by firms.	Gruenewald et al., 2024
			The financial stability of an economy should consider the sub-annual and sub-national economic trends	Economic trends at the subnational level and across the year should be included in stability assessments, as this could provide more nuanced insights into the impacts of climate change risks on the economy. The heterogeneity within the regional economies should also be factored in.	Stan et al., 2021; L. Wu et al., 2023

		are encouraged to consider how climate change affects the firm and how the firm, in turn, may affect climate change. This perspective offers firms opportunities to consider strategies for addressing both sources of climate change impacts. Finally, expanding current climate change risk evaluations to include sub-annual and sub-national factors could improve understanding of the impacts on systemic stability.			
	Financial Stability Mechanisms	In addition to considering additional factors, a wide range of tools and mechanisms could be further enhanced to support financial stability. The development or application of financial mechanisms could improve the value of climate-related market instruments, such as bonds. In doing so, there could be additional benefits for	Climate-related stress testing could be a tool for financial stability	Climate-related stress testing could lessen the impacts on financial stability, but there have yet to be enough practical applications to fully understand if this type of stress testing works. Also, stress testing alone might not result in mitigating those impacts.	DeMenno, 2023; Weber, 2024
			Climate hedging could aid financial stability	Applying climate hedging could help understand the potential impacts of climate derivations on financial stability.	Bressan & Romagnoli, 2021
			Current macroeconomic modelling needs to	The current approaches to macroeconomic modelling do not	Battiston et al., 2021; Fabris, 2020

		reducing financial instability, as economic actors' access to funds might improve through these mechanisms. Another suite of tools includes stress testing that targets climate change risks to assess potential impacts. Furthermore, climate hedging, climate change risk-related differential capital requirements, and green quantitative easing programs are additional tools that might support alleviating the adverse implications for financial stability. Although the above tools and mechanisms generate new possibilities for addressing climate change risks, it is vital to be mindful of the role of macroeconomic modelling in scenario development and policy formulation. Climate change may not be fully accounted for within	account for climate change risks	consider the role of climate change risks. These risks are fat tails and would benefit from early intervention, but the models do not fully recognise this.	
			Climate change risk-related differential capital requirements could reduce physical risk impacts and improve stability	Developing Climate change risk-related differential capital requirements could facilitate resilience within the system since credit provisions and leverage are reduced.	Dafermos & Nikolaidi, 2021
			Financial instability from climate change could be lessened by green quantitative easing programs	Refers to sources that argue in favour of applying green quantitative easing programs targeting green bonds. This program would increase bond yields, thereby making it easier for firms to borrow funds.	Dafermos et al., 2018

		existing modelling, leading to challenges in understanding how risks, tools and mechanisms could operate efficiently within a specified system.			
Climate Change Disclosures	Sustainability Reporting Standards Complexity	There have been calls for harmonisation or refinement of global sustainability reporting standards due to firms' difficulties in managing diverse reporting expectations and conflicting requirements. However, another perspective argues against harmonisation since there is already cooperation or complementarity between the various standards. Furthermore, the persistent challenge of operationalising or translating sustainability issues into reporting metrics could perpetuate conflicts among standards, since each standard has its own set of metrics and target group of	Cooperation of standards	Unlike the Harmonisation of standards code, this code argues that existing standards do not need to be harmonised because they already provide complementary support and do not need to be combined.	Giner & Luque-Vílchez, 2022
			Harmonisation of standards	Given the variability and number of different reporting standards used by firms, there is an argument for developing a universal or standardized standard that firms can apply.	de Villiers et al., 2022; Giner & Luque-Vílchez, 2022; Ngo et al., 2023
			Refinement of standards	Encompasses arguments that existing reporting standards need to be revised or enhanced to improve the impact or outcomes of the standards.	Ngo et al., 2023
			Inherent complexity	Describes the complexity of sustainability reporting, specifically how it is hard to define and operationalise due to the number	Afolabi et al., 2023; Ascui & Lovell, 2012

		stakeholders or actors.		of actors, topics, and impacts that need to be considered. This code also encompasses the opinions that sustainability reporting or disclosure is a contested concept due to its complexity	
Firm-level Traits Impact Disclosures	The disclosure of sustainability or climate change information may depend on several firm-level characteristics, the business models utilised, and the firm's environmental sensitivity. Embedding a sustainability or climate change focus within the firm's business model reduces the potential negative impacts of external climate change threats while also supporting public disclosure. Integrating corporate social responsibility could further support public disclosures since sharing relevant or material information aligns with the tenets of corporate social responsibility. Additionally,	Business models and strategies influence climate change disclosures		A firm's business model could impact the quality of its climate change disclosures. That impact could also be linked to internal governance structures or strategies, like CSR.	Aldoseri & Albaz, 2023; Amran et al., 2014; Galeone et al., 2023; Ooi et al., 2019
			subscription to CSR initiatives, environmental sensitivity and international presence impact disclosure	A firm's disclosure of climate change information could result from its adoption of CSR initiatives, its sensitivity to environmental impacts, and its degree of international presence.	Halkos & Skouloudis, 2016
			Disclosure quality based on managerial ability	The quality of climate change disclosures could be improved when managers have relevant knowledge and skillsets to produce such disclosures.	Daradkeh et al., 2023
			Ownership type impacts disclosure	The ownership type or structure could impact the firm's disclosure of climate change information. State-owned firms could have more disclosures than	Acar et al., 2021; Bilala et al., 2022; Bose et al., 2024; de Grosbois & Fennell, 2022; Giannarakis et al., 2018

		firms that already employ actions to improve their environmental performance tend also to have better corporate disclosures. However, the quality of the disclosure could be affected by employees' or managers' knowledge and skills, leading to poorer disclosures if the capacity of internal actors is not developed. Further, the ownership type and firm size. State-owned firms may be more likely to publicly disclose sustainability or climate change information because they have an external obligation to do so (i.e., they are regulated to do so). Yet, the impact of firm size on corporate disclosure is mixed.		non-state-owned firms, and foreign ownership can also impact the degree of disclosure.	
			Firm size could have a positive impact on disclosure	The amount of information contained within a firm's disclosure could be influenced by its overall size, with larger firms being more likely to include more information.	Eleftheriadis & Anagnostopoulou, 2015; Kouloukoui et al., 2019
			Firm size and board size have no significant impact on disclosure	There is some evidence to suggest that there is no statistically significant connection between firm and board size on the firms' disclosures	Amran et al., 2014
	Challenges with Comparability and Trust in Climate Disclosures	Although public disclosure of climate change or sustainability information could be beneficial, the quality of	Variability in the quality of disclosures	Firms' disclosure of sustainability information, including climate change information, varies in quality, depth, or comprehensiveness	Santos & Rodrigues, 2021

		existing disclosure is highly variable, making comparisons difficult. Furthermore, firms can use public disclosure to greenwash their environmental or climate change performance. With such challenges, a disconnect between the firm's financial balance sheets and non-financial disclosures exists that will require further work by firms to address climate change risks and realise real-world impacts.		s, making comparability difficult.	
			Obfuscation through greenwashing	There is a possibility that firms engage in greenwashing in their climate change disclosures to conceal poor emissions performance.	Cong et al., 2020
			Climate change excluded from balance sheets	Evidence indicates that climate change information is not linked to financial items on a firm's balance sheet. This means that firms consider the impacts of non-financial issues, such as climate change, on their financial performance.	Scholten et al., 2020
			More efforts are needed	The literature argues that firms should take action beyond merely disclosing climate change information to achieve real, sustainable change.	Ameli, 2020; Ameli et al., 2021; Christophers, 2017; Galeone et al., 2023
	Rationales for Climate Change Disclosures	Several theories could explain how and why firms participate in public disclosure, including institutional and legitimacy theory.	Climate change disclosure can be explained through a variety of theories	(1) Agency theory, (2) signalling theory, (3) voluntary disclosure theory, (4) political economy theory, (5) legitimacy theory, (6) legitimacy theory, and (7) stakeholder theory have been used to explain climate change disclosures by firms.	Guo et al., 2022; Park et al., 2023
			Disclosure could be impacted by	Institutional pressures (e.g., normative and coercive) could	de Grosbois & Fennell, 2022

			institutional pressures	influence how a firm discloses climate change information.	
Financial Performance	Mitigating Negative Financial Impacts of Climate Change	Climate change could affect financial performance through various pathways. Yet, the impacts of physical risks are felt by firms through reduced productivity and difficulties in securing or allocating capital, as well as in sales and profits. Fortunately, firms that manage their environmental and sustainability performance or seek ESG investments might be able to limit the effects of climate change on their financial performance. Additionally, more specific measures, such as reductions in GHG emissions, could help mitigate adverse effects on the firm's finances.	The impacts of climate change on financial performance can be reduced through ESG investments	When firms like Banks, face high degrees of climate change risks, those risks could be offset through ESG investments.	Erhemjamts et al., 2024
			The environmental performance, including emissions, of a large firm can impact its financial performance	Large firms could enhance their financial performance by improving their environmental performance. However, operational efficiency is also needed to support increased financial performance fully.	Sueyoshi & Goto, 2010
			How emissions are measured can impact the relationship between carbon performance and financial performance	There can be a positive link between a firm's carbon emissions and financial performance. However, this link may only be true for relative emissions measures and not for absolute emissions.	Busch & Lewandowski, 2018
			Physical climate change impacts financial performance through labour productivity	Financial performance is linked to labour productivity, which can be susceptible to physical risks, such as temperature changes and extreme weather events.	He et al., 2021
			Physical climate change impacts financial performance through the allocation of or	When firms face the impacts of physical risks, they may need to reallocate capital for repairs and upgrades. This might also lead to	He et al., 2021; H. Huang et al., 2022

			access to capital	reductions in R&D spending, which could impact the firm's financial outcomes. Additionally, climate change could influence interest rates and require firms to collateralise loans, thereby limiting their ability to access capital.	
			Sustainability performance could enhance the financial performance of firms	If firms align their actions and disclosures with SDGs that are financially material, as per the SASB mapping, then they might see improved financial performance and sustainability performance.	Betti et al., 2018
			Physical climate change impacts financial performance through sales growth	Financial performance is linked to sales growth. However, the physical impacts of climate change could stall or hinder sales growth, resulting in profit losses for firms.	Bergmann et al., 2016
	Short- and Long-Term Financial Impacts of Climate Efforts	The influence of corporate climate action on financial performance can depend on several factors, including the time horizon used to assess impact or make decisions. Organisations could seek short-term financial gains through	The impact of corporate emissions reductions (environmental performance) on financial performance depends on the time horizon used.	The impact of reducing GHG emissions is unprofitable during the short term due to increased costs to offset. However, the market expects there to be a long-term value in such emission reduction efforts since the Tobin q is increased when GHG emissions decrease.	Delmas et al., 2015

		specialised initiatives, such as clean development mechanisms. However, the firm's long-term market value may require additional support. By implementing climate change actions, firms could reduce risk-related costs, thereby improving financial performance. However, firms must focus on generating real impacts or change due to those climate actions rather than symbolic disclosures. Otherwise, financial performance might be negatively impacted.	The corporate climate action could positively impact its financial performance	corporate environmental performance, such as climate mitigation strategies or climate management related to climate change, can positively impact firms' financial performance by reducing costs associated with climate-related risks. Further, outcome-based (emission levels reductions, etc.) corporate environmental performance is positively connected to financial performance.	Busch & Hoffmann, 2011; Castilho & Barakat, 2022; Secinaro et al., 2020; Sun et al., 2023
			Process-based corporate environmental performance is negatively linked to financial performance.	Process-based (internal corporate management efforts) corporate environmental performance refers to a firm's climate change commitments or the complexity of its environmental management systems. Overall, there is a negative relationship between process-based performance and financial performance. This means that firms must focus on improving the outcomes of their process-based performances to impact their financial performance positively.	Busch & Hoffmann, 2011

