

**Support for the
Task Force on Climate-Related Financial Disclosures (TCFD)
and Impact on Non-Renewable Energy Sector Investments in
United States Public Pension Funds**

by

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Author's Declaration

I hereby declare that I am the sole author of this thesis. This is a true copy of the thesis, including any required final revisions, as accepted by my examiners.

I understand that my thesis may be made electronically available to the public.

Abstract

The recommendations of the Task Force on Climate-Related Financial Disclosures (TCFD) are expected to play an important role in advancing the transition towards a climate target-aligned economy. However, the impact of the TCFD framework on investment decisions in sectors vulnerable to climate-related risks, such as the non-renewable energy sector, has yet to be studied. Applying the lens of institutional theory, this study investigates whether normative pressures stemming from voluntary support for the TCFD influence non-renewable energy sector investment decisions by public pension funds in the United States. This study employs a quantitative approach to pursue three interconnected objectives. First, identify the public pension funds in the United States that support the TCFD, and among those, identify their stage of implementation of the TCFD's recommendations. Second, assess whether fund size and location are influential in determining TCFD support or implementation stage. Third, examine whether the exposure to non-renewable energy sector investments before and after the release of the TCFD recommendations in 2017 significantly differs depending on whether a fund supports the TCFD or not. The study's findings reveal that 8 of 191 sampled public pension funds in the United States support the TCFD and are at various stages of implementation of the recommendations. Fund size was identified as a significant predictor of both TCFD support and stage of implementation, with larger funds more likely to be supporters and more advanced in implementation. California and New York were the only states with public pension funds that support the TCFD. Location, specifically whether a fund is in California or New York, emerged as a significant predictor of TCFD implementation stage, with funds in these two states being more advanced in implementation. Lastly, no significant differences in exposure to non-renewable energy sector investments before and after the TCFD recommendations were released between TCFD supporters and non-supporters were found. These findings contribute to the literature on the implementation of the TCFD framework and its impacts on investment decision-making. They also apply institutional theory in a new context and demonstrate that normative pressures resulting from voluntary TCFD support have not redirected institutional investments away from the non-renewable energy sector, despite its significant climate-related risks. These findings may be of interest to policymakers working towards a climate target-aligned economy and considering regulatory measures to influence institutional investment decisions. They also

may be of interest to public and private pension funds seeking to understand market engagement with the TCFD and its impact on investment decisions.

Key words: TCFD, climate-related risks, public pension funds, non-renewable energy sector, sustainable finance, climate change, institutional theory

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Introduction

Despite decades of sustainability engagement from governments, businesses, and financial institutions, the Earth System and the societies and economies embedded within it continue to face threats. Climate change is one of the most pressing sustainability challenges being faced today (Pörtner et al., 2021). Since 1850-1900, global surface temperature has increased by 1.1°C (IPCC, 2023). This warming has been driven by greenhouse gas emissions from human activities (IPCC, 2023). In 2019, the non-renewable energy sector was the highest contributor to net global greenhouse gas emissions, accounting for approximately 34% of emissions and exceeding the contributions of the industrial, agricultural, transportation, and buildings sectors (IPCC, 2023). To achieve the target of limiting global warming to 1.5°C above pre-industrial levels, as outlined in the 2015 Paris Agreement, scientists have identified that large portions of non-renewable energy reserves such as coal, gas, and oil cannot be burned and emitted (IPCC, 2023). As a result, the pursuit of limiting warming to 1.5°C carries significant implications for market participants engaged with the non-renewable energy sector. Throughout this paper, the term climate target-aligned economy is used to describe an economy that is aligned to limit warming to 1.5°C.

The TCFD framework, released in 2017, includes a set of recommendations to support corporations in disclosing the risks and opportunities that climate change poses to enterprise value (IFRS Foundation, 2022). The disclosure of climate-related financial information is expected to better inform markets and help investors evaluate the risks and opportunities present in the transition to a climate target-aligned economy (TCFD, 2022). The disclosure of climate-related financial information should, in theory, facilitate the allocation of capital away from firms facing high climate-related risks to firms facing lower risks and engaging with opportunities (TCFD, 2022). The TCFD identified two categories of climate-related risks facing firms, physical and transition risks (TCFD, 2017). Physical risks include those resulting from the physical impacts of climate change on the company and its operations (TCFD, 2017). Transition risks include those resulting from the transition to a climate target-aligned economy and can include policy, legal, market, and reputation risks (TCFD, 2017). The climate-related risks that an organization faces depends on its business model. For example, agricultural businesses are

more exposed to physical climate risks such as floods and extreme heat (TCFD, 2017). Whereas non-renewable energy businesses are more exposed to transition risks such as policy changes, legal risks, and shifting market demand (TCFD, 2017). Since a limited portion of fossil fuel reserves can be burned to meet climate targets, companies in the non-renewable energy sector face high climate-related transition risks. Therefore, it is expected that disclosures supported by the TCFD will result in capital shifting away from the non-renewable energy sector.

However, there is a need for further research on the TCFD framework (O'Dwyer & Unerman, 2020). Prior research has not explored the impact of the TCFD framework on investment decisions in sectors vulnerable to climate-related risks, such as the non-renewable energy sector. Additionally, research is limited on the engagement of institutional investors with the TCFD framework, despite their potential to contribute to the transition to a climate target-aligned economy (Ilhan et al., 2023). Lastly, institutional theory has yet to be employed to explore the influence of voluntary TCFD support on public pension fund investment decisions in the non-renewable energy sector. This study seeks to contribute to these research gaps and, ultimately, enhance the understanding of the capacity of the TCFD recommendations to facilitate the transition to a climate target-aligned economy.

This study is divided into two sections. The first section of the study aims to assess the level of TCFD support among public pension funds in the United States and their stage of implementation of the TCFD's recommendations. This section also assesses the influence of fund size and location on both TCFD support and implementation stage. There are four research questions that are pursued in this section. (1a.) What proportion of public pension funds in the United States support the recommendations of the TCFD? (1b.) Does fund size and location influence TCFD support? (2a.) What stage of implementation are public pension funds in the United States at in reporting in alignment with the TCFD recommendations? (2b.) Does fund size and location influence the stage of TCFD implementation?

The second section of the study employs institutional theory to explore whether TCFD support is impacting public pension fund investment decisions in the non-renewable energy sector. There are two research questions that are pursued in this section. (3a.) Does the difference in average

public equity non-renewable energy sector exposure change significantly before and after the 2017 TCFD recommendations whether a fund is a TCFD supporter or not? (3b.) Does the ratio of average energy exposure before and after the 2017 TCFD recommendations change significantly whether a fund is a TCFD supporter or not?

The findings of this study are expected to contribute to the literature in three ways. First, they will contribute to literature on the level of support and implementation of the TCFD recommendations among institutional investors. Second, they will contribute to literature on the influence of fund size and location on climate-related disclosures in pension funds. Third, they will contribute to institutional theory literature by applying the theory in a new context, seeking to demonstrate the influence of TCFD support, a normative pressure, on public pension fund investments in the non-renewable energy sector. Collectively, the results of this study will provide insight into the capacity of the TCFD framework to contribute to the transition to a climate target-aligned economy. This is likely to be of interest to policymakers seeking to facilitate the transition towards a climate target-aligned economy, practitioners in pension funds seeking to engage with the TCFD framework and make informed investment decisions, and corporate sustainability researchers.

This paper begins with a literature review which is divided into three sections. The first section of the literature review provides an overview of Earth System science, Earth System agreements, sustainable development, climate change, and climate change contributors. The second section introduces markets, institutional investors, the perspective of climate change as a market failure, and the rise of corporate sustainability reporting standards and frameworks, such as the TCFD framework. This section also discusses the expected limitations of the TCFD framework and its impacts. The final section of the literature review explores the use of institutional theory in previous related research and highlights how the theory has yet to be applied in the contexts of this study. Following the literature review, the study's methods are presented. Next, the findings of the study are shared. The results are then further explored in the context of our expected results and previous research findings in the discussion section. The paper concludes by discussing the study's limitations, its main literature contributions, and areas for future research.

Literature Review

The literature review provides insights into the research that informed this study and presents the identified gaps in the literature that this study seeks to contribute to. Through presenting the findings of previous related research, the literature review also includes hypotheses for our research questions. The literature review is divided into three sections.

The first section of the literature review offers an overview of the current understanding of climate change and Earth System science, highlighting that climate change is the issue of focus in this study. It then provides a historical background on international Earth System agreements, sustainable development, and the evolution of the relationship between business, finance, and sustainability. This section concludes with an overview of the sources of climate change, specifically highlighting the role of the non-renewable energy sector and proportion of fossil fuel reserves that can be burned to meet climate targets.

The second section of the literature review begins with an overview of markets, market participants, and the perspective of climate change as a market failure. Next, it provides a background on the increasing market demand for sustainability information, introducing social and environmental accounting along with the most prevalent corporate sustainability reporting standards and frameworks. The TCFD framework is highlighted as the primary focus for this study. The historical evolution of the TCFD is then explored, followed by an examination of the various risks that climate change poses to market participants. Within this section, the need for further research on the TCFD is emphasized. Next, with support from existing literature, three major assumptions of the TCFD are discussed. The third assumption on the willingness of market participants to engage with the framework is expanded on further by providing an overview of the debates about the role of market participants, such as business, finance, investors, and regulators in contributing to sustainability challenges. The rationale for selecting institutional investors as the market participant of focus in this study is explained here. Additionally, context is provided on the recent political turmoil created by a proposal for regulation on corporate sustainability disclosures in the United States and how this may impact

the results of the study. The second section of the literature review concludes with a discussion on the future of the TCFD.