			Financial performance is linked to higher emissions levels, and disclosure provides no value.	The higher the emissions levels of a firm, the more likely it is to have better financial performance. Apart from symbolic disclosure, there is no connection between disclosure and financial performance	Busch et al., 2022
			Integrating clean development mechanisms could lead to financial performance increases in the short term	Firms that adopt clean development mechanisms could experience short-term improvements in financial performance. However, that increase might lessen over time.	Zhang et al., 2018
			Climate change information is not being connected to balance sheet items	Climate change information has not been fully disclosed on the balance sheets of non-renewable energy firms, even though the TCFD recommendations could help with this.	Scholten et al., 2020
Stakeholders	Essential Stakeholders in Climate Interventions	Climate change policies and initiatives should consider the involvement and influence of several key stakeholders. Central banks are important actors at the system level, as they can affect economic stability and climate finance policy given their authority and power. Moreover, other financial regulators have	Central banks are key actors in addressing climate change risks and ensuring financial stability	Because they can direct or influence financial policy within a market, central banks are important actors in facilitating climate action by managing economic and financial stability.	Campiglio et al., 2018; Lamperti et al., 2021
			Investors' attention or pressure could impact market expectations	Investors can influence market expectations regarding firms' climate change actions. When investors place greater emphasis on climate change, expectations for firms increase.	An et al., 2022

		a role in developing climate change policy. Investors are essential stakeholders when considering the individual firm, as they may influence the firm's climate change disclosures through market expectations.	Financial regulators should be included in climate change policy development	Financial regulators are essential actors that should be included in the decision-making process related to low-carbon economy transitions and climate change risk management.	Gruenewald et al., 2024
			The skills and knowledge of internal actors or managers could offset the financial impacts of climate change risks	Internal actors can be essential factors in addressing or preventing firm-related climate change risks. The higher the managerial ability of a firm is, the less likely they are to face climate-related financial impacts.	Almaghrabi, 2023
Materiality	Confusion About Reporting Material Topics	Within reporting standards and frameworks, there can be confusion around materiality for firms since there could be competing material issues to consider or general vagueness about the nature of some topics.	Harmonising reporting standards could reduce confusion	Building cooperation or harmonisation between the various reporting standards could help firms by reducing confusion and increasing guidance.	Jørgensen et al., 2022
	Firm-level Traits can Impact Materiality Disclosures	What material information is shared within corporate reports can depend on the industry in which the firm operates, since some firms find specific issues more material than others. Moreover, board traits and	Disclosure of material information can be impacted by industry type	The type of industry and its sensitivity to environmental issues can influence whether material information is disclosed	Andersson & Arvidsson, 2023; Fasan & Mio, 2017; Sichigea et al., 2021
			Disclosure of material information can be impacted by board size	The larger the board is, the less likely they are to disclose material information	Fasan & Mio, 2017

		size may affect how firms report material information, while overall profitability and corporate leverage may influence whether firms disclose material information.	Disclosure of material information can be impacted by board diversity	The more diverse the board is, the less likely they are to disclose material information	Fasan & Mio, 2017
			Disclosure of materiality can be impacted by profitability	A firm's inclusion of materiality assessments, mapping, or processes in corporate disclosures increases with higher profitability.	Farooq et al., 2021
			Disclosure of materiality can be impacted by corporate leverage	A firm's inclusion of materiality assessments, mapping, or processes within corporate disclosures can decrease if the firm faces higher financial or reputational costs.	Farooq et al., 2021
	Limitations of Materiality	Although disclosing material issues is important for stakeholders and potentially beneficial for firms, firms have not disclosed sufficient information about the processes used to determine materiality. Even if that information is shared, the mapping process appears to be inconsistent between firms, making comparability difficult. Furthermore, publicly shared information	Disclosure of materiality is not widely adopted	The inclusion of materiality assessments, mapping, or processes within firm disclosures is not a widespread phenomenon.	Farooq et al., 2021
			Materiality mapping is not consistent	Firms apply different processes or provide different levels of detail related to materiality assessment or mapping within their disclosures	Andersson & Arvidsson, 2023
			There are differences between what firms report in disclosures and their internal practices.	The firm's internal reporting process may contain more detail and insight than is disclosed in the public disclosures.	Andersson & Arvidsson, 2023
			Disclosures do not provide enough insight into corporate climate actions	Existing firm disclosures do not clearly outline the measures, processes, or	Abhayawansa & Adams, 2022; Ng et al., 2022

		might be vague when discussing the firm's climate actions or initiatives. Also, current disclosures are short-sighted and unable to fully consider the long-term implications of climate change risks or other sustainability issues for the firm. However, this does not mean the firm's internal or private information is as ambiguous or short-sighted.		actions taken to address climate risks or impacts.	
			Current disclosures are short-sighted	Firms are not adopting a long-term perspective in their disclosures or materiality assessments. This results in disclosures that value short-term gains or impacts and do not consider the longer-term implications.	Abhayawansa & Adams, 2022

Appendix 2 - Integrative Review Themes and Codes

Theme Name	Second-level Code Name	Second-level Code Description	First-level Code Name	First-level Code Description	Literature Sources
Smart Policy and Tools	Multi-level financial impacts	The stability of firms and financial systems is not only dependent on economic events but also on the implications of climate change risks. Direct or indirect physical impacts on firms, such as drastic changes in global temperatures, could generate instability. At the same time, transition risks might pose additional challenges for the entire system. Several financial-related tools or mechanisms could offset instability. These include climate stress testing, climate hedging, and green quantitative easing programs. However, it is crucial to ensure that economic actors have equitable access to financial services within the system to facilitate resilience at the individual or firm and system levels.	Risks could drive financial instability	The financial stability of firms could be hindered by climate change risks, either physical or transition risks.	Battiston et al., 2021; Chabot & Bertrand, 2023; Chenet et al., 2021; Fabris, 2020; Lamperti et al., 2021; Li, 2023; Malik et al., 2023; Ramos et al., 2022; Song & Fang, 2023
			Climate stress testing could be a tool to improve financial stability	Applying climate-related stress testing could benefit financial stability. Yet these benefits have not been fully tested, and further research is needed.	Weber, 2024
			Climate hedging could aid financial stability	Climate hedging could be a tool to promote financial stability, but current issues of mispricing or pricing uncertainties could have adverse implications.	Bressan & Romagnoli, 2021
			Financial inclusion could bolster financial and environmental performance	The relationship between environmental performance and financial performance may be mediated by the firm's degree of financial inclusion in the economy.	Malik et al., 2023
			Financial stability could be impacted by both positive and negative climate shocks	Both positive and negative shocks could impact financial stability. Positive shocks, in the form of physical risks, could increase instability as their impact intensifies. Negative shocks, in the form of transition risks, could increase instability due to the restrictions they apply and the	Liu et al., 2021

				litigations they generate.	
			Climate change can pose adverse implications for regional and national economies.	Examining regional economies within a nation is important for understanding how climate change may have heterogeneous impacts across the country.	Stan et al., 2021
			Green quantitative easing programs could lessen financial instability from climate change	Applying green quantitative easing programs targeting green bonds could support the increase in bond prices, making it easier for firms to borrow funds.	Dafermos et al., 2018
	Constraints on Climate Financial Stability Policy Adoption	At the national level, an essential concern regarding climate change risks is the potential negative implications for the nation's financial stability and the global economy. A nation's stability can be influenced by the financial leverage (fiscal space) available to it, and the adoption of green, climate-related financial policies is also shaped by this availability. As such, nations with low fiscal space might be more inclined to adopt climate-related financial policies. Furthermore, the nation's degree of exposure to	Financial stability is linked to a country's degree of financial leverage	There is a connection between financial stability and a nation's financial leverage. Highly leveraged high-income nations could experience more significant climate impacts than other nations, thereby hindering the nation's financial stability.	Mandel et al., 2021
			Financial stability is linked to a country's degree of exposure to physical risks	Nations with greater exposure to physical risks may experience financial instability due to potential effects on GDP or financial leverage.	Mandel et al., 2021
			The degree of exposure to climate risks impacts the adoption of green financial policy	Nations that have a high degree of exposure to climate change risks could be more likely to adopt green financial policy or some other climate-related financial policy.	Gupta et al., 2023
			Availability of fiscal space impacts the	Countries with low fiscal space tend to adopt green financial policies.	Gupta et al., 2023

		climate risks can influence the severity of impacts on financial stability and the ways the nation might address them.	adoption of green financial policies		
	Importance of Financial Stability and Performance in Climate Policy	Although climate-related policy and reporting standards provide opportunities for firms and nations to address climate change risks, such policies might not result in sustainable development outcomes. This could be due to firms' and nations' innate focus on economic benefits in climate-related financial policy and corporate reporting standards. Nevertheless, integrating climate change risks into financial policy decision-making is crucial given their potential negative impacts.	Climate-related policymaking does not always lead to ecological or sustainable policy outcomes	Climate-focused policy may not yield sustainable outcomes if the nation does not prioritise a rapid, short-term economic transition. Delaying the transition could increase the climate shock for the national market.	Li, 2023
			Financial policies should consider climate change risks	Not all financial policies fully consider or integrate climate change and associated risks. Thus, current economic and financial policies have inherent shortcomings that need to be resolved in order to address climate change risks	D'Orazio, 2021
			Integrated reporting does not support sustainable development	There can be an incompatibility between integrated reporting and sustainable development because integrated reporting focuses on shareholders and prioritises financial or capital generation over the firm's environmental impacts.	Mähönen, 2020
Resilience Building	Resilience Building	For firms, physical risks could result in the development of corporate climate change actions or improved environmental performance. This would require firms to become	Physical risks can motivate actions	Physical risks can be a factor, influence, or driver for improving environmental (e.g., GHG emissions) performance	Erhemjamts et al., 2024
			Climate change disclosures could aid in preventing stock price crashes	Climate change disclosures can serve as a tool to help firms build resilience to stock price crashes.	Jung & Song, 2023