The final section of the literature review begins by introducing institutional theory and how it supports understanding of the elements that influence public pension fund TCFD support and non-renewable energy sector investment decisions. This section explores previous studies that have applied institutional theory and offer insights relevant to our study. Included in this exploration are studies on the influences that contribute to asset owner support for sustainable finance initiatives and capital flows to the oil and gas sector. The rationale for analyzing the influence of fund size and location on TCFD support and implementation is provided here. Additionally, previous studies on the influence of fund size and location on corporate sustainability disclosures are highlighted. Insights from these studies are drawn to facilitate a discussion on the expected influence of size and location on TCFD support and implementation stage. This section concludes by highlighting that institutional theory has yet to be employed to analyze public pension fund TCFD support or to understand how TCFD support influences non-renewable energy sector investment decisions.

Climate Change, the Anthropocene, and Earth System Science

Climate change is one of the most pressing challenges facing human societies and economies in the Anthropocene, the current geological epoch where human activities and societies have been recognized as a global geophysical force (Pörtner et al., 2021; Steffen et al., 2007). Many features of human societies that are recognised today, including sedentary communities, agriculture, and technological advancement are understood to have developed during the epoch prior to the Anthropocene, the Holocene (Steffen et al., 2018). The Holocene is recognized as a period of relatively stable Earth System functioning (Rockström et al., 2009).

The exact start date of the Anthropocene is debated. One of the proposed start dates is the beginning of the Industrial Revolution in the 18th century (Crutzen & Stoermer, 2000; Steffen et al., 2007). This period marked the beginning of large-scale fossil fuel use by humans (Steffen et al., 2007, 2015). However, the mid-20th century, following the Second World War, has been

proposed as another start date for the Anthropocene (Steffen et al., 2015). This start date has been proposed due to convincing evidence provided by the “Great Acceleration” graphs, which track socio-economic and Earth System trends from 1750-2010 (Steffen et al., 2015). The graphs provide evidence that beyond 1950 human activities have driven a fundamental shift in the state and functioning of the Earth System beyond the range of variability of the last 10,000 years of the Holocene epoch (Rockstrom et al., 2009; Steffen et al., 2015).

The “Great Acceleration” graphs highlight the Earth System indicators that experienced acceleration after 1950 (Steffen et al., 2015). These include the atmospheric concentrations of three long-lived greenhouse gases, carbon dioxide, nitrous oxide, and methane, as well as terrestrial biosphere degradation, ocean acidification, and surface temperature (Steffen et al., 2015). For example, atmospheric carbon dioxide concentrations pre-industrialization were 270-275 parts per million (ppm) and by 1950 concentrations had risen to 310 ppm (Steffen et al., 2007). As of May 2023, concentrations of carbon dioxide in the atmosphere have risen to 424 ppm (Lindsey, 2023). According to the Earth System scientists that developed the planetary boundaries framework in 2009, atmospheric concentrations of carbon dioxide should not exceed 350 ppm and transgressing this boundary increases the risk of irreversible climate change (Rockström et al., 2009).

In addition to the climate change boundary, the framework highlights other critical boundaries, including biodiversity loss, freshwater use, ocean acidification, and land use change (Rockström et al., 2009). These boundaries should not be exceeded if we aim to maintain a “safe operating space for humanity,” resembling the conditions of the Holocene epoch (Rockström et al., 2009; Steffen et al., 2015). In 2023, the planetary boundaries research advanced to include justice considerations (Rockström et al., 2023). The resulting “safe and just” Earth System Boundaries (ESBs) recognise that the contributions to Earth System change and the consequences of its impacts vary largely across regions, countries, and individuals (IPCC, 2023; Rockström et al., 2023). Seven of eight globally quantified safe and just ESBs have been transgressed, including climate, surface water, functional integrity, nitrogen, and phosphorus (Rockström et al., 2023).

The implications of surpassing these boundaries are already being experienced in regions around the world through a range of ecological and human health impacts. These include, but are not limited to, increased intensity and frequency of extreme events such as droughts, heavy precipitation, heatwaves, and flooding, as well as sea level rise, reduced food security, reduced water security, altered crop growth, and ocean acidification (IPCC, 2023). Returning each ESB to the identified “safe and just” thresholds is critical to protect life-support systems, reduce societal impacts, and avoid crossing thresholds that may trigger nonlinear and irreversible changes in the Earth System (IPCC, 2023; Rockström et al., 2023; Steffen et al., 2015). Among the numerous challenges facing the Earth System, this study specifically focuses on the issue of climate change.

Overview of International Earth System Agreements, Sustainable Development, and the Evolution of the Relationship of Business and Finance with Sustainability

Corporations, economies, and societies are embedded in and dependent on the life-support systems of the Earth System (Dasgupta, 2021). Over the past five decades, governments have made efforts to address the issues facing the Earth System. This has involved convening at conferences, formulating policies and regulations, establishing national targets, and engaging in international agreements. Over the same period, the relationship between business, finance, and sustainability has evolved significantly (Weber & Feltmate, 2016).

Rachel Carson’s 1962 book, *Silent Spring*, is credited with inspiring the modern environmental movement and prompting government regulations on business (Griswold, 2012; Weber & Feltmate, 2016). Carson’s book brought attention to the dangers of indiscriminate pesticide use on ecosystems and human health in the United States (Nature, 2022). This resulted in a regulation banning the use of the synthetic pesticide DDT (Nature, 2022). During this time, the relationship between business and the environment transformed from inactive to reactive, with businesses aiming to maximize profits while adhering to regulations (Frankel, 1998; Nattrass & Altomare, 1999). The transition to businesses being reactive to environmental regulations is further contextualized by the prevalence of shareholder capitalism in Western countries like the United States and Canada at the time. Shareholder capitalism argues that a business’ primary

purpose is to maximize value for its shareholders, who are the owners of the business (Friedman, 1970). Milton Friedman, a prominent advocate for shareholder capitalism, famously argued that “the social responsibility of business is to increase its profits” (Friedman, 1970, p. 17).

In 1972, the first global environmental conference, the United Nations Conference on the Human Environment, was held in Stockholm (United Nations, 2022). The Stockholm Declaration, adopted at this conference, initiated discussions between governments of industrialized and developing countries and outlined a set of principles to guide environmental protection and enhancement (United Nations, 2022). At this conference, the United Nations Environment Programme (UNEP) was established (United Nations, 2022). UNEP’s responsibilities included scientific environmental monitoring, informing policy, and coordinating responses to environmental challenges (UNEP, 2023).

In the 1980s, the relationship between business and the environment shifted from compliance to anticipating future risks and regulations (Natrass & Altomare, 1999). High-polluting industries drove this shift in business sustainability, catalyzed by the accident in Bhopal, India in 1984 (Weber & Feltmate, 2016). The 1984 accident involved the release of 15,000 gallons of a dangerous gas, methyl isocyanate, from a Union Carbide Corporation plant (Natrass & Altomare, 1999). The accident resulted in the loss of thousands of lives and millions of dollars in damage lawsuits, despite the plant’s compliance with laws and regulations (Weber & Feltmate, 2016). The environmental, social, financial, and reputational costs of the Union Carbide Corporation’s accident highlighted the significance of companies anticipating risks, exceeding regulatory compliance, and incorporating stakeholder interests. Stakeholder theory and stakeholder capitalism developed during this time. In 1984, Edward Freeman wrote about stakeholder capitalism, highlighting the interconnected relationships between businesses, customers, suppliers, employees, investors, and communities (Freeman, 1984). Freeman argued that firms should prioritize value creation for all stakeholders, not just shareholders (Freeman, 1984).

In 1987, the World Commission on Environment and Development (WCED) published a report titled, *Our Common Future* (WCED, 1987). The Commission was chaired by Norwegian Prime

Minister Gro Harlem Brundtland and included politicians and experts on environment and development (WBCSD, 2006; WCED, 1987). The report emphasized the urgent need for economic development that could be sustained without harming the environment and defined sustainable development as “development that meets the needs of the present without compromising the ability of future generations to meet their own needs” (WBCSD, 2006; WCED, 1987).

In 1988, the Intergovernmental Panel on Climate Change (IPCC) was established by UNEP and the World Meteorological Organization (WMO) to provide policymakers with scientific assessments on the current state of knowledge about climate change (IPCC, 2021). The IPCC released their first Assessment Report in 1990, which highlighted the global consequences of climate change and the need for international cooperation (IPCC, 2023).

In 1989, the Exxon Valdez oil spill occurred, representing one of the largest environmental disasters in United States history (NOAA, 2020). The environmental damage from the spill triggered public outrage against Exxon and prompted the United States government to introduce the Oil Pollution Act in 1990, changing the United States response to oil spills (Shigenaka, 2020).

In 1991, the Business Council for Sustainable Development (BCSD) was established (WBCSD, 2006). The BCSD brought together business leaders, CEOs, and diplomats to discuss the role of business in achieving sustainable development (WBCSD, 2006). Before this, businesses were commonly viewed as either bystanders or villains in sustainable development discussions typically led by governments and non-profit organizations (WBCSD, 2006). Swiss business entrepreneur, Stephen Schmidheiny, was a key figure in organizing the BCSD and advocated for businesses playing a crucial role in advancing sustainable development (Idowu, 2013; WBCSD, 2006).

The second world conference on the environment, known as the United Nations Conference on Environment and Development, took place in Rio de Janeiro in 1992 (United Nations, 2022). The conference convened 117 heads of state and representatives from 178 nations to address the

environmental effects of human socio-economic activities and commit to sustainable development (United Nations, 2022; WBCSD, 2006). The United Nations Framework Convention on Climate Change (UNFCCC) was adopted at the conference (United Nations, 2022). The BCSD, later known as the World Business Council for Sustainable Development (WBCSD), participated in the 1992 conference, and contributed to the discussion (WBCSD, 2006). This represented the first time a business group presented at a United Nations conference (WBCSD, 2006). Additionally, the UNEP Finance Initiative was launched at the conference, becoming the first organization to involve the finance sector in sustainability (UNEP, 2023a).