		aware of and measure the risks they face. Tools such as stress testing could help identify and develop risk management strategies. The combination of corporate initiatives and public disclosures could allow firms to be resilient to external disruptions, such as stock market crashes. It is important to remember that voluntary public disclosure can depend on the firm's size, board and other attributes.	Financial disclosures could be influenced by climate change risk exposure	Climate change risk exposure could impact a firm's level of accounting conservatism. Firms with higher degrees of exposure are more likely to be "aggressive" in their accounting practices to prevent earnings volatility.	Khalifa et al., 2023
			Climate change stress testing can help measure climate change risks, but it cannot prevent those risks	Climate-related stress testing could be a valuable tool for measuring potential impacts on financial stability. However, the empirical evidence does not show a significant effect of stress testing on the link between climate change and financial stability.	DeMenno, 2023
			Firm-level attributes could impact the disclosure of climate change information	Climate change disclosures can be impacted by board size, integration of ESG risks, and firm size. Larger firms are more likely to disclose climate change information, but larger boards might lead to fewer disclosures.	Principale & Pizzi, 2023
Mixed Financial Impacts	Predominantly Negative Financial Impacts of Climate Change	There are several pathways by which climate change could impact a firm's financial performance either directly or indirectly. One such option is to trade off economic	Trade-offs between economic growth and GHG emissions	Reducing GHG emissions can result in potential losses for a company's financial performance or a country's economic growth, while the opposite could also occur when seeking to improve economic growth.	Di Febo et al., 2023

		growth against corporate climate actions. Economic growth is typically a sought-after outcome for firms. However, in pursuit of climate action and GHG emissions reductions, firms may experience declines in their financial performance. Additionally, a firm's assets may be hindered, as asset values may be diminished by transition risks, and firms may face rising interest rates as the impacts of climate change are realised in the economy. The physical nature of climate change may reduce firms' productivity and allocation of capital. Although there are several possible adverse impacts that firms face from climate change, there are positive impacts for several reasons. First, some industries, such as energy and agriculture, may present new business or market opportunities that could facilitate financial growth. Second, some asset values might increase due to market changes facilitated by climate change. productivity and	Climate change risks could adversely impact assets	The research shows that even though the broader credit market and bond spreads are yet to systematically incorporate the impact of climate policies or the potential for physical climate change could adversely impact the current and future values of assets since such risks are not fully integrated into market pricing and risk premiums. As such, firms' asset values could be hindered by their exposure to climate risks and by the markets' inability to fully account for those risks.	Karydas & Xepapadeas, 2022; Mastouri et al., 2022
			Physical impacts and risks could adversely affect firms' productivity and allocation of capital	Potential reductions in firm financial performance could result from the impacts physical risks have on labour productivity and capital allocation. However, this depends on the firm's geographical location and ownership type.	He et al., 2021
			Climate change could impact interest rates	Interest rates could increase due to the impacts of, or increasing exposure to, climate change, which could also lead to reductions in firms' financial performance.	Huang et al., 2022; Karydas & Xepapadeas, 2022
			Physical climate risks could impact sales growth	Because firms depend on the stability of the natural environment, the adverse impacts of climate change could reduce their financial performance by hindering sales growth.	Bergmann et al., 2016

		restrict their sales growth, both of which reduce the firm's financial performance.	Stock markets and trade can facilitate transition risks.	Due to market operations and intermarket interactions, transition risks can be transferred or spill over from one economic region to another.	Wu & Wan, 2023
			Climate change risks could adversely impact the financial performance of firms	Climate change and a firm's degree of risk exposure could increase operational costs, thereby impacting the financial performance of the firm.	Nikolaou et al., 2015
			Climate change risks could positively impact assets	Given a positive transition risk, climate change may positively affect assets (e.g., their value or market participation). If a firm or its operations benefit from low-carbon activities (e.g., a renewable energy company), then it might experience positive asset values.	Campiglio et al., 2023
			Climate change could result in positive impacts for some industries	Depending on the firm, there could be positive impacts on its operations and/or financial performance if it is in an industrial sector, like energy or agriculture, that benefits from some impacts of climate change or the shift to a low-carbon economy.	Sun et al., 2023; Thai et al., 2023
	Climate Risk Sensitivity Exacerbates Financial Risks	Climate change risks could increase financial risks for firms since asset values and the firm's financial performance,	Transition and physical risks could enhance financial risks	Changes in climate and increased stakeholder demands could impose additional financial risks on firms if they do not mitigate climate risks.	Migliorelli, 2023

		along with other financial factors, could be adversely impacted. Yet, the degree of impact would depend on the firm's sensitivity to climate risks.	Climate change risks could positively or negatively impact financial asset values	When climate change risks are incorporated into asset pricing, the resulting effects can be positive or negative, depending on the asset's susceptibility or exposure to climate change. Negatively exposed assets (e.g. impacted by climate change or a low-carbon economy) show negative impacts on asset prices. Exposures to climate-related assets (e.g., those that benefit from climate change or a low-carbon economy) have positive effects on asset pricing, particularly when transition risks are considered. Furthermore, corporate bond values could be adversely affected.	Campiglio et al., 2023; Mastouri et al., 2022
			Climate change risks could impact financial performance through several causal loops	Physical and transitions (regulation and litigation) risks could impose additional costs that reduce the firm's financial performance. Yet regulatory risks and pressures could drive innovation that reduces costs.	Nikolaou et al., 2015
			The impact of climate change risks on firm financial performance may depend on the firm's sensitivity to those risks.	Firms operating in industries sensitive to climate change may experience greater negative effects on financial performance.	Sun et al., 2020; Thai et al., 2023

Crisis-based Resilience	Crisis-based Resilience	Although capital markets are making efforts to integrate climate change risks and considerations into corporate emissions, current approaches may not yield gains in financial performance due to oversights in the pricing of climate risks or a disconnect between market indices and actual environmental performance. That said, there are still benefits for firms that proactively manage climate change impacts and environmental performance, particularly during economic crises.	The strength of connections between environmental performance (climate change initiatives or emissions reductions) can be increased during an economic crisis	Firms that focus on CSR or environmental performance during a crisis tend to perform better than firms that do not. Yet, outside an economic crisis, environmental performance has no positive or negative effect on financial performance.	Gallego-Alvarez et al., 2014
			Participation in carbon-focused indices may not affect firms' financial performance.	Although thematic indices can help identify firms that meet specific criteria, carbon-based indices may not yield higher returns on investment.	de Lima et al., 2022
			Markets have not fully integrated climate change risks into their pricing	Physical and transition risks could adversely impact corporate bond prices and credit spreads. Yet, the consideration for those risks has not been factored into the pricing of those assets	Mastouri et al., 2022
Disclosure Benefits	Sustainability Reporting Facilitates Financial Gains	The influence of actors such as IFRS and TCFD has shaped sustainability reporting by catering to the financial needs and values of financial stakeholders. As such, firms could gain financial, reputational, or competitive advantage by participating in sustainability disclosures.	Financial coup d'etat	Describes perspectives arguing that sustainability reporting, firm disclosures, and literature are being heavily influenced by financial actors, like the IFRS, or values that evaluate financial implications. It also denotes instances in which firms prioritise short-term financial gains over long-term climate benefits.	Abhayawansa & Adams, 2022; Adams & Mueller, 2022; Arian & Sands, 2024; Christophers, 2017; Ma et al., 2023; Zitti & Guttormsen, 2023
			Climate change initiatives (e.g., TCFD, SBT, etc.) bolster legitimacy and competitive advantage	Describes the perspective that firms implement climate change initiatives to gain legitimacy and a competitive advantage rather than taking climate action.	Shimizu & Goto, 2023
			TCFD-based disclosures improve financial performance	The adoption of the TCFD recommendations could positively	Maji & Kalita, 2022

				impact a firm's financial performance.	
	Benefits of Mandatory and Voluntary Disclosure	Regulating sustainability or climate change disclosures could alleviate some information asymmetry between firms and the public regarding physical risks. However, it is crucial to be mindful of the potential positive and negative impacts of mandatory reporting. Additionally, mandatory reporting could improve the information shared with the public, but disclosures alone might not prompt firms to act or achieve real, sustainable impacts. On the other hand, firms that voluntarily disclose could experience benefits to their environmental performance alongside their financial performance. Yet, further research is needed to fully understand how voluntary disclosures yield such benefits.	Regulation influences physical risk information asymmetry	Regulation could be a factor for moderating the relationship between disclosure and information asymmetry. The higher the degree of regulation, the lower the information asymmetry.	Schiemann & Sakhel, 2019
			Trade-offs for legislated non-financial disclosures	Mandatory non-financial disclosures might lead to both positive and negative impacts for firms and nations.	Fiandrino et al., 2022
			Mandatory reporting increases internal disclosure processes, but does not have a real impact	Mandatory reporting regulations can influence firms' internal operations and public disclosures. Yet, those regulations may not directly lead to real-world sustainable impacts by the firms.	Tang & Demeritt, 2018
			Voluntary disclosure could lead to positive financial and environmental performance, but more research is needed.	Firms that voluntarily disclose carbon-related information may realise positive gains in their financial or environmental performance. However, further research is required to determine the extent of those gains and the required level of transparency.	Shui et al., 2023
			Voluntary disclosure leads to positive financial performance	Firms that voluntarily disclose climate change or carbon information could see positive gains in their financial performance.	Alsaifi et al., 2020
	Enhancing Climate Disclosure Value Through Assurance	The disclosure of climate change information not only provides stakeholders with insights about the	Climate-related information asymmetry	Firms' external disclosures do not share the same information or insights that internal managers have.	Andersson & Arvidsson, 2023

		firm's approaches to climate change risks but also reduces information asymmetry. Furthermore, public disclosures could yield positive financial gains, reduce financial distress, and, in some cases, improve firms' stock values. Finally, firms that seek external assurance may improve their public disclosures.	Disclosure leads to positive financial performance	By disclosing information, firms may further enhance their financial performance.	Alsaifi et al., 2020; Chen et al., 2022
			Disclosure reduces financial distress	If specific conditions of firm attributes are met, firms could be less prone to financial stress when disclosing climate change information.	Alshahrani et al., 2023
			Positive impact of disclosure on stock performance	There is evidence of a positive effect on stock performance for firms that disclose climate change information.	Ziegler et al., 2011
			Positive benefits from external assurance and verification	The use of external assurance or verifications could aid firms in improving the quality of their disclosures.	Dutta & Dutta, 2021; Giannarakis et al., 2018
	Various Financial Impacts of Climate Change Disclosures	The disclosure of sustainability or climate change information by firms could have positive or negative implications for the financial performance of the organisations, but the impact depends on the firm, industry, and external institutional pressures. Disclosure could positively impact financial performance, such as supporting stock performance, and the disclosure of material topics could lead to	Firms with strong financial performance tend to disclose sustainability information	Firms that disclose sustainability information may depend on the degree of financial performance the firm experiences. With better performance, firms are more likely to disclose.	Carvajal & Nadeem, 2023
			Sustainability disclosure could improve financial performance	The disclosure of sustainability information might lead to enhanced financial performance. Depending on the firm, industry, and institutional pressures, stock performance could also increase. This also includes disclosures of corporate climate initiatives and climate change risks.	Caby et al., 2022; Chen et al., 2022; Maji & Kalita, 2022