In the 1990s, environmental efficiency was the focus for business (Nattrass & Altomare, 1999). The WBCSD was a large supporter of environmental efficiency efforts (WBCSD, 2006). Environmental efficiency encouraged businesses to maximize outputs while minimizing inputs, including reduced energy usage and waste production (Weber & Feltmate, 2016). This led to cost savings and enhanced company reputation (Weber & Feltmate, 2016). The era of environmental efficiency marked a shift in businesses seeing sustainability as an opportunity, not just a risk (Nattrass & Altomare, 1999; Weber & Feltmate, 2016). During the 1990s, businesses primarily focused on the environmental aspects of sustainable development, with less emphasis on the social aspects (Weber & Feltmate, 2016).

In 2000, the United Nations Millennium Development Goals (MDGs) were released (United Nations, 2015). The release of the MDGs marked a historic moment, establishing a set of eight goals to be achieved by 2015 that were clear, measurable, and time bound (Sachs, 2012). These goals, which included eradicating extreme poverty and hunger, promoting gender equality, combating HIV/AIDS, ensuring environmental sustainability, and achieving universal primary education, became a central focus for policymakers and civil society (Sachs, 2012).

Changing demands and expectations from investors, society, and other stakeholders ushered in the next era of businesses engaging with sustainability, aiming to move beyond environmental efficiency and contribute to sustainable development. Increasing market demand for sustainability information prompted the establishment of various sustainability reporting initiatives. In 1997, the Global Reporting Initiative was founded, referencing the Exxon Valdez

oil spill as a catalyst (GRI, 2023). The GRI aimed to create a standardized reporting framework for organizations to communicate their impacts (GRI, 2023). In 1998, the concept of triple bottom-line reporting emerged, referring to the incorporation of environmental and social performance in addition to economic performance in corporate reporting (Elkington, 1998). In 1998, through a collaboration between the WBCSD and major corporate partners, the Greenhouse Gas Protocol was established to standardize greenhouse gas accounting methods (GHG Protocol, 2023). In 2000, the first version of the GRI's guidelines were released, offering the first global framework for sustainability reporting (GRI, 2023).

Throughout the 2000s, other sustainability initiatives were established with various areas of focus. For example, the Carbon Disclosure Project (CDP) was established in 2000 and focused on supporting companies in disclosing their climate impact and strategies for managing their impact (CDP, 2023). The Equator Principles, launched in 2003, established a financial industry benchmark for evaluating and managing environmental and social risks, particularly in project finance, which supports large projects like infrastructure and energy-related projects (Weber & Acheta, 2014). In 2004, the term ESG, encompassing environmental, social, and governance (ESG) considerations, emerged in the Global Compact's report, *Who Cares Wins* (Global Compact, 2005). ESG factors include climate change, biodiversity, energy efficiency, customer satisfaction, human rights, diversity, equity, inclusion, board composition, bribery, and corruption. In 2005, the United Nations Secretary General Kofi Annan brought the world's largest institutional investors together to collaborate on the development of the Principles for Responsible Investment (PRI) (PRI, 2023). Examples of the principles included the integration of ESG considerations into investment analysis and decision-making, active ownership policies that include ESG issues, and the disclosure of ESG matters from investee companies (PRI, 2023). In 2007, the Climate Disclosure Standards Board (CDSB) was established to provide a framework for companies to report environmental information with similar rigor as financial information (CDSB, 2022).

In 2008, the global financial crisis occurred. In response to the crisis, in 2009, His Royal Highness the Prince of Wales called a meeting to bring together investors, companies, regulators, standard setters, academics, and civil society to brainstorm solutions to reduce the risk of another

financial collapse (IIRC, 2020). In 2010, the International Integrated Reporting Council (IIRC) was established (IIRC, 2020). The IIRC sought to advance integrated thinking and reporting to challenge corporate short-termism and facilitate companies reflecting on their value creation strategy in the short, medium, and long-term (IIRC, 2020). In 2011, another sustainability reporting initiative was founded, the Sustainability Accounting Standards Board (SASB) (SASB, 2023). SASB aimed to support businesses and investors in developing a common language for the financial impacts of sustainability (SASB, 2023).

By 2015, not all the MDGs were met but progress was made with variable results across goals, countries, and regions (United Nations, 2015a). Building on lessons learned from the MDGs, 17 Sustainable Development Goals (SDGs) were released in 2015 with the goal for them to be achieved by 2030 (United Nations, 2023). The goals of the SDGs ranged from no poverty, zero hunger, good health and well-being, quality education, climate action, peace, justice and strong institutions, and partnerships for the goals (United Nations, 2023). The SDGs had a greater focus on environmental objectives alongside poverty-reduction objectives.

The 21st Conference of the Parties (COP21) to the United Nations Framework Convention on Climate Change occurred in 2015 and resulted in the adoption of the Paris Agreement (UNFCCC, 2023). The Paris Agreement is a legally binding international treaty on climate change adopted by 196 parties at the conference (UNFCCC, 2023). The Paris Agreement committed countries to the long-term target of keeping average global temperature rise to well below 2°C while pursuing efforts to limit the increase to 1.5°C above pre-industrial levels (UNFCCC, 2023). Also in 2015, the Financial Stability Board, an international body that monitors and promotes global financial stability, announced that it would establish an industry-led Task Force on Climate-Related Financial Disclosures (TCFD) (FSB, 2015). The goal of the TCFD was to develop recommendations for companies to make disclosures that will help financial market participants such as lenders, insurers, and investors understand their climate-related risks (FSB, 2015). In 2017, the TCFD recommendations were released (TCFD, 2023).

As the number of sustainability reporting initiatives grew, calls from global investors and corporations to simplify the sustainability reporting landscape increased. In June 2021, the IIRC

and SASB merged their efforts and resources to create the Value Reporting Foundation (SASB, 2023). In November 2021, at the 26th Conference of the Parties to the UNFCCC, the IFRS Foundation Trustees announced the formation of the International Sustainability Standards Board (ISSB) (IFRS, 2023). The ISSB would consolidate the CDSB and VRF and build on the work of other sustainability reporting initiatives, such as the GRI and TCFD, to provide the global financial markets with a comprehensive global baseline for climate and sustainability disclosure standards (IFRS, 2023). In June 2023, the ISSB issued its inaugural IFRS Sustainability Standards S1 and S2 (IFRS, 2023a). With IFRS S1 and IFRS S2 fully incorporating the recommendations of the TCFD, the Financial Stability Board has stated that this is the culmination of the work of the TCFD (IFRS, 2023b). The responsibility for monitoring company progress in making climate-related disclosures in alignment with the TCFD recommendations will shift from the TCFD to the IFRS Foundation by 2024 (IFRS, 2023b).

Over the last two decades, the rise of ESG, triple bottom-line, and corporate sustainability reporting has paralleled a growing public interest in corporate purpose, sustainable development, and stakeholder capitalism. Despite recent momentum, including 50 years of government initiatives and agreements and 30 years of business and finance engagement with sustainability, several critical planetary boundaries remain transgressed. This poses a significant threat to the stability and long-term viability of corporations, economies, and societies that depend on the stable functioning of the Earth System.

Sources of Climate Change and the Role of the Non-Renewable Energy Sector in Achieving the 1.5°C Target

The IPCC's most recent Sixth Assessment Report concludes that global surface temperature has reached 1.1°C above 1850-1900 levels in 2011-2020 (IPCC, 2023). It also highlights disparities between the global ambition to limit warming in accordance with the Paris Agreement, national commitments, and ongoing implementation actions (IPCC, 2023).

Global surface temperature warming over the last century has been driven by net greenhouse gas emissions from human activities (IPCC, 2023). Human activities contributing to net greenhouse gas emissions include unsustainable energy use, land use, land use change, lifestyles, and

consumption and production patterns (IPCC, 2023). Since 2010, net greenhouse gas emissions increased across all major sectors, including energy, industry, agriculture, transport, and buildings (IPCC, 2023). In 2019, the non-renewable energy sector emerged as the leading contributor, accounting for 34% of net global greenhouse gas emissions, followed by industry at 24%, agriculture, forestry, and other land-use at 22%, transport at 15%, and buildings at 6% (IPCC, 2023).

This study focuses specifically on the energy sector. According to the Global Industry Classification Standards (GICS), the energy sector is defined as encompassing companies engaged in exploration, production, refining, marketing, storage, and transportation of oil, gas, coal, and consumable fuels (MSCI, 2023). The GICS defines the energy sector as only encompassing companies engaged with non-renewable resources. For extra clarity, the energy sector is referred to as the non-renewable energy sector throughout this paper.

According to the IPCC, projections of future CO₂ emissions over the lifetime of existing fossil fuel infrastructure exceed the remaining carbon budget for limiting warming to 1.5°C (IPCC, 2023). Limiting warming to 2°C or lower will result in stranded fossil fuel assets as approximately 80% of coal, 50% of gas, and 30% of oil reserves cannot be burned and emitted (IPCC, 2023). As a result, the non-renewable energy sector is facing high climate-related transition risks.

Overview of Markets, Market Participants, and Climate Change as a Market Failure

Corporations, economies, and societies are embedded in the Earth System and embedded in global markets. Global markets have been around for thousands of years and have been a powerful force for organizing human society and creating value (Freeman, 2007). In capitalist economies, such as Canada and the United States, markets are a place where parties can exchange goods and services (Kenton, 2023). Money represents a medium of exchange that is widely accepted by parties providing goods and services in markets (Asmundson & Oner, 2012). Finance refers to the management, creation, and study of money and can be broken down into

three categories: public, corporate, and personal (Hayes, 2023). The three categories of finance highlight the roles that governments, corporations, and citizens play in markets.

Corporations operate in markets and organize the economic production of goods and services (Hayes, 2023a). Investors also operate in markets and can be a person or entity that commits capital with an expectation of achieving financial returns (Hussain, 2023). Institutional investors are legal entities that invest in financial markets on behalf of groups or individuals, which can include current and future generations (CFA, 2024). Pension funds are an example of an institutional investor. Pension funds pool monetary contributions from pension plans set up by employers or other organizations and invest those funds to provide retirement benefits for employees or members (CFA, 2020). Public pension funds are the market participant of focus in this study.

The behavior of market participants is shaped by several forces, including regulation and cultural norms. Regulations are a form of government intervention in markets (CFA, 2024a). Regulatory rules can include safety standards for products, rules for business operations to reduce environmental impacts, and rules for marketing goods and services to citizens (Kenton, 2022). Cultural norms also shape how market participants behave in markets (Guiso et al., 2006). Guiso et al. (2006) define culture as the customary values and beliefs that social, religious, and ethnic groups transmit relatively unchanged from generation to generation. Values influenced by cultural norms that impact the behavior of market participants can include integrity, sustainability, and reciprocity. Different regions have different cultural norms in markets and different governments have different approaches to the level and focus of legal regulation in markets.

Climate Change as a Market Failure

Economists refer to climate change as an example of a market failure (Bowen et al., 2014). A market failure is said to occur when the free market does not maximize society's welfare (Bowen et al., 2014). Market failures associated with climate change include externalities and the exploitation of public goods. An externality is a cost or benefit experienced by parties external to

a transaction that is caused by an economic actor but not directly incurred or received by that actor (Kenton, 2022). Greenhouse gas emissions created by a company are an example of a negative externality because the company does not pay for the damage caused by its emissions to the Earth System. Exploitation of public goods is another market failure that is associated with climate change. In 1968, Garrett Hardin developed the concept of the Tragedy of the Commons to describe the market failure of public goods exploitation (Hardin, 1968). Hardin discussed how public goods like fish stocks are at risk of exploitation as market actors seek to maximize their immediate interest and do not put effort into the conservation of resources for future common use (Hardin, 1968). In the case of climate change, the overproduction of greenhouse gas emissions has resulted in the exploitation of stable Earth System functioning.

Several strategies exist to attempt to solve market failures. One strategy is government intervention in the form of regulations or taxes (Ross, 2021). In relation to climate change, imposing a carbon tax is an example of government intervention. A carbon tax seeks to make corporations internalize the costs of the damage caused by their greenhouse gas emissions and incentivize emissions reductions and low-emissions innovation (Bowen et al., 2014). Another strategy proposed to solve market failures is zero intervention and the belief that the free market will correct itself over time (Ross, 2021). For climate change, this market correction could result as more market participants understand how greenhouse gas emissions are degrading the Earth System and decide to reduce demand for high emitting products such as fossil fuels. Elinor Ostrom's research focused on the potential for market participants to correct public goods market failures. Ostrom's research demonstrated that without government oversight it was possible to cultivate resource sharing through cooperation in a community (Rangamani, 2012). In the context of climate change, Ostrom suggested that the issue could be combated by more citizens stepping up to take responsibility rather than focusing entirely on governments and policy to drive the change required (Rangamani, 2012).

Growth in Market Demand for Sustainability Information

Since the 1970s, there has been a significant increase in market demand for sustainability information (IFRS Foundation, 2022). This rise in demand coincided with the emergence of

social accounting in the 1970s and environmental accounting in the 1980s (Bebbington & Larrinaga, 2021). Social and environmental accounting is defined as “the process of communicating the social and environmental effects of organizations’ economic actions to particular interest groups within society and to society at large. It involves extending the accountability of organizations beyond the traditional role of providing a financial account to the owners of capital” (Gray et al., 1987, p. 9). Since its inception, social and environmental accounting research, teaching, and practice has grown steadily in developed and emerging economies (Gray et al., 2010).

Increasing demand for sustainability information reflects a market response to addressing sustainability-related market failures such as climate change. Corporate sustainability reporting represents a market application of social and environmental accounting. Since the late 1990s, several corporate sustainability reporting standards and frameworks have been developed.

Today, the most common sustainability disclosure frameworks and standards include CDP, CDSB, GRI, IIRC, SASB, and TCFD (IFRS Foundation, 2022). While these frameworks and standards vary in guidance, materiality approach, target audiences, and scope, they can be employed together to improve corporate disclosures (IFRS Foundation, 2022). For example, GRI and SASB represent standards, offering specific and replicable guidance on the information companies should disclose (IFRS Foundation, 2022). On the other hand, CDSB, IIRC, and TCFD are frameworks, providing principles-based guidance on what information should be covered and how it should be structured and prepared (IFRS Foundation, 2022). Standards like the GRI and SASB can be complemented using frameworks such as CDSB, IIRC, and TCFD to enhance disclosures.

These initiatives also differ in their approach to materiality and target audiences. CDP and GRI define material information for corporate disclosures based on the information that is needed to understand a company’s impact on the economy, environment, and people (IFRS Foundation, 2022). CDP and GRI support the communication of impact information to multiple stakeholders such as communities, civil society, employees, and capital providers. In contrast, CDSB, IIRC, SASB, and TCFD define material information based on its relevance to understanding the impact

of sustainability on enterprise value, which is a measure of a company's total market value (IFRS Foundation, 2022). CDSB, IIRC, SASB, and TCFD seek to serve investors and lenders concerned about sustainability's impact on a company's financial condition, operating performance, and investment risk (IFRS Foundation, 2022).

Lastly, these standards and frameworks differ in the issues that they address. TCFD focuses only on climate, while CDP and CDSB focus on climate and other environmental aspects like water and deforestation. GRI, SASB, and IIRC cover a broader perspective, addressing environmental, social, and governance aspects of sustainability (IFRS Foundation, 2022). Of the several corporate sustainability reporting standards and frameworks, this study focuses on the TCFD framework.

The Recommendations of the Task Force on Climate-Related Financial Disclosures

The TCFD was established in 2015 by the Financial Stability Board in response to a request from the Group of 20 Finance Ministers and Central Bank Governors (FSB, 2015). The TCFD's mission was to explore how the financial sector could account for climate-related risks and opportunities (FSB, 2015). In 2017, the TCFD issued its final recommendations report for how companies should report on the financial implications of climate-related risks and opportunities to provide information to investors, lenders, and insurance underwriters (TCFD, 2023). Notably, the TCFD recommendations focus on facilitating corporate disclosures on the impact of climate on enterprise value (IFRS Foundation, 2022; O'Dwyer & Unerman, 2020). The recommendations do not provide guidance for corporations to disclose the impact of other sustainability issues on enterprise value or their impact on climate change.

The risks that climate change poses to enterprise value fall into two categories: physical and transition risks. Physical risks include chronic risks related to gradual climate changes, like rising surface temperatures, and acute risks arising from more frequent and severe events, such as droughts and floods (European Bank for Reconstruction and Development, 2018). Physical risks can impact a business's strategic and financial position through asset damage, insurance costs, and supply chain disruptions. Transition risks include those that arise in the transition to a

climate target-aligned economy such as new regulation, policy, and shifts in consumer preferences (Ens & Johnston, 2020). Each organization's climate-related risks are unique and business impacts are likely to vary significantly depending on the industry in which an organization operates (TCFD, 2016). For example, an agricultural business is likely to be more affected by physical climate risks such as floods, droughts, and extreme heat (TCFD, 2017). A fossil fuel business is likely to be more affected by transition risks such as policy changes and shifting market demands (TCFD, 2017). By providing the market with enhanced information on the climate-related risks and opportunities facing organizations, it is expected that capital will flow away from firms that face high risks and towards those that face less risks and respond to the business opportunities available in the climate target-aligned economy (TCFD, 2022).

The TCFD framework has been referred to as having transformative potential (O'Dwyer & Unerman, 2020). However, there is a need for further research on TCFD reporting (O'Dwyer & Unerman, 2020). Additionally, there is a need for research to demonstrate how the TCFD framework is resulting in capital shifting away from firms facing high climate-related risks like those in the non-renewable energy sector. This study seeks to further explore the capacity of TCFD reporting to facilitate the transition to a climate target-aligned economy by analyzing its influence on non-renewable energy sector investments.

Limitations of the TCFD

The ability of the TCFD recommendations to contribute to the climate target-aligned economy may be hindered by three major assumptions. First, the TCFD assumes that risks posed by societal challenges, like climate change, can be quantified in financial terms (Arjalies & Bansal, 2018; Di Marco et al., 2022; Michelon et al., 2020). However, it has been highlighted that the quantification of climate risk presents unique challenges (Carney, 2015). While markets routinely price in other risks, climate-related risks are distinct due to the need to extend time horizons and consider several complex factors. A study by Demaria and Rigot (2021) demonstrates how challenges with quantifying the financial impacts related to climate risk are reducing the ability of firms to comply with the TCFD's recommendations. Demaria and Rigot (2021) analyzed a sample of 40 French firms and found that while TCFD compliance levels have

increased from 2015 to 2018, the mean level of compliance in 2018, based on their methodology, was only 65%. They found that very rarely did firms disclose quantified information on the financial impacts of climate risks, such as the financial impacts of climate risks on operating expenses and capital expenditures (Demaria & Rigot, 2021). This study demonstrates how the complexity associated with quantifying the financial impacts of climate risk may limit the practical application and effectiveness of the TCFD's recommendations in the market.

Second, the ability of the TCFD framework to facilitate the transition to a climate target-aligned economy may be limited by market inefficiencies and misalignment in incentives across generations. Corporate sustainability reporting assumes that market participants lack sufficient information, and that by providing that information, it will lead to shifts in decision-making (Ilhan et al., 2023). Similarly, the TCFD assumes that by enhancing available climate-related financial information, it will lead to more accurate pricing and risk management, resulting in the redirection of capital from high-risk firms to those with lower-risks and engaged with opportunities (FSB, 2015; Ilhan et al., 2023). The TCFD relies on an optimistic and rational view of markets (Ameli et al., 2019; David & Giordano-Spring, 2021). However, as market failures and historical corporate environmental and social disasters exemplify, markets do not consistently operate rationally or in alignment with the public interest. Additionally, due to the temporal nature of climate change and its consequences, there is misalignment in decision-making incentives among market participants. This may lead to rational decisions by one market participant being seen as irrational to another participant. This misalignment in incentives is further explained by the concept of The Tragedy of the Horizon, which highlights how current generations face less incentive to shift their decision-making as the most severe impacts of climate change are projected to affect future generations (Carney, 2015). Market inefficiencies and misalignment in decision-making incentives may also limit the application and effectiveness of the TCFD's recommendations.