		negative impacts if the firm or industry is susceptible to those topics (e.g., a gas company disclosing GHG emissions might see negative impacts since the oil and gas sector is sensitive to that topic). Interestingly, the disclosure of information could be further influenced by firms' financial performance, with stronger-performing firms more likely to disclose information.	Financial performance could be negatively impacted by disclosures	Depending on the firm, disclosing specific environmental or sustainability-related information may reduce financial performance. The impact of specific information categories depends on the firm and the industry in which it operates.	Sichigea et al., 2021
			Voluntary carbon disclosure can be a strategic tool to increase firm value	Proactive, voluntary disclosures are positively associated with improved financial performance, suggesting that firms that disclose such information may experience improved performance.	Alsaifi et al., 2020
			The disclosure of climate change information could help prevent stock price crashes.	When climate change information is shared with stakeholders, the stock price could become more resilient to shocks since market stakeholders are aware of the firm's status.	Jung & Song, 2023
Shaping Disclosure	Pressures Leading to Disclosure Manipulation	Several factors can impact the disclosure of sustainability or climate change information. The industry in which a firm operates may influence the type of information disclosed, since not all sustainable or climate change topics are relevant across industries. At the firm level, the amount of media exposure the firm receives may affect the information shared, given the potential	Central banks disclosures or communications impact financial stability	Financial stability could be impacted by the disclosures and public announcements of central banks.	Lupu & Criste, 2023
			Carbon intensity of an industry impacts disclosure	The depth or quality of disclosure is impacted by the overall carbon intensity of the industry in which the firm operates. This means that firms in a carbon-intensive industry could be more likely to disclose carbon information.	Amran et al., 2014
			Climate change disclosure impacted by environmental performance and media exposure	The degree of environmental performance a firm has and its level of exposure or visibility in the media could	Dawkins & Fraas, 2011

		reputational consequences if negative insights are publicised. Additionally, the firm's exposure to climate change risks could affect how it discloses climate-related information, with greater exposure potentially leading to more disclosure. Furthermore, firms might also be influenced by their stakeholders or regulators to share insights regarding specific climate change or sustainability issues.		influence whether the firm discloses environmental or climate change information.	
			Climate change risks influence disclosure	Firms exposed to higher degrees of climate change risks could be more likely to disclose climate change information or adopt the TCFD recommendations.	Amar et al., 2022
			Pressured to disclose by the public and regulators	External stakeholder pressures, other than those of financial-related stakeholders, could influence how the firms disclose information.	Cotter & Najah, 2012; de Grosbois & Fennell, 2022; Liesen et al., 2015; Luo et al., 2012; Yu & Ting, 2012
	Board of Directors' Influence on Disclosure	When considering the internal influencers for corporate sustainability or climate change disclosure, the board of directors could potentially influence what information is shared, depending on the carbon intensity of the firm's industry. As well, boards with more independent directors and a more gender diverse board could be more likely to support improved corporate disclosure. Another supporting factor for disclosure stems from establishing board committees, specifically	Board's influence on disclosure	A firm's board could influence or sway the disclosure of sustainability or climate change information or improve the quality of such disclosures.	Cosma et al., 2022; Mehedi et al., 2024; Siao et al., 2022
			Director independence influences disclosure	The degree of director independence could influence, positively or negatively, the degree or quality of the firm's disclosures.	Ooi et al., 2019
			The board's influence on disclosure depends on the carbon intensity of the industry	Although a firm's Board of Directors could influence disclosures, those impacts could also depend on the industry in which the firm operates. Boards might be inclined to support disclosures in industries with lower carbon intensity.	Toukabri & Youssef, 2023
			Board committees positively influence disclosure	There could be a positive connection between the adoption of board-led sustainability or CSR committees and firms'	Cosma, Principale, et al., 2022

		sustainability or corporate social responsibility oversight committees. As such, boards could positively influence corporate climate change disclosures. However, the size of the board and of the audit committee, or similar board committees, may not influence disclosure. This suggests that the board's impact on disclosure may not be linked to traditional metrics, such as size.		climate change disclosures.	
			Board gender diversity improves disclosure	Including women or enhancing the gender diversity of a firm's board could improve climate change disclosures.	Ararat & Sayedy, 2019; Ben-Amar et al., 2017; Ooi et al., 2019
			Board size and audit committee size do not impact disclosure	There is some evidence suggesting no statistically significant link between board size, audit committees, or other forms of board oversight committees and the degree of firm disclosure.	Ooi et al., 2019
Financial Focused	Stakeholders' Interests Influence Disclosures	The disclosure of sustainability and climate change information can be important to investment decision-making and complements the current efforts by financial material-based standard-setters to promote the information needs of financial stakeholders. However, it is important to remember that, even though firms provide relevant stakeholder information, internal actors' or stakeholders' abilities and knowledge may influence how firms are exposed to climate change risks and the potential impacts of that exposure	The disclosure of sustainability issues is influenced by financial stakeholders	Financial material-based standard setters, like the IFRS, have been able to influence the reporting landscape by addressing the sustainability-related information needs of financial stakeholders.	Afolabi et al., 2023; Aibar-Guzmán et al., 2023; Nikolaou et al., 2015
			The skills and knowledge of internal actors or managers could offset the financial impacts of climate change risks	Internal actors can be an essential factor in addressing or preventing firm-related climate change risks. The higher a firm's managerial ability, the less likely it is to experience climate-related financial impacts.	Almaghrabi, 2023
			Climate change information is important for investment decision-making	Climate change information is material and impacts the decision-making for investments, so companies that address climate change could have more market value than those that do not.	Kamarudin et al., 2023

		on financial performance.			
Contextual Materiality	National Influences on Climate Change Disclosure	In addition to considering firm-level factors that might influence public disclosure, there could be considerable influence from the top-down, national level on firms' disclosure practices. The national governance structure may affect whether a firm discloses, with common-law nations having a greater propensity for disclosure. Similarly, the social and cultural traditions, along with a nation's financial and economic status, might influence what information is disclosed. These national factors could lead to high-quality disclosure or underreporting of certain sustainability or climate change topics. To mitigate potential differences in disclosures arising from national influences, supranational legislation, such as the EU's CSRD, could help	Common-law governance structure increases disclosure	Firms operating within nations that have a common-law system could be more likely to disclose carbon or climate change information than firms operating in nations without a common-law system	Grael & Gotthardt, 2016
			The country of origin has positive impacts on disclosures	Specific firm characteristics impact the quality of climate change risk disclosures, with the firm's country of origin being a potential trait that could influence climate change risk disclosure.	Kouloukoui et al., 2019
			Economic policy uncertainty increases disclosure	Economic policy uncertainty could be a facilitator for climate change information disclosures. Meaning, during uncertain economic times, firms tend to release more information.	Assaf et al., 2023
			Expanding EU legislation	Improving existing EU NFRD or CSRD is needed in order to adequately include additional considerations for materiality	Lee et al., 2023
			National development levels and financial development impacts disclosures by banks	There is the possibility of a positive connection between industrial development (i.e., developing or developed countries), financial development, and bank disclosures.	Caby et al., 2020

		promote a unified set of material issues for firms across several nations.	Regional economic development can influence disclosure	There is a connection between the economic development of the region the firm operates within and the quality of the firm's disclosure. Higher economic development leads to higher-quality disclosure	Bilala et al., 2022; Yu & Ting, 2012
			Society and political climates impact climate change disclosures	The political climate or regime in which a firm operates may influence its disclosures. Political alignments or local community support could also influence firms' disclosures.	Antonini et al., 2021
	Impacts of Materiality Definitions	Although climate change risks are material for firms, different interpretations of materiality (e.g., double or single-financial) could impact the information firms disclose. Yet some firms apply both types of materiality definitions in their disclosures, resulting in a single financial lens first, followed by a double materiality lens. In doing so, the relevance of specific topics, specifically the SDGs, could be impacted by the firm's application of materiality definitions. A potential solution could be for standard setters or regulators to develop an accountability-focused	Climate change risks are material for firms	Firms understand that physical and transition risks could impact their financial performance or stability.	Andersson & Arvidsson, 2023; Migliorelli, 2023
			The materiality lens impacts the materiality of the SDGs applied	The relevance of SDGs varies depending on their alignment with the selected reporting standard. This is especially the case for SASB standards.	Betti et al., 2018
			The accountability-based materiality definition can support investor and sustainability values	If a firm integrates its accountability to the economy, society, and the planet, it can redefine materiality to include considerations for sustainability and financial material issues.	Abhayawansa, 2022
			Different definitions or perspectives of materiality impact what is disclosed	The application of non-financial reporting policies, like the NFRD, or standards, could vary due to differences in materiality perspectives. A financial material perspective would promote more financially relevant issues, while a double material perspective	Raith, 2023

		materiality definition so that firms report on economic, social, and environmental issues. Nevertheless, the conundrum of materiality is rooted in the age-old debate over corporate social responsibility. Given the nature of corporate social responsibility debates, a clear, unified approach to materiality might never manifest.		would promote financial and social.	
			Firms use double and single materiality in their disclosures	When developing their materiality assessments, firms first use a single materiality perspective and then apply a double materiality lens.	De Cristofaro & Gulluscio, 2023
			Arguments related to materiality definitions are proxies for corporate responsibility debates	Discussions of defining materiality, or debates between double and single materiality, are extensions of corporate responsibility debates.	Raith, 2023
Socio-economic Expectations	Financially Material Climate Risks	At the firm level, disclosing climate change information can be strongly influenced by the information needs of financial stakeholders and the potential impacts on a firm's financial performance. Climate change risks may be material due to their potential to affect a firm's financial stability.	Climate change information is material for financial stakeholders	Firm disclosure of climate change information is critical for financial stakeholders, such as investors, to make decisions.	Kamarudin et al., 2023
			Climate change risks are material for firms	Climate change risks are material for firms due to the implications on financial performance and stability.	Migliorelli, 2023
	Stakeholders Hold Material Agency	Stakeholders could influence the importance of specific material topics and the development of reporting standards. Additionally, firms can serve as important	Investor and financial-focused actors influence reporting standards.	The development of sustainability reporting standards has been influenced by the interests and engagement of financial stakeholders, such as investors, and by financially focused standard-setters, such as the IFRS.	Abhayawansa & Adams, 2022; Adams & Mueller, 2022

		stakeholders in the standard-setting process, as prominent firms may shape the outcomes of standard-setters.	Materiality issues vary depending on the stakeholder	Internal and external stakeholders can have different values or perspectives regarding the importance of material issues. Thus, disclosures that cater to one stakeholder group might not provide enough insight for other stakeholder groups.	Jørgensen et al., 2022; Reimsbach et al., 2020
			Firms can influence the form and use of materiality assessment tools.	A few firms with strong influence within the industry could direct the design and application of materiality assessments from standard setters. This means reporting standards could be shaped by firms as well as by the original standard-setting organisations.	De Cristofaro & Raucci, 2022
Financial Trade-offs	Mixed Financial Implications for Material Disclosures	The literature highlights that disclosing material topics can negatively affect firms' and stocks' financial performance. Disclosing information based on material relevance to stakeholders may adversely affect a firm's financial performance, particularly if the firm is sensitive to specific material topics or operates in an emerging economy. Additionally, selecting stocks based on a materiality-focused assessment may yield a low rate of return. Alternatively,	In emerging economies, material sustainable issues could lead to poorer financial performance	Firms that scored higher in sustainable materiality exhibited weaker financial performance. Suggesting that there could be a negative relationship between material sustainability issues and firm financial performance in emerging economies.	Gill et al., 2022
			Disclosure could negatively impact firm financial performance	The impacts of the disclosure of material topics on financial performance are not uniform. Some issues, like emissions or water management, could have a negative impact. These impacts could be related to the industry in which the firm operates.	Sichigea et al., 2021
			Material disclosures can benefit firm value	The disclosure of material topics has been shown to support firm value and financial performance.	Carvajal & Nadeem, 2023