The third assumption of the TCFD is that market participants will be willing to engage with and implement its recommendations. However, the role of market participants such as business, finance, and investors in contributing to solving sustainability challenges like climate change has

been debated since the mid-1990s. This third assumption will be explored further in the following section.

Role of Market Participants in Responding to Sustainability Challenges

The TCFD recommendations rely on market participants disclosing the financial implications of climate on enterprise value. This necessitates organizations such as businesses, financial institutions, and investors to engage with the climate challenge, understand the associated risks, and communicate them transparently and consistently. However, this process is expected to encounter some resistance, as the role of market participants in responding to sustainability challenges has been debated since the mid-1990s.

Business and Finance

Shareholder capitalism, developed in 1970, argues that the sole purpose of business is to maximize value for shareholders (Friedman, 1970). Shareholder capitalism suggests that it is not the responsibility of business to engage with or respond to societal challenges. This view is still held by several market participants today (Weber & Feltmate, 2016). Businesses aligned with this school of thought argue that they are not responsible for the impacts of its products or operations on society as long as they are operating in alignment with laws and regulations. Banks and investors that operate in alignment with shareholder capitalism argue that they are not responsible for the impacts of their borrowers or investees on society as long as the clients that they finance are in alignment with laws and regulations (Weber & Feltmate, 2016). Although the TCFD is not requesting businesses or financial institutions to disclose their impact on climate change, its attempt to engage institutions in understanding and disclosing the risks of climate change on their enterprise may still be challenged.

Stakeholder capitalism, developed in 1984, argues that a firm should pursue value creation for all its stakeholders, including its customers, suppliers, employees, investors, communities, and the environment, not just its shareholders (Freeman, 1984). A business operating in alignment with stakeholder capitalism may take note of the impact of its product or operations on its

stakeholders and seek to ensure a positive impact through living wages for its employees, energy efficiency, and a product or service aligned with improving human health. A bank that is engaged with stakeholder capitalism may choose to withhold funds from businesses that have human rights violations and direct funds towards businesses engaged with projects oriented towards sustainable development. In their pursuit of value creation for all stakeholders, market participants aligned with stakeholder capitalism may be more likely to engage with and disclose in alignment with the TCFD.

The belief that business and finance can contribute to sustainable development grew in the 1990s. During this time, the WBCSD, led by Stephen Schmidheiny, promoted the belief that business can play an important role in sustainable development (WBCSD, 2006). Schmidheiny also published the book *Financing Change* in 1996 where he highlighted that finance could contribute to sustainable development (Schmidheiny & Zorraquin, 1996). However, by the late 1990s, criticism of this perspective arose as the transformation of these ideals into viable business strategies, products, and services was slower than expected (Weber & Feltmate, 2016).

Throughout the 2000s, the debate about the role of business and finance in contributing to sustainable development has continued. On one hand, there has been growth in purpose-driven corporations, ESG considerations, and sustainability reporting. On the other hand, there remain businesses and financial institutions that break the law, go against regulation, and could be categorized as impediments to sustainable development. For example, in the early 2000s, Enron collapsed due to accounting fraud and not complying with laws and regulations (Segal, 2023; Weber & Feltmate, 2016). Additionally, in the lead up to the financial crisis in 2008, the banking sector was engaging with risky financial products and services and not communicating this risk to its clients (Weber & Feltmate, 2016). Given these conflicting forces, the categorization of business and finance as a catalyst for or an impediment of sustainable development remains unclear.

This complex and continuing to evolve history of the relationship between business, finance, and sustainability suggests that market engagement with the TCFD recommendations will be mixed. There is likely to be a market segment that is eager to engage with the challenge of transitioning

to a climate target-aligned economy and will do so voluntarily. There may be another segment that is less eager but will comply with the recommendations of the TCFD if required by regulation. Lastly, drawing insights from history, it is likely that there will be a market segment that opposes the recommendations of the TCFD and actively works against efforts to transition to a climate target-aligned economy. This market segment is likely to be the one most disrupted by the pursuit of a climate target-aligned economy, such as the non-renewable energy sector.

A study by Eccles and Krzus (2019) alludes to the expected reluctance of the non-renewable energy sector to engage with the TCFD recommendations and contribute to the climate target-aligned economy. Eccles and Krzus (2019) analyzed 15 of the largest oil and gas companies by market capitalization to see how difficult it will be for companies in this sector to implement the TCFD recommendations. The authors found that it is feasible for companies in this sector to follow the TCFD's recommendations, but only "if they are interested in doing so," alluding to their reluctance to engage (Eccles & Krzus, 2019). If the non-renewable energy sector does not disclose their climate-related financial information, it will limit the ability of financial market participants to make accurate and informed investment, lending, and underwriting decisions. This would ultimately limit the ability of the TCFD to facilitate the transition to the climate target-aligned economy.

Institutional Investors

The main market participants that this study focuses on are institutional investors. Institutional investors have been selected as the focus of this study due to their potential to increase TCFD market engagement and play a pivotal role in advancing the transition to a climate target-aligned economy. Institutional investors have been identified as having this potential for several reasons.

First, institutional investors manage large pools of capital, granting them substantial market power (Weber & Feltmate, 2016). Stroebel and Wurgler (2021) found that, among financial mechanisms, pressure from institutional investors is viewed as the most powerful force for influencing corporations to reduce their climate risk exposures. This pressure is also expected to extend to climate risk disclosure (Ilhan et al., 2023).

The second reason that institutional investors are the market participant of focus in this study is because they are recognized as universal owners, which means that they own a broad cross-section of firms in global markets and hold shares in those firms for the long-term (Hawley & Williams, 2000). Their broad ownership footprint and long-term investing perspective exposes them to the externalities stemming from companies contributing to climate change (Hawley & Williams, 2000; Ilhan et al., 2023). Due to the incentive to reduce the externalities they face, it is expected that institutional investors will engage with the TCFD, demand climate risk disclosures from portfolio companies, and potentially exert pressure on firms to reduce their greenhouse gas emissions (Ilhan et al., 2023). Ilhan et al. (2023) demonstrated that institutional investors indeed value and demand high-quality climate risk disclosures from firms and actively engage portfolio firms to improve their disclosures.

Third, it has been recognized that current levels of financial flows for climate mitigation and adaptation are insufficient to meet the scale of investment required for the transition to a climate target-aligned economy (UNFCCC, 2022). Institutional investors such as public pension funds have been identified as potential key contributors to fulfilling this need due to their size and long-term investing lens (Ameli et al., 2019; UNFCCC, 2022).

The fourth reason that institutional investors are the market participant of focus in this study is due to their fiduciary duty, which is a legal obligation, to act in the best interests of their beneficiaries (Watchman, 2005). Sharing some similarities with the debate of the role of business and finance in sustainable development, whether fiduciary duty requires the integration of ESG considerations and what the “best interests” of beneficiaries includes is an ongoing debate. The fiduciary duty debate challenges the eager uptake of the TCFD recommendations by institutional investors. On one side of the argument, fiduciary duty is a concept for only addressing financial returns (Shrivastava et al., 2019). Some professionals believe that fiduciary duty restricts investors from considering non-financial criteria (Hutchinson & Cole, 1980; Richardson, 2007). Unless there is a clear mandate to consider non-financial criteria, it is believed that an investment intermediary must choose investments that maximize financial returns or face the risk of having to compensate for financial losses that can be attributed to a “breach of duty” (Ho, 1998). On the

other side of the argument, ESG issues are not seen as contradictory to fiduciary duty but a component of it (Watchman, 2005). Richardson (2007) explored whether the fiduciary obligations of pension funds hinder socially responsible investment and found that socially responsible investing can be financially advantageous and aligned with fiduciary duty, despite the assumption that this investment approach results in sacrificing returns. Although this debate remains ongoing, the fiduciary duty concept and its relationship with climate-risk makes it another reason why institutional investors are a market participant of interest for this study.

Lastly, there is currently limited research on the implementation and impacts of the TCFD within institutional investors. Due to their strong market power, status as universal owners, ability to contribute to the climate finance gap, and fiduciary duty obligations, they could play a pivotal role in increasing TCFD engagement and facilitating the transition to a climate target-aligned economy. Therefore, there is a need for further research on TCFD engagement among institutional investors and its impacts on investment decisions.

Government and Regulation

The debates among business, finance, and investors about the role that they play in sustainable development suggest the need for an external body to guide market participants toward sustainability and address market failures like climate change. Government and regulation are often considered to play this external role. Public policy serves as a tool to address market failures. In the case of climate change, carbon pricing is a widely used policy tool to make market participants internalize the costs of their contributions to the issue (World Bank, 2023).

However, jurisdictional governments face limitations in their ability to address market failures. Daly (1999) discusses how globalization, which refers to the flow of goods and services between nations, limits the effectiveness of national policy measures aimed at internalizing social and environmental costs and increasing resource efficiency. As markets become global, individual governments are limited in their ability to control them (Schmidheiny & Zorraquin, 1996).

Governments and regulatory bodies around the world have recently become more engaged with corporate sustainability disclosures. Over the last two decades, corporate sustainability disclosures, including the TCFD, have been voluntary. In 2021, the Government of New Zealand became the first country in the world to pass a law to ensure financial organizations disclose and act on climate-related risks and opportunities (New Zealand Government, 2021). The Government of New Zealand's climate standards were based on the TCFD recommendations (New Zealand Government, 2021). Following New Zealand, other countries began proposing and adopting rules for mandatory climate-related financial disclosures, including the United Kingdom, Canada, Switzerland, European Union, and the United States (European Commission, 2023; Government of United Kingdom, 2021; Segal, 2022; Swiss Federal Council, 2022; United States Securities and Exchange Commission, 2022).