		some studies indicate that disclosing material information can positively affect a firm's financial performance. By developing disclosures, firms could improve their image regarding environmental performance, which is positively associated with financial performance. However, there is debate over whether the mere disclosure of material topics is sufficient to improve financial performance.	Disclosures could lead to improved financial performance in firms that focus on environmental performance	Disclosure of sustainability material information could provide firms with the ability to improve their environmental performance image, which then enhances their financial performance	Jadhav et al., 2022
			Materiality does not have a direct impact on financial performance	Material issues are important for determining assessment methods, but there is not sufficient evidence to claim that there is an impact on financial performance.	Busch & Hoffmann, 2011
	Contextual Benefits of Materiality	For firms, using materiality-based assessments in investment decision-making may improve their financial performance. Additionally, mandatory reporting requirements could enhance decision-making by firms and investors since firms disclose material information. However, materiality-based portfolios may not yield expected returns in portfolio evaluation, as they typically do not yield higher returns.	Using materiality as an assessment tool may not lead to reliable stock return predictions	Using materiality-based assessment may not lead to reliable predictions of stock returns. Portfolios using a materiality-weighted measure do not lead to significant financial returns or advantages.	Berchicci & King, 2022
			Materiality-based scoring for investment decision-making could result in positive financial performance	Applying a materiality-based scoring system could improve firms' financial performance.	Badía et al., 2022
			Mandatory non-financial disclosures can benefit firms' and investors' decision-making	Mandatory disclosures could support decision-making within the firm and by external investors since material information must be disclosed.	Gibbons, 2023

	Benefits of Single-Financial Materiality	Firms might be able to improve their financial performance since disclosing financially relevant issues can improve their performance. Additionally, the potential financial benefits might motivate firms to disclose material topics or improve their existing disclosures.	Applying a financial materiality perspective improves financial performance	Although material issues can improve firm value, the specific application of a financially focused materiality approach, like SASB, could further enhance the benefits of disclosure on financial performance.	Aras & Kazak, 2022; Carvajal & Nadeem, 2023
			Applying a financial materiality perspective improves disclosures	The adoption of financial-focused standards, such as SASB, could benefit firms by incentivising disclosure and addressing investor-relevant issues.	Jebe, 2019
	Diverse Financial Impacts of Materiality Disclosures	The relationship between materiality and financial performance is complex, with the potential for both positive and negative effects. Yet materiality alone may not influence financial performance, and materiality-based assessments of stocks or portfolios may not yield higher returns, suggesting limits to the application of materiality.	The possibility of sustainability disclosure by firms is improved by financial materiality	The application of a financial materiality perspective, such as the SASB framework, could facilitate sustainability disclosures, as this perspective has a positive impact on financial performance.	Carvajal & Nadeem, 2023
			In emerging economies, firms with high degrees of sustainable materiality might have poorer performance	Firms that disclose more sustainability information do not perform the same as firms with lower degrees of disclosure. This suggests that sustainability disclosure may adversely affect financial performance.	Gill et al., 2022
			The application of materiality weighting within portfolio assessments may not lead to significant financial returns	Evaluating stocks using a materiality matrix or similar assessment process may not yield significant investment returns, as such assessments are poor predictors of stock returns.	Berchicci & King, 2022
			Financial materiality could improve the financial	The application of a financial materiality perspective, such as the SASB framework, could positively	Aras & Kazak, 2022

			performance of firms	impact financial performance by ensuring that relevant ESG issues are accounted for by the firm.	
			Materiality does not directly or on its own impact financial performance	Materiality is important for determining assessment methods, but is not sufficient to claim that there is an impact on financial performance.	Busch & Hoffmann, 2011
Double Materiality	Double Materiality	Applying a dual materiality lens to corporate disclosures may enable firms to meet the information needs of both financial and non-financial stakeholders. Also, applying double materiality could aid in addressing systemic climate change risks. Firms and nations can identify and address risks that impact the organisation or country itself, along with the broader economy, society, and environment. However, the application of double materiality in corporate disclosures is inconsistent, resulting in missing or vague information, suggesting that corporate climate change disclosures are not generated solely for the purpose of addressing double material issues.	Double materiality could appeal to both general stakeholders and financial stakeholders	A double materiality lens could provide disclosures with information that is relevant to a wider set of stakeholders. However, disclosures should be clear about what information is financial material and what is double material.	Jørgensen et al., 2022
			Double materiality can be linked to climate change risks	Double materiality is an important feature since it supports addressing systemic climate change risks	Gruenewald et al., 2024
			Double materiality is not central to corporate climate change disclosures	Current climate change disclosures do not uniformly adopt a double materiality perspective. This leads to fewer details about emissions targets and makes it difficult to compare firms' disclosures.	Ng et al., 2022

Multi-level Impacts	Climate Change Risks are Material	Climate change risks are material at both the firm and national levels. Yet, regional and cultural differences could affect perceptions of the material importance of climate issues and their effects on firms' financial performance. Furthermore, climate change risks could exacerbate financial instability at both the systemic and firm levels, making it imperative for nations and firms to address these risks.	Regional cultural and social differences could influence the relationship between materiality and financial performance	Differences in cultural norms and social expectations may lead to geographic variation in the impact of materiality on financial performance. For example, U.S. firms may experience a more positive impact than EU firms.	Badía et al., 2022
			Climate change issues are material for firms, society, and the economy	Climate change-related issues have been identified as important by both firms and stakeholders. Also, climate change can impact economic stability, meaning these issues have material impacts	Lamperti & Roventini, 2022; Sepulveda-Alzate et al., 2022
	Widespread Stability Impacts	Both physical and transition risks can negatively influence the global economy and encourage instability. These risks could flow from the household level to the business or financial intermediary level to the systemic economic level. Suggesting the material importance of climate change risks for firms and nations. The transient nature of these risks has effects at all three levels, potentially undermining the stability of the broader system. However, it is	Climate change risks can influence adverse economic events	Climate change could cause adverse economic events to become less predictable and more frequent. This means current interest rates and asset values may also fluctuate.	Karydas & Xepapadeas, 2022; Lamperti & Roventini, 2022
			Temperature shocks (physical impacts) could impact stability	Physical changes in the temperature of the climate could result in a decrease in financial stability	Song & Fang, 2023
			There are multiple pathways by which climate risks could impact financial stability	Climate change risks could impact an economy's financial stability through direct and indirect channels. Risks affect households and corporations, which are then passed on to financial institutions and, ultimately, to the financial system, resulting in market volatility. Additionally, the	Battiston et al., 2021; Chabot & Bertrand, 2023

		important to remember that climate change risks do not affect financial stability alone; other economic or social risks may intersect with and interact with climate change risks. Additionally, changes to global temperature, positive increases or negative decreases, can impose shocks to the economic system, which could enhance instability.		impacts of climate change could be influenced by how actors perceive these risks.	
			Climate risks can impact financial stability	Both transition risks and physical risks can impact financial stability. This is because emissions and climate variability impact both financial institutions and the financial system.	Chabot & Bertrand, 2023; Fabris, 2020; Li, 2023
			Addressing physical risks could improve financial stability	Reducing the impacts of physical risks could help improve the stability of the economy since the direct impacts (e.g., weather and natural disasters) are lessened.	Malik et al., 2023; Mandel et al., 2021
			Financial stability is impacted by climate risks and other risks	Although climate change risks can negatively impact financial stability, those risks do not operate in isolation from other risks.	D’Orazio, 2023
			Transition risks can influence financial stability via investor attention	Transition risks could influence investors' attention, thereby affecting the financial stability of a market. As investors become more aware of transition risks, they impose additional expectations on the market or change their behaviour towards carbon-intensive assets or market fluctuations.	An et al., 2022

			Financial stability could be impacted by both positive and negative climate shocks	Both positive and negative shock types could have implications for financial stability. Positive shocks, in the form of physical risks, could increase instability because these risks become more impactful. Negative shocks, in the form of transition risks, could increase instability due to the restrictions they apply and the litigation generated.	Z. Liu et al., 2021
			Climate change is material for systemic financial stability	Both the transition and physical impacts of climate change could adversely affect economic stability. Physical impacts would be exacerbated, while transition risks could increase financial costs and hamper economic growth.	Lamperti & Roventini, 2022
			Climate change risks are material for firms because they impact financial stability	The financial stability of firms can be affected by climate change risks, resulting in material impacts on the firm.	Migliorelli, 2023

References

- Abhayawansa, S. (2022). Swimming against the tide: Back to single materiality for sustainability reporting. *Sustainability Accounting Management and Policy Journal*, 13(6), 1361–1385. <https://doi.org/10.1108/SAMPJ-07-2022-0378>
- Abhayawansa, S., & Adams, C. (2022). Towards a conceptual framework for non-financial reporting inclusive of pandemic and climate risk reporting. *Meditari Accountancy Research*, 30(3), 710–738. <https://doi.org/10.1108/MEDAR-11-2020-1097>
- Acar, E., Çaliyurt, K., & Zengin-Karaibrahimoglu, Y. (2021). Does ownership type affect environmental disclosure? *International Journal of Climate Change Strategies and Management*, 13(2), 120–141. <https://doi.org/10.1108/IJCCSM-02-2020-0016>
- Adams, C., & Mueller, F. (2022). Academics and policymakers at odds: The case of the IFRS foundation trustees' consultation paper on sustainability reporting. *Sustainability Accounting Management and Policy Journal*, 13(6), 1310–1333. <https://doi.org/10.1108/SAMPJ-10-2021-0436>
- Afolabi, H., Ram, R., & Rimmel, G. (2023). Influence and behaviour of the new standard setters in the sustainability reporting arena: Implications for the global reporting initiative's current position. *Sustainability Accounting Management and Policy Journal*, 14(4), 743–775. <https://doi.org/10.1108/SAMPJ-01-2022-0052>
- Aibar-Guzmán, B., Raimo, N., Vitolla, F., & García-Sánchez, I. (2023). Corporate governance and financial performance: Reframing their relationship in the context of climate change. *Corporate Social Responsibility and Environmental Management*. <https://doi.org/10.1002/csr.2649>
- Aldoseri, M., & Albaz, M. (2023). Climate change risks disclosure: Do business strategy and management characteristics matter? *International Journal of Financial Studies*, 11(4). <https://doi.org/10.3390/ijfs11040150>
- Almaghrabi, K. (2023). Climate change exposure and firm performance: Does managerial ability matter? *Sustainability*, 15(17). <https://doi.org/10.3390/su151712878>
- Alsaifi, K., Elnahass, M., & Salama, A. (2020). Carbon disclosure and financial performance: UK environmental policy. *Business Strategy and the Environment*, 29(2), 711–726. <https://doi.org/10.1002/bse.2426>
- Alshahrani, F., Eulaiwi, B., Duong, L., & Taylor, G. (2023). Climate change performance and financial distress. *Business Strategy and the Environment*, 32(6), 3249–3271. <https://doi.org/10.1002/bse.3298>
- Amar, J., Demaria, S., & Rigot, S. (2022). Enhancing financial transparency to mitigate climate change: Toward a climate risks and opportunities reporting index. *Environmental Modeling & Assessment*, 27(3), 425–439. <https://doi.org/10.1007/s10666-021-09800-7>
- Ameli, N., Drummond, P., Bisaro, A., Grubb, M., & Chenet, H. (2020). Climate finance and disclosure for institutional investors: Why transparency is not enough. *Climatic Change*, 160(4), 565–589. <https://doi.org/10.1007/s10584-019-02542-2>
- Ameli, N., Kothari, S., & Grubb, M. (2021). Misplaced expectations from climate disclosure initiatives. *Nature Climate Change*, 11(11), 917–924. <https://doi.org/10.1038/s41558-021-01174-8>
- Amran, A., Periasamy, V., & Zulkafli, A. (2014). Determinants of climate change disclosure by developed and emerging countries in Asia Pacific. *Sustainable Development*, 22(3), 188–204. <https://doi.org/10.1002/sd.539>