Important to note for this study, in the United States, the March 2022 proposal by the Securities and Exchange Commission to require exchange registrants to make climate-related disclosures caused controversy (Dial et al., 2022). Following the proposal, several states proposed or adopted new legislation prohibiting or limiting their state governments from investing in ESG strategies or doing business with financial institutions that adopt ESG policies (Dial et al., 2022). The Republican party issued a proposal to specifically prevent pension fund managers from using climate change considerations to inform investment decisions (Reuters, 2023). United States President Joe Biden issued the first veto of his presidency to reject this proposal (Reuters, 2023). In the context of this study, this turmoil sheds light on some of the political challenges that climate-related financial disclosures are facing in the United States. It is expected that this may translate into public pension funds, on aggregate, in the United States being less advanced in implementing the recommendations of the TCFD. It is also expected that this may translate into only a small proportion of public pension funds having stated their support for the TCFD.

Future of TCFD

Significant momentum and support for the TCFD has grown since the recommendations were published in 2017. As of 2023, 19 jurisdictions, representing approximately 60% of 2022 global GDP, have finalized or proposed TCFD-aligned disclosure requirements (TCFD, 2023a).

Additionally, over 4800 organizations, including governments, companies, and civil society, have indicated their support for the recommendations (TCFD, 2023a). However, in 2023, it was announced by the Financial Stability Board that the International Sustainability Standards Board (ISSB) release of the IFRS Sustainability Standards S1 and S2 marks the “culmination of the work of the TCFD” (IFRS, 2023a). The IFRS Sustainability Standards fully incorporate the TCFD recommendations (IFRS, 2023a). Moving forward, the responsibility for monitoring companies’ progress in making climate-related disclosures in alignment with the TCFD recommendations will shift from the TCFD to the ISSB (IFRS, 2023a). The culmination of the work of the TCFD and subsequent transfer of responsibility to the ISSB is important to note for future corporate sustainability disclosure research. This study is not impacted by this development because it analyzes the 5 years before and after the TCFD recommendations were released in 2017, from 2013 to the end of 2022.

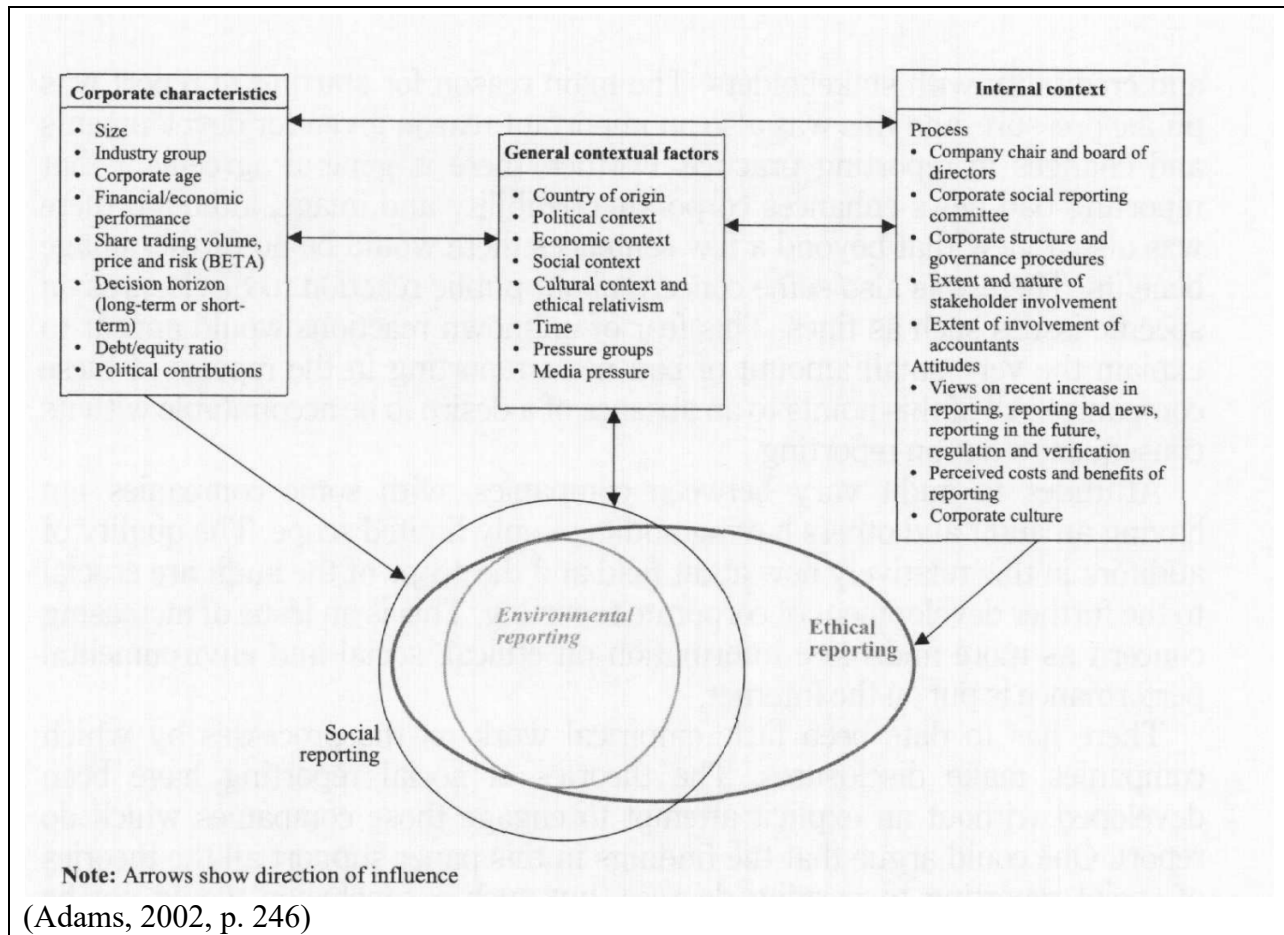
Institutional Theory, TCFD Support, and Non-Renewable Energy Sector Investments Decisions

Institutional theory can be applied to understand the elements that influence public pension fund TCFD support. It can also be applied to understand the elements that influence public pension fund investment decisions. In institutional theory, institutions are defined as “social structures that have attained a high degree of resilience and are composed of cultural-cognitive, normative, and regulative elements that, together with associated activities and resources, provide stability and meaning to social life” (Scott, 2008, p. 48). Institutional theory states that institutions are embedded in and shaped by the elements in their environment (Hoepner et al., 2021; Scott, 2008). These elements are organized into three categories: cultural-cognitive, normative, and regulative (Scott, 2008). Regulative elements influence institutions through defining what institutions *have* to do and include rules, regulations, and policies (Palthe, 2014). Normative elements influence institutions through defining what organizations *ought* to do and include the norms associated with the expected behavior of individuals and organizations (Cojoianu, 2021; Palthe, 2014). Cultural-cognitive elements influence institutions through defining what organizations *want* to do and include the values and beliefs that shape institutional behavior (Palthe, 2014).

Previous research has applied institutional theory to explore asset owner support for sustainable finance initiatives. Hoepner et al. (2021) demonstrated how the elements of institutional theory influence an asset owner's decision to subscribe to the Principles for Responsible Investment (PRI). The study revealed that the decision of asset owners to sign the PRI is influenced by a combination of regulative, normative, and cultural-cognitive factors (Hoepner et al., 2021). Plan ownership was identified as one of the normative factors influencing PRI support (Hoepner et al., 2021). The study found that public service employee pension funds were more inclined to sign the PRI compared to corporate pension funds (Hoepner et al., 2021). This finding highlights that institutional norms present in public service employee pension funds influence the likelihood of their support of a responsible investment initiative. For our study, these findings highlight that, prior to TCFD support, public pension funds are likely to already face a normative pressure towards responsible investment. This suggests two potential expectations for our study. It may result in a large proportion of public pension funds stating their support for the TCFD because public pension fund normative pressures are already leading to them engaging with the issue. On the other hand, it may result in only a few public pension funds supporting the TCFD because the framework may be seen as redundant with their current responsible investment strategies.

Hoepner et al. (2021)'s study included size and location as control variables for an asset owner's decision to sign the PRI. Other variables that influence corporate social, environmental, and ethical reporting have also been identified (Adams, 2002) (Figure 1).

Figure 1: Influences on Corporate Social, Environmental, and Ethical Reporting



However, for this study, only size and location will be analyzed for their influence on TCFD support and implementation stage. Previous research finds that larger firms are more engaged with sustainability reporting. Adams et al. (1998) found that larger companies disclose more corporate social information. Cowen et al. (1987) also demonstrated that larger companies tend to have a greater amount of social responsibility disclosures. Additionally, Gallo and Christensen (2011) found a positive correlation between firm size and sustainability reporting. Gallo and Christensen (2011) discuss how larger firms may be more likely to engage with sustainability disclosures because their size results in greater sustainability-related pressures from stakeholders and more resources to respond to those pressures. The results of previous research suggest that larger public pension funds may be more likely to support the TCFD and more advanced in their implementation of the TCFD recommendations.

This study also analyzes the influence of location on public pension fund TCFD support and implementation. From a company perspective, Adams et al. (1998) highlights how country of origin influences corporate social disclosures. From an investor perspective, previous research demonstrates that investor location influences the sustainability disclosures and performance of investee companies. Ilhan et al. (2023) found a positive association between climate-conscious institutional ownership and improved firm-level climate risk disclosures. Ilhan et al. (2023) defined climate-conscious investors as those from countries where stewardship codes exist that promote corporate sustainability and those located in countries where climate-conscious norms exist (Ilhan et al., 2023). Similarly, Dyck et al. (2019) found that shareholders from countries with strong beliefs in the importance of environmental and social issues increase firms' environmental and social performance. The results of previous research suggests that a public pension fund's country of origin is likely to be influential to TCFD support and implementation. However, this study is comparing public pension funds within a single country, the United States. Therefore, the location variable will be captured by considering the fund's state of origin instead of country. It is expected that the funds located in states with stewardship codes, climate-conscious norms, and/or beliefs in the importance of environmental and social issues will support the TCFD and be more advanced in its implementation.

Existing literature has also applied institutional theory to explore how normative and regulative elements influence capital flows to the oil and gas sector. Cojoianu et al. (2021) analyzed the relationship between the fossil fuel divestment movement, a normative influence, and its subsequent impact on capital flows to the oil and gas sector. The study found that increased fossil fuel divestment pledges in a country were associated with lower capital flows to domestic oil and gas companies (Cojoianu et al., 2021). However, the study also found that the normative influence of the movement is moderated by country-level regulatory influences (Cojoianu et al., 2021). Domestic banks situated in countries with a strong divestment movement and stringent environmental policies were found to direct more finance to oil and gas companies abroad (Cojoianu et al., 2021). The study concludes by stating that, despite the divestment movement's ability to reduce capital flows within individual countries, the aggregate financing for the oil and gas sector across several countries has continued to increase (Cojoianu et al., 2021). The findings of this study are not directly applicable to our study, but they do provide some insights. Our

study analyzes fund exposure to the non-renewable energy sector, it does not analyze what countries firms in the sector are operating in. Additionally, our study analyzes support for TCFD, an internationally recognized framework, as a normative pressure not domestic fossil fuel divestment campaigns. However, the Cojoianu et al. (2021) study does highlight that normative pressures can influence capital flows to the non-renewable energy sector. This suggests that normative pressures from TCFD support may contribute to public pension funds reducing their capital flows to the non-renewable energy sector. The results also highlight the limitations of normative pressures on reducing non-renewable energy sector investments on aggregate. For our study, this suggests that even if TCFD support translates into reduced non-renewable energy sector investments in a subset of public pension funds, this may not translate to aggregate reductions in non-renewable energy sector investments and a substantial impact on achieving climate targets. This study also brings attention to limitations of jurisdictional governments in addressing the climate challenge. If the United States proposed mandatory TCFD reporting and strict regulations to reduce greenhouse gas emissions, then financing for the oil and gas sector may just move to another country that has less strict regulations.

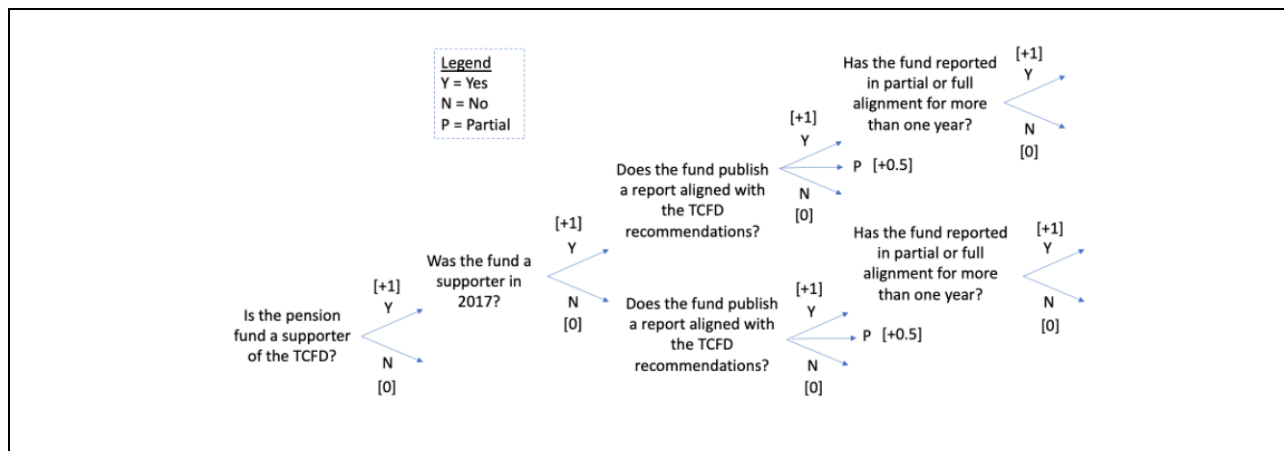
Previous research has applied institutional theory to examine various phenomena, including the support of asset owners for sustainable finance initiatives (Hoepner et al., 2021) and capital flows to the oil and gas sector (Cojoianu et al., 2021). A study has not yet been conducted that employs institutional theory to investigate the impact of TCFD support on public pension fund non-renewable energy sector investments. This study contributes to the literature on institutional theory by applying the theory in a new context. In theory, the funds that voluntarily support the TCFD will face increased normative pressures to shift their behavior than those that do not support the TCFD. Therefore, it is expected that the institutions that have chosen to support the TCFD will have a significant reduction in exposure to the non-renewable energy sector after the TCFD recommendations were released than those that do not support the TCFD.

Methods

Research Approach

This study employed a quantitative research approach (Creswell & Creswell, 2018). First, this approach was used to arrive at a binary classification of TCFD support and relative ranking of TCFD stage of implementation. Publicly available fund data related to TCFD disclosures was analyzed to inform the development of the TCFD stage of implementation relative scoring instrument (Figure 2).

Figure 2: Stage of TCFD Implementation Scoring Instrument



Second, quantitative correlational methods (Creswell, 2012) were used to examine the relationships among the variables of fund size, location, TCFD support, and stage of TCFD implementation. Third, t-tests were used to compare the public equity non-renewable energy sector exposure for TCFD supporters and non-supporters.

The philosophical worldview that informed the quantitative research approach employed in this study was postpositivist. The postpositivist worldview involves theory verification through empirical observation and measurement (Creswell & Creswell, 2018). It is also sometimes referred to as the scientific method or empirical science (Creswell & Creswell, 2018).

Data Collection

The subset of institutional investors that this study focuses on are public pension funds in the United States. Public pension funds were selected due to the availability of data and the expectation that public institutional investors may be more aligned with the pursuit of a goal that is in the public interest (Hoepner et al., 2021), a climate target-aligned economy. In the United States, individual pension plans are often managed together in a retirement system, referred to as a public employees retirement system (PERS) (Public Plans Data, 2022). According to the United States Census Bureau, there are over 5000 PERS in the United States (Public Plans Data, 2022). Collectively, they hold approximately \$5 trillion in assets, cater to 15 million active members, serve 12 million retirees, and distribute approximately \$330 billion in benefits annually (Public Plans Data, 2022). Common beneficiaries of the United States PERS are teachers, police officers, and firefighters (Public Plans Data, 2022).

To conduct the analysis for the first two research questions, a list of US public pension funds, fund locations by state, fund size, TCFD support or not, TCFD support year, and public TCFD disclosures were required. To obtain a list of public pension funds in the United States the Public Plans Data database from the Center for Retirement Research at Boston College was used (Lu et al., 2019; Public Plans Data, 2022). There were 191 state and local public pension funds identified for analysis (Table 11). To obtain information on fund location and size, the Public Plans Data database, and public reports available on fund websites were used. For fund size, the market value of assets under management as of the most recent available fiscal year, either 2023, 2022, or 2021, was recorded. Data on whether a fund is a supporter of the TCFD and what year they became a supporter was obtained from the TCFD's supporters webpage (TCFD, 2023b). The data to assess the stage of implementation of the TCFD's recommendations was obtained from publicly available fund reports such as annual reports and sustainability/ESG/climate-risk reports.

To conduct the analysis for the third research question, 10 years of fund public equity energy sector holdings data was needed. The data collection timeframe selected was from 31 December 2013 to 31 December 2022. This timeframe was chosen because it captures five years before and

after the TCFD recommendations were released in 2017. This allowed for the collection of the maximum amount of time since the TCFD recommendations were released. It also allowed for a before and after comparison using equal intervals of time. To obtain the fund public equity energy sector holdings data, the Capital IQ database was used. Of the 191 funds included in the study, only 34 had 10 years of public equity holdings data available. For each of the 34 funds, custom filtering tools were used to obtain fund public equity energy sector holdings data for the 10 years.

Data Analysis

To answer research question one, identify the public pension funds in the United States that support the TCFD's recommendations, each fund was searched for on the TCFD supporter webpage (TCFD, 2023b). To analyze whether fund size and location influence TCFD support, descriptive statistics, and a logistic regression model were used.

To answer research question two, assess fund stage of TCFD implementation, a scoring methodology was developed and applied (Figure 2). Scores ranged from lowest of 0 for the funds that were not TCFD supporters and highest of 4. Four questions were developed to categorize funds based on their stage of TCFD implementation. The first question asked whether the fund supports the recommendations of the TCFD. If yes, the fund score increased by 1. If no, the fund received a 0 score. The second question asked whether the fund was a supporter of the TCFD in 2017. If yes, the fund score increased by 1. If no, the fund score did not increase. It was decided that an extra point would be provided to the funds that supported the recommendations in 2017, the year that they were first released, because it suggested high engagement and leadership in disclosing climate-related financial information. It also suggested that these funds may be further ahead in stage of implementation based on length of time engaging with the recommendations. The third question asked whether a fund publishes a report fully or partially aligned with the TCFD recommendations. The TCFD recommendations have 4 pillars (governance, strategy, risk management, and metrics and targets) and 11 recommendations under the 4 pillars (TCFD, 2023). A fund received 1 point if they had a section in a report or a full report centered around discussing each of the 11 recommendations. A fund received 0.5 points if they had a section in a

report or a full report centered around discussing at least 1 of the 11 recommendations. Each of the 4 pillars and 11 recommendations were considered equal in the scoring method developed. A fund received 0 points if they did not have a report, or a section devoted to any of the TCFD recommendations. The fourth question asked whether the fund had reported in full or partial alignment with the 11 recommendations for more than one year. If yes, the fund received 1 point. If no, the fund received 0 points. To analyze whether fund size and location influence the stage of TCFD implementation, descriptive statistics, and linear regression models were used.