- An, Q., Zheng, L., Li, Q., & Lin, C. (2022). Impact of transition risks of climate change on Chinese financial market stability. *Frontiers In Environmental Science*, 10. <https://doi.org/10.3389/fenvs.2022.991775>
- Andersson, F., & Arvidsson, S. (2023). Understanding, mapping and reporting of climate-related risks among listed firms in Sweden. *Climate Policy*, 23(8), 945–958. <https://doi.org/10.1080/14693062.2022.2116383>
- Antonini, C., Olczak, W., & Patten, D. (2021). Corporate climate change disclosure during the trump administration: Evidence from standalone CSR reports. *Accounting Forum*, 45(2), 118–141. <https://doi.org/10.1080/01559982.2021.1909819>
- Ararat, M., & Sayedy, B. (2019). Gender and climate change disclosure: An interdimensional policy approach. *Sustainability*, 11(24). <https://doi.org/10.3390/su11247217>
- Aras, G., & Kazak, E. (2022). Enhancing firm value through the lens of ESG materiality: Evidence from the banking sector in OECD countries. *Sustainability*, 14(22). <https://doi.org/10.3390/su142215302>
- Arian, A., & Sands, J. (2024). Corporate climate risk disclosure: Assessing materiality and stakeholder expectations for sustainable value creation. *Sustainability Accounting, Management and Policy Journal*, 15(2), 457–481. <https://doi.org/10.1108/SAMPJ-04-2023-0236>
- Ascui, F., & Lovell, H. (2012). Carbon accounting and the construction of competence. *Journal of Cleaner Production*, 36, 48–59. <https://doi.org/10.1016/j.jclepro.2011.12.015>
- Assaf, C., Benlemlih, M., El Ouadghiri, I., & Peillex, J. (2023). Does policy uncertainty affect non-financial disclosure? Evidence from climate change-related information. *International Journal of Finance & Economics*. <https://doi.org/10.1002/ijfe.2888>
- Badía, G., Gómez-Bezares, F., & Ferruz, L. (2022). Are investments in material corporate social responsibility issues a key driver of financial performance? *Accounting and Finance*, 62(3), 3987–4011. <https://doi.org/10.1111/acfi.12912>
- Battiston, S., Dafermos, Y., & Monasterolo, I. (2021). Climate risks and financial stability. *Journal of Financial Stability*, 54. <https://doi.org/10.1016/j.jfs.2021.100867>
- Ben-Amar, W., Chang, M., & McIlkenny, P. (2017). Board gender diversity and corporate response to sustainability initiatives: Evidence from the carbon disclosure project. *Journal of Business Ethics*, 142(2), 369–383. <https://doi.org/10.1007/s10551-015-2759-1>
- Berchicci, L., & King, A. (2022). Corporate sustainability: A model uncertainty analysis of materiality. *Journal of Financial Reporting*, 7(2), 43–74. <https://doi.org/10.2308/JFR-2021-022>
- Bergmann, A., Stechemesser, K., & Guenther, E. (2016). Natural resource dependence theory: Impacts of extreme weather events on organizations. *Journal of Business Research*, 69(4), 1361–1366. <https://doi.org/10.1016/j.jbusres.2015.10.108>
- Betti, G., Consolandi, C., & Eccles, R. (2018). The relationship between investor materiality and the sustainable development goals: A methodological framework. *Sustainability*, 10(7). <https://doi.org/10.3390/su10072248>
- Bilala, Tan, D., Komal, B., Ezeani, E., Usman, M., & Salem, R. (2022). Carbon emission disclosures and financial reporting quality: Does ownership structure and economic development matter? *Environmental Science & Policy*, 137, 109–119. <https://doi.org/10.1016/j.envsci.2022.08.004>
- Bose, S., Lim, E., Minnick, K., & Shams, S. (2024). Do foreign institutional investors influence corporate climate change disclosure quality? International evidence. *Corporate Governance-An International Review*, 32(2), 322–347. <https://doi.org/10.1111/corg.12535>

- Bressan, G., & Romagnoli, S. (2021). Climate risks and weather derivatives: A copula-based pricing model. *Journal Of Financial Stability*, 54. <https://doi.org/10.1016/j.jfs.2021.100877>
- Busch, T., & Hoffmann, V. H. (2011). How hot is your bottom line? Linking carbon and financial performance. *Business and Society*, 50(2), 233–265. <https://doi.org/10.1177/0007650311398780>
- Busch, T., & Lewandowski, S. (2018). Corporate carbon and financial performance: A meta-analysis. *Journal Of Industrial Ecology*, 22(4), 745–759. <https://doi.org/10.1111/jiec.12591>
- Busch, T., Bassen, A., Lewandowski, S., & Sump, F. (2022). Corporate carbon and financial performance revisited. *Organization & Environment*, 35(1), 154–171. <https://doi.org/10.1177/1086026620935638>
- Caby, J., Ziane, Y., & Lamarque, E. (2020). The determinants of voluntary climate change disclosure commitment and quality in the banking industry. *Technological Forecasting and Social Change*, 161. <https://doi.org/10.1016/j.techfore.2020.120282>
- Caby, J., Ziane, Y., & Lamarque, E. (2022). The impact of climate change management on banks profitability. *Journal of Business Research*, 142, 412–422. <https://doi.org/10.1016/j.jbusres.2021.12.078>
- Campiglio, E., Dafermos, Y., Monnin, P., Ryan-Collins, J., Schotten, G., & Tanaka, M. (2018). Climate change challenges for central banks and financial regulators. *Nature Climate Change*, 8(6), 462–468. <https://doi.org/10.1038/s41558-018-0175-0>
- Campiglio, E., Daumas, L., Monnin, P., & von Jagow, A. (2023). Climate-related risks in financial assets. *Journal of Economic Surveys*, 37(3), 950–992. <https://doi.org/10.1111/joes.12525>
- Carvajal, M., & Nadeem, M. (2023). Financially material sustainability reporting and firm performance in New Zealand. *Meditari Accountancy Research*, 31(4), 938–969. <https://doi.org/10.1108/MEDAR-06-2021-1346>
- Castilho, A., & Barakat, S. (2022). The relationship between climate change mitigation strategies and the financial performance of Brazilian companies. *Journal ff Industrial Ecology*, 26(4), 1294–1305. <https://doi.org/10.1111/jiec.13265>
- Chabot, M., & Bertrand, J. (2023). Climate risks and financial stability: Evidence from the European financial system. *Journal of Financial Stability*, 69, 101190. <https://doi.org/10.1016/j.jfs.2023.101190>
- Chen, H., Kuo, T., & Chen, J. (2022). Impacts on the ESG and financial performances of companies in the manufacturing industry based on the climate change related risks. *Journal of Cleaner Production*, 380. <https://doi.org/10.1016/j.jclepro.2022.134951>
- Chenet, H., Ryan-Collins, J., & van Lerven, F. (2021). Finance, climate-change and radical uncertainty: Towards a precautionary approach to financial policy. *Ecological Economics*, 183. <https://doi.org/10.1016/j.ecolecon.2021.106957>
- Christophers, B. (2017). Climate change and financial instability: Risk disclosure and the problematics of neoliberal governance. *Annals of the American Association of Geographers*, 107(5), 1108–1127. <https://doi.org/10.1080/24694452.2017.1293502>
- Cong, Y., Freedman, M., & Park, J. (2020). Mandated greenhouse gas emissions and required SEC climate change disclosures. *Journal of Cleaner Production*, 247. <https://doi.org/10.1016/j.jclepro.2019.119111>
- Cosma, S., Leopizzi, R., Nobile, L., & Schwizer, P. (2022). Revising the non-financial reporting directive and the role of board of directors: A lost opportunity? *Journal Of Applied Accounting Research*, 23(1), 207–226. <https://doi.org/10.1108/JAAR-04-2021-0102>

- Cosma, S., Principale, S., & Venturelli, A. (2022). Sustainable governance and climate-change disclosure in European banking: The role of the corporate social responsibility committee. *Corporate Governance-The International Journal of Business in Society*, 22(6), 1345–1369. <https://doi.org/10.1108/CG-09-2021-0331>
- Cotter, J., & Najah, M. (2012). Institutional investor influence on global climate change disclosure practices. *Australian Journal of Management*, 37(2), 169–187. <https://doi.org/10.1177/0312896211423945>
- D’Orazio, P. (2021). Towards a post-pandemic policy framework to manage climate-related financial risks and resilience. *Climate Policy*, 21(10), 1368–1382. <https://doi.org/10.1080/14693062.2021.1975623>
- D’Orazio, P. (2023). Navigating financial stability through the dual challenges of climate change and pandemics. *Current Opinion in Environmental Sustainability*, 65. <https://doi.org/10.1016/j.cosust.2023.101386>
- Dafermos, Y., & Nikolaidi, M. (2021). How can green differentiated capital requirements affect climate risks? A dynamic macrofinancial analysis. *Journal of Financial Stability*, 54. <https://doi.org/10.1016/j.jfs.2021.100871>
- Dafermos, Y., Nikolaidi, M., & Galanis, G. (2018). Climate change, financial stability and monetary policy. *Ecological Economics*, 152, 219–234. <https://doi.org/10.1016/j.ecolecon.2018.05.011>
- Daradkeh, H., Shams, S., Bose, S., & Gunasekarage, A. (2023). Does managerial ability matter for corporate climate change disclosures? *Corporate Governance-An International Review*, 31(1), 83–104. <https://doi.org/10.1111/corg.12436>
- Dawkins, C., & Fraas, J. (2011). Coming clean: The impact of environmental performance and visibility on corporate climate change disclosure. *Journal Of Business Ethics*, 100(2), 303–322. <https://doi.org/10.1007/s10551-010-0681-0>
- De Cristofaro, T., & Gulluscio, C. (2023). In search of double materiality in non-financial reports: First empirical evidence. *Sustainability*, 15(2). <https://doi.org/10.3390/su15020924>
- De Cristofaro, T., & Raucci, D. (2022). Rise and fall of the materiality matrix: Lessons from a missed takeoff. *Administrative Sciences*, 12(4). <https://doi.org/10.3390/admsci12040186>
- de Grosbois, D., & Fennell, D. (2022). Determinants of climate change disclosure practices of global hotel companies: Application of institutional and stakeholder theories. *Tourism Management*, 88. <https://doi.org/10.1016/j.tourman.2021.104404>
- de Lima, C., Barbosa, S., Neto, R., Bazil, D., & Guerra, J. (2022). Corporate financial performance: A study based on the carbon efficient index (ICO2) of Brazil stock exchange. *Environment Development and Sustainability*, 24(3), 4323–4354. <https://doi.org/10.1007/s10668-021-01617-4>
- de Villiers, C., La Torre, M., & Molinari, M. (2022). The global reporting initiative’s (GRI) past, present and future: Critical reflections and a research agenda on sustainability reporting (standard-setting). *Pacific Accounting Review*, 34(5), 728–747. <https://doi.org/10.1108/PAR-02-2022-0034>
- Delmas, M., Nairn-Birch, N., & Lim, J. (2015). Dynamics of environmental and financial performance: The case of greenhouse gas emissions. *Organization & Environment*, 28(4), 374–393. <https://doi.org/10.1177/1086026615620238>
- DeMenno, M. (2023). Environmental sustainability and financial stability: Can macroprudential stress testing measure and mitigate climate-related systemic financial risk? *Journal of Banking Regulation*, 24(4), 445–473. <https://doi.org/10.1057/s41261-022-00207-2>

- Di Febo, E., Angelini, E., & Le, T. (2023). From transition risks to the relationship between carbon emissions, economic growth, and renewable energy. *Risks*, 11(12). <https://doi.org/10.3390/risks11120210>
- Dutta, P., & Dutta, A. (2021). Impact of external assurance on corporate climate change disclosures: New evidence from Finland. *Journal of Applied Accounting Research*, 22(2), 252–285. <https://doi.org/10.1108/JAAR-08-2020-0162>
- Eleftheriadis, I., & Anagnostopoulou, E. (2015). Relationship between corporate climate change disclosures and firm factors. *Business Strategy and the Environment*, 24(8), 780–789. <https://doi.org/10.1002/bse.1845>
- Erhemjamts, O., Huang, K., & Tehranian, H. (2024). Climate risk, ESG performance, and ESG sentiment in US commercial banks. *Global Finance Journal*, 59. <https://doi.org/10.1016/j.gfj.2023.100924>
- Fabris, N. (2020). Financial stability and climate change. *Journal of Central Banking Theory and Practice*, 9(3), 27–43. <https://doi.org/10.2478/jcbtp-2020-0034>
- Farooq, M., Zaman, R., Sarraj, D., & Khalid, F. (2021). Examining the extent of and drivers for materiality assessment disclosures in sustainability reports. *Sustainability Accounting Management and Policy Journal*, 12(5), 965–1002. <https://doi.org/10.1108/SAMPJ-04-2020-0113>
- Fasan, M., & Mio, C. (2017). Fostering stakeholder engagement: The role of materiality disclosure in integrated reporting. *Business Strategy and the Environment*, 26(3), 288–305. <https://doi.org/10.1002/bse.1917>
- Fiandrino, S., di Trana, M., Tonelli, A., & Lucchese, A. (2022). The multi-faceted dimensions for the disclosure quality of non-financial information in revising Directive 2014/95/EU. *Journal of Applied Accounting Research*, 23(1), 274–300. <https://doi.org/10.1108/JAAR-04-2021-0118>
- Galeone, G., Onorato, G., Shini, M., & Dell’Atti, V. (2023). Climate-related financial disclosure in integrated reporting: What is the impact on the business model? The case of Poste Italiane. *Accounting Research Journal*, 36(1), 21–36. <https://doi.org/10.1108/ARJ-04-2022-0107>
- Gallego-Alvarez, I., García-Sánchez, I., & Vieira, C. (2014). Climate change and financial performance in times of crisis. *Business Strategy and the Environment*, 23(6), 361–374. <https://doi.org/10.1002/bse.1786>
- Giannarakis, G., Zafeiriou, E., Arabatzis, G., & Partalidou, X. (2018). Determinants of corporate climate change disclosure for European firms. *Corporate Social Responsibility and Environmental Management*, 25(3), 281–294. <https://doi.org/10.1002/csr.1461>
- Gibbons, B. (2023). The financially material effects of mandatory nonfinancial disclosure. *Journal of Accounting Research*. <https://doi.org/10.1111/1475-679X.12499>
- Gill, S., Kohli, M., & Satija, P. (2022). Materiality in sustainability disclosures and investment portfolio performance in the Indian context. *Journal of Sustainable Finance & Investment*. <https://doi.org/10.1080/20430795.2022.2086844>
- Giner, B., & Luque-Vílchez, M. (2022). A commentary on the “new” institutional actors in sustainability reporting standard-setting: A European perspective. *Sustainability Accounting Management and Policy Journal*, 13(6), 1284–1309. <https://doi.org/10.1108/SAMPJ-06-2021-0222>

- Grauel, J., & Gotthardt, D. (2016). The relevance of national contexts for carbon disclosure decisions of stock-listed companies: A multilevel analysis. *Journal of Cleaner Production*, 133, 1204–1217. <https://doi.org/10.1016/j.jclepro.2016.05.182>
- Gruenewald, S., Knijp, G., Schoenmaker, D., & van Tilburg, R. (2024). Embracing the brave new world: A response to Demekas and Grippa. *Journal of Financial Regulation*, 10(1), 127–134. <https://doi.org/10.1093/jfr/fjad011>
- Guo, Y., Zhao, J., & Yang, D. (2022). Theories applicable to corporate climate change disclosure. *Journal of Corporate Accounting and Finance*, 33(4), 147–157. <https://doi.org/10.1002/jcaf.22572>
- Gupta, B., Cheng, R., & Rajan, R. (2023). Climate risks: Nexus between green financial policies and fiscal space. *Applied Economics Letters*. <https://doi.org/10.1080/13504851.2023.2205092>
- Halkos, G., & Skouloudis, A. (2016). Exploring the current status and key determinants of corporate disclosure on climate change: Evidence from the Greek business sector. *Environmental Science & Policy*, 56, 22–31. <https://doi.org/10.1016/j.envsci.2015.10.011>
- He, W., Cheng, Y., Zhang, H., Guo, F., & Yu, H. (2021). The microeconomic effects of temperature changes. *Journal of Cleaner Production*, 326. <https://doi.org/10.1016/j.jclepro.2021.129389>
- Huang, D. Z. (2022). An integrated theory of the firm approach to environmental, social and governance performance. *Accounting & Finance*, 62(S1), 1567–1598. <https://doi.org/10.1111/acfi.12832>
- Jadhav, A., Rahman, S., & Ahsan, K. (2022). Sustainability practices disclosure of top logistics firms in Australia. *International Journal of Logistics Management*, 33(5), 244–277. <https://doi.org/10.1108/IJLM-09-2021-0452>
- Jebe, R. (2019). The convergence of financial and ESG materiality: Taking sustainability mainstream. *American Business Law Journal*, 56(3), 645–702. <https://doi.org/10.1111/ablj.12148>
- Jørgensen, S., Mjos, A., & Pedersen, L. (2022). Sustainability reporting and approaches to materiality: Tensions and potential resolutions. *Sustainability Accounting, Management and Policy Journal*, 13(2), 341–361. <https://doi.org/10.1108/SAMPJ-01-2021-0009>
- Jung, H., & Song, C. (2023). Managerial perspectives on climate change and stock price crash risk. *FINANCE RESEARCH LETTERS*, 51. <https://doi.org/10.1016/j.frl.2022.103410>
- Kamarudin, Y., Mohd-Sanusi, Z., Musa, K., Kazemian, S., Hitam, M., Ghazali, A., & Shafie, N. (2023). Climate change risk for sustainability: The implication on financial and environment, social and governance reporting. *Journal of Nusantara Studies-Jonus*, 8(3), 277–299. <https://doi.org/10.24200/jonus.vol8iss3pp277-299>
- Karydas, C., & Xepapadeas, A. (2022). Climate change financial risks: Implications for asset pricing and interest rates. *Journal of Financial Stability*, 63. <https://doi.org/10.1016/j.jfs.2022.101061>
- Khalifa, M., Zouaoui, H., Ben Othman, H., & Hussainey, K. (2023). The impact of climate risk on accounting conservatism: Evidence from developing countries. *Journal of Applied Accounting Research*. <https://doi.org/10.1108/JAAR-01-2023-0028>
- Kouloukoui, D., Sant'Anna, A., Gomes, S., Marinho, M., de Jong, P., Kiperstok, A., & Torres, E. (2019). Factors influencing the level of environmental disclosures in sustainability reports: Case of climate risk disclosure by Brazilian companies. *Corporate Social Responsibility and Environmental Management*, 26(4), 791–804. <https://doi.org/10.1002/csr.1721>

- Lamperti, F., & Roventini, A. (2022). Beyond climate economics orthodoxy: Impacts and policies in the agent-based integrated-assessment DSK model*. *European Journal of Economics and Economic Policies: Intervention*, 19(3), 357–380. <https://doi.org/10.4337/ejeep.2022.0096>
- Lamperti, F., Bosetti, V., Roventini, A., Tavoni, M., & Treibich, T. (2021). Three green financial policies to address climate risks. *Journal of Financial Stability*, 54. <https://doi.org/10.1016/j.jfs.2021.100875>
- Lee, J., Serafin, A., & Courteau, C. (2023). Corporate disclosure, ESG and green fintech in the energy industry. *Journal of World Energy Law & Business*, 16(6), 473–491. <https://doi.org/10.1093/jwelb/jwad018>
- Li, N. (2023). Measuring the combining effects of financial stability and climate risk for green economic recovery. *Economic Change and Restructuring*, 56(2), 1225–1241. <https://doi.org/10.1007/s10644-022-09466-5>
- Liesen, A., Hoepner, A., Patten, D., & Figge, F. (2015). Does stakeholder pressure influence corporate GHG emissions reporting? Empirical evidence from Europe. *Accounting Auditing & Accountability Journal*, 28(7), 1047–1074. <https://doi.org/10.1108/AAAJ-12-2013-1547>
- Liu, Z., Sun, H., & Tang, S. (2021). Assessing the impacts of climate change to financial stability: Evidence from China. *International Journal of Climate Change Strategies and Management*, 13(3), 375–393. <https://doi.org/10.1108/IJCCSM-10-2020-0108>
- Luo, L., Lan, Y., & Tang, Q. (2012). Corporate incentives to disclose carbon information: Evidence from the CDP global 500 report. *Journal Of International Financial Management & Accounting*, 23(2), 93–120. <https://doi.org/10.1111/j.1467-646X.2012.01055.x>
- Lupu, I., & Criste, A. (2023). Climate change in the discourse of central banks. Influence on financial stability at the European level. *Studies In Business And Economics*, 18(2), 235–246. <https://doi.org/10.2478/sbe-2023-0034>
- Ma, B., Lin, S., Bashir, M., Sun, H., & Zafar, M. (2023). Revisiting the role of firm-level carbon disclosure in sustainable development goals: Research agenda and policy implications. *Gondwana Research*, 117, 230–242. <https://doi.org/10.1016/j.gr.2023.02.002>
- Mähönen, J. (2020). Comprehensive approach to relevant and reliable reporting in Europe: A dream impossible? *Sustainability*, 12(13). <https://doi.org/10.3390/su12135277>
- Maji, S., & Kalita, N. (2022). Climate change financial disclosure and firm performance: Empirical evidence from Indian energy sector based on TCFD recommendations. *Society and Business Review*, 17(4), 594–612. <https://doi.org/10.1108/SBR-10-2021-0208>
- Malik, A., bin Jais, M., Rahim, S., Rehman, A., & Khalid, S. (2023). Significance of environmental sustainability to maintain financial stability: Mediating roles of financial inclusion. *Asia-Pacific Journal of Regional Science*, 7(4), 1307–1328. <https://doi.org/10.1007/s41685-023-00308-4>
- Mandel, A., Tiggeloven, T., Lincke, D., Koks, E., Ward, P., & Hinkel, J. (2021). Risks on global financial stability induced by climate change: The case of flood risks. *Climatic Change*, 166(1–2). <https://doi.org/10.1007/s10584-021-03092-2>
- Mastouri, A., Mendiratta, R., & Giese, G. (2022). Corporate bonds and climate change risk. *Journal of Portfolio Management*, 48(10), 78–97. <https://doi.org/10.3905/jpm.2022.1.421>
- Mehedi, S., Nahar, S., & Jalaludin, D. (2024). Determinants of corporate climate change disclosure: Is the mediating role of corporate strategic response to environmental governance and policy matter? Evidence from emerging market. *Sustainable Development*, 32(1), 195–210. <https://doi.org/10.1002/sd.2641>

- Migliorelli, M. (2023). Climate change, environmental sustainability, and financial risks: Are we close to an understanding? *Current Opinion in Environmental Sustainability*, 65. <https://doi.org/10.1016/j.cosust.2023.101388>
- Ng, A. W., Yorke, S. M., & Nathwani, J. (2022). Enforcing double materiality in global sustainability reporting for developing economies: Reflection on Ghana's oil exploration and mining sectors. *Sustainability (Switzerland)*, 14(16). <https://doi.org/10.3390/su14169988>
- Ngo, T., Le, T., Ullah, S., & Trinh, H. (2023). Climate risk disclosures and global sustainability initiatives: A conceptual analysis and agenda for future research. *Business Strategy and the Environment*, 32(6), 3705–3720. <https://doi.org/10.1002/bse.3323>
- Nikolaou, I., Evangelinos, K., & Leal, W. (2015). A system dynamic approach for exploring the effects of climate change risks on firms' economic performance. *Journal of Cleaner Production*, 103, 499–506. <https://doi.org/10.1016/j.jclepro.2014.09.086>
- Ooi, S., Amran, A., Yeap, J., & Jaaffar, A. (2019). Governing climate change: The impact of board attributes on climate change disclosure. *International Journal of Environment and Sustainable Development*, 18(3), 270–288.
- Park, J., Nishitani, K., Kokubu, K., Freedman, M., & Weng, Y. (2023). Revisiting sustainability disclosure theories: Evidence from corporate climate change disclosure in the United States and Japan. *Journal of Cleaner Production*, 382. <https://doi.org/10.1016/j.jclepro.2022.135203>
- Principale, S., & Pizzi, S. (2023). The determinants of TCFD reporting: A focus on the Italian context. *Administrative Sciences*, 13(2), 61. <https://doi.org/10.3390/admsci13020061>
- Raith, D. (2023). The contest for materiality. What counts as CSR? *Journal of Applied Accounting Research*, 24(1), 134–148. <https://doi.org/10.1108/JAAR-04-2022-0093>
- Ramos, L., Gallagher, K., Stephenson, C., & Monasterolo, I. (2022). Climate risk and IMF surveillance policy: A baseline analysis. *Climate Policy*, 22(3), 371–388. <https://doi.org/10.1080/14693062.2021.2016363>
- Reimsbach, D., Schiemann, F., Hahn, R., & Schmiedchen, E. (2020). In the eyes of the beholder: Experimental evidence on the contested nature of materiality in sustainability reporting. *Organization & Environment*, 33(4), 624–651. <https://doi.org/10.1177/1086026619875436>
- Santos, A., & Rodrigues, L. (2021). Banks and climate-related information: The case of Portugal. *Sustainability*, 13(21). <https://doi.org/10.3390/su132112215>
- Schiemann, F., & Sakhel, A. (2019). Carbon disclosure, contextual factors, and information asymmetry: The case of physical risk reporting. *European Accounting Review*, 28(4), 791–818. <https://doi.org/10.1080/09638180.2018.1534600>
- Scholten, R., Lambooy, T., Renes, R., & Bartels, W. (2020). The impact of climate change in the valuation of production assets via the IFRS framework. *Accounting Economics and Law-A Convivium*, 10(2). <https://doi.org/10.1515/acl-2018-0032>
- Secinaro, S., Brescia, V., Calandra, D., & Saiti, B. (2020). Impact of climate change mitigation policies on corporate financial performance: Evidence-based on European publicly listed firms. *Corporate Social Responsibility and Environmental Management*, 27(6), 2491–2501. <https://doi.org/10.1002/csr.1971>
- Sepulveda-Alzate, Y., Garcia-Benau, M., & Gomez-Villegas, M. (2022). Materiality assessment: The case of Latin American listed companies. *Sustainability Accounting Management and Policy Journal*, 13(1), 88–113. <https://doi.org/10.1108/SAMPJ-10-2020-0358>

- Shimizu, S., & Goto, M. (2023). Why do companies participate in climate change-related initiatives? Theoretical and empirical analyses of motivations for Japanese companies. *Sustainable Development*. <https://doi.org/10.1002/sd.2848>
- Shui, X., Zhang, M., & Smart, P. (2023). Climate change disclosure and the promise of response-ability and transparency: A synthesizing framework and future research agenda. *European Management Review*, 20(1), 145–158. <https://doi.org/10.1111/emre.12514>
- Siao, H., Gau, S., Kuo, J., Li, M., & Sun, C. (2022). Bibliometric analysis of environmental, social, and governance management research from 2002 to 2021. *Sustainability*, 14(23). <https://doi.org/10.3390/su142316121>
- Sichigea, M., Siminica, M., Cristea, M., Noja, G., & Circiumaru, D. (2021). Materiality conditions in the interplay between environment and financial performance: A graphical modeling approach for EEA oil and gas companies. *Complexity*, 2021. <https://doi.org/10.1155/2021/7380759>
- Song, X., & Fang, T. (2023). Temperature shocks and bank systemic risk: Evidence from China. *Finance Research Letters*, 51. <https://doi.org/10.1016/j.frl.2022.103447>
- Stan, K., Watt, G., & Sanchez-Azofeifa, A. (2021). Financial stability in response to climate change in a northern temperate economy. *Nature Communications*, 12(1). <https://doi.org/10.1038/s41467-021-27490-3>
- Sueyoshi, T., & Goto, M. (2010). Measurement of a linkage among environmental, operational, and financial performance in Japanese manufacturing firms: A use of data envelopment analysis with strong complementary slackness condition. *European Journal of Operational Research*, 207(3), 1742–1753. <https://doi.org/10.1016/j.ejor.2010.07.024>
- Sun, Y., Yang, Y., Huang, N., & Zou, X. (2020). The impacts of climate change risks on financial performance of mining industry: Evidence from listed companies in China. *Resources Policy*, 69. <https://doi.org/10.1016/j.resourpol.2020.101828>
- Sun, Y., Zou, Y., Jiang, J., & Yang, Y. (2023). Climate change risks and financial performance of the electric power sector: Evidence from listed companies in China. *Climate Risk Management*, 39. <https://doi.org/10.1016/j.crm.2022.100474>
- Tang, S., & Demeritt, D. (2018). Climate change and mandatory carbon reporting: Impacts on business process and performance. *Business Strategy and the Environment*, 27(4), 437–455. <https://doi.org/10.1002/bse.1985>
- Thai, H., Huong, G., Nguyen, T., Pham, H., Nguyen, H., & Vu, T. (2023). Impacts of climate change risks on financial performance of listed firms in agriculture industries in Vietnam. *Journal Of Agribusiness in Developing and Emerging Economies*. <https://doi.org/10.1108/JADEE-07-2022-0137>
- Toukabri, M., & Youssef, M. (2023). Climate change disclosure and sustainable development goals (SDGs) of the 2030 agenda: The moderating role of corporate governance. *Journal of Information Communication & Ethics in Society*, 21(1), 30–62. <https://doi.org/10.1108/JICES-02-2022-0016>
- Ünüvar, B., & Yeldan, A. (2023). Green central banking under high inflation-more of a need than an option: An analytical exposition for Turkey. *Development Policy Review*, 41(6). <https://doi.org/10.1111/dpr.12720>
- Wu, G. S. T., & Wan, W. T. S. (2023). What drives the cross-border spillover of climate transition risks? Evidence from global stock markets. *International Review of Economics and Finance*, 85, 432–447. <https://doi.org/10.1016/j.iref.2023.01.027>

- Wu, J., Wang, D., Fu, X., & Meng, W. (2023). Antecedent configurations of ESG disclosure: Evidence from the banking sector in China. *Sustainability*, 15(17), 13234. <https://doi.org/10.3390/su151713234>
- Wu, L., Liu, D., & Lin, T. (2023). The impact of climate change on financial stability. *Sustainability*, 15(15). <https://doi.org/10.3390/su151511744>
- Yu, V., & Ting, H. (2012). Financial development, investor protection, and corporate commitment to sustainability evidence from the FTSE global 500. *Management Decision*, 50(1–2), 130–146. <https://doi.org/10.1108/00251741211194912>
- Zhang, B., Lai, K., Wang, B., & Wang, Z. (2018). The clean development mechanism and corporate financial performance: Empirical evidence from China. *Resources Conservation and Recycling*, 129, 278–289. <https://doi.org/10.1016/j.resconrec.2017.10.004>
- Ziegler, A., Busch, T., & Hoffmann, V. (2011). Disclosed corporate responses to climate change and stock performance: An international empirical analysis. *Energy Economics*, 33(6), 1283–1294. <https://doi.org/10.1016/j.eneco.2011.03.007>
- Zitti, M., & Guttormsen, A. (2023). Climate risk and financial disclosure in salmon aquaculture. *Aquaculture Economics & Management*, 27(3), 441–467. <https://doi.org/10.1080/13657305.2022.2143934>



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