For research question three, changes in exposure to the non-renewable energy sector was analysed by first taking the average percent exposure to the non-renewable energy sector pre-TCFD (2013-2017) and post-TCFD (2018-2022). Next, the average percent exposure to the non-renewable energy sector from 2013-2017 was subtracted from the average percent exposure from 2018-2022. This resulted in a “difference in average energy sector exposure after 2017” variable. Additionally, the average percent exposure to the non-renewable energy sector from 2013-2017 was divided by the average percent exposure to the non-renewable energy sector from 2018-2022 to arrive at a “ratio of average energy sector exposure after 2017” variable. The “difference in average energy sector exposure after 2017” variable was analyzed using a t-test. The data was grouped by TCFD supporter and TCFD non-supporter. A two-tailed equal variance t-test was used to test the null hypothesis that there is no statistically significant difference between the “difference in average energy exposure after 2017” of TCFD supporters and TCFD non-supporters. The ratio variable was also grouped by TCFD supporters and non-supporters and analyzed using a t-test. A two-tailed unequal variance t-test was used to test the null hypothesis that there is no statistically significant difference between the ratios of TCFD supporters and TCFD non-supporters.

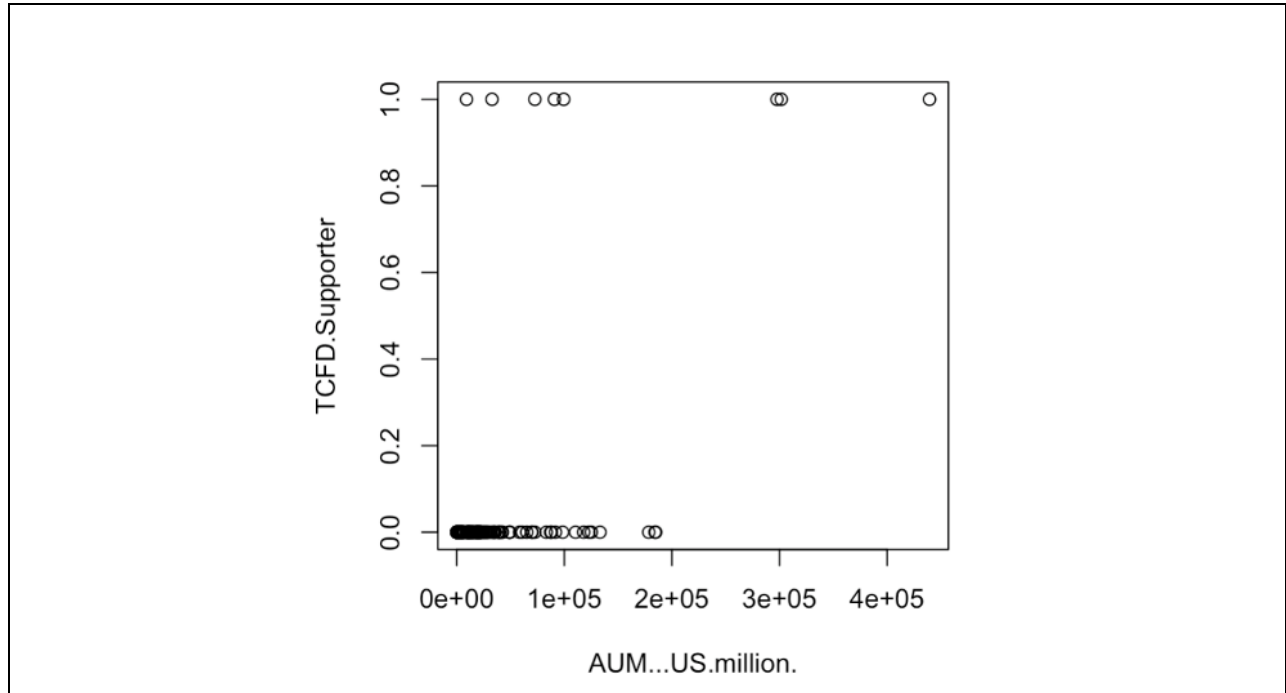
Results

The results section will highlight the findings of the analyses that were conducted to explore each research question. It will first present the findings of the level of support for the TCFD among public pension funds in the United States. It will then present the results of analyses assessing whether TCFD support is influenced by fund size and location. Second, it will present the findings of the stage of TCFD implementation assessment followed by the findings of the influence of fund size and location on stage of implementation. Third, the findings from analyses to identify whether fund non-renewable energy sector exposure pre- and post-TCFD recommendations being released in 2017 is significantly different if a fund is a TCFD supporter or not will be presented. Throughout the results section, tables and graphs will be utilized to present the study's findings. The section will conclude with a summary of the results.

First, which public pension funds in the United States support the recommendations of the TCFD was explored. The analysis showed that 183/191, approximately 95.8%, of public pension funds in the United States are not TCFD supporters and 8/191, approximately 4.2%, of funds are supporters. The 191 sampled public pension funds represent approximately 5.05 trillion USD in assets under management (AUM). The 8 funds that support the TCFD represent 1.343 trillion USD or 26.6% of AUM. The 183 funds that do not support the TCFD represent 3.704 trillion USD or 73.4% of AUM.

Second, the influence of fund size on TCFD support and location on TCFD support was analyzed. A scatter plot of TCFD supporter and fund size (Figure 3) demonstrates that the funds that do not support the TCFD are small to medium sized, ranging in size from 29.2 million USD to 184.9 billion USD.

Figure 3: Scatter Plot of TCFD Supporter and Fund Size (AUM in \$US millions)



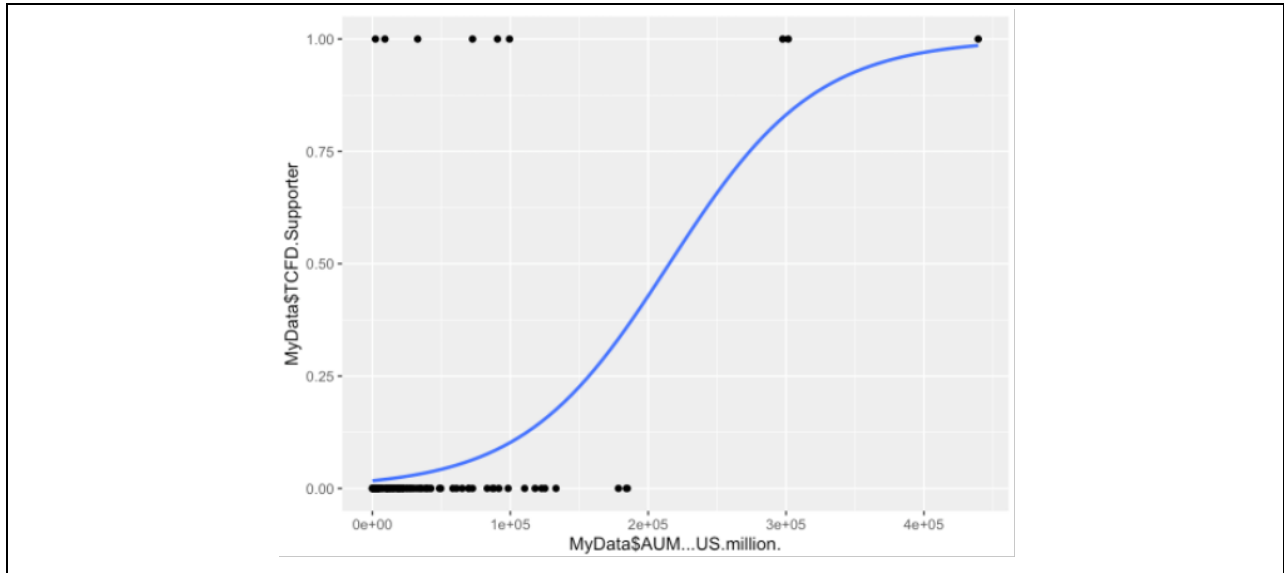
Additionally, the TCFD supporting funds include the three largest funds in the sample, ranging from 297.5 billion USD to 439.4 billion USD, and five small and medium sized funds, ranging from 9.07 billion USD to 99.4 billion USD.

A logistic regression model was used to analyze the relationship between the size of a public pension fund and whether it is a TCFD supporter (Table 1, Figure 4).

Table 1: Logistic Regression Analysis of TCFD Support and Fund Size (AUM in \$US millions)

Predictor Variable	Odds Ratio	95% Confidence Interval	p-value
Fund Size (AUM in \$US millions)	1.0000208	1.000011385, 1.00003328	0.000171

Figure 4: Plot Logistic Regression Analysis of TCFD Support and Fund Size (AUM in \$US millions)



It was found that fund size is a significant predictor for whether a fund is a TCFD supporter ($p < 0.05$). The odds of a fund supporting TCFD increases by 0.00208% (95% confidence interval [0.00114%, 0.00333%]) for a one unit increase in AUM (i.e., fund size increase of \$US 1 million). The results suggest that as fund size increases so does the likelihood of a fund being a TCFD supporter.

To analyze the relationship between location and TCFD support, first a table of TCFD supporters organized by state was created (Table 2).

Table 2: List of TCFD Supporters and Non-Supporters by State

State	Number of TCFD Supporters	Number of Non-Supporters
1. Arizona	0	4
2. Washington	0	2
3. Oregon	0	1
4. California	4	11
5. Alaska	0	3
6. Idaho	0	1
7. Nevada	0	1
8. Montana	0	2
9. Wyoming	0	1
10. Utah	0	1
11. Colorado	0	2
12. New Mexico	0	2
13. North Dakota	0	4
14. South Dakota	0	3
15. Nebraska	0	4
16. Kansas	0	2
17. Oklahoma	0	6
18. Texas	0	12
19. Minnesota	0	4
20. Iowa	0	2
21. Missouri	0	12
22. Arkansas	0	3
23. Louisiana	0	9
24. Michigan	0	5
25. Indiana	0	1
26. Kentucky	0	5
27. Tennessee	0	2
28. Mississippi	0	1
29. Ohio	0	5
30. West Virginia	0	3
31. Maine	0	1
32. New Hampshire	0	2
33. Vermont	0	4
34. Massachusetts	0	3
35. Rhode Island	0	2
36. Connecticut	0	4
37. New York	4	3
38. Pennsylvania	0	5
39. District of Columbia	0	1
40. Delaware	0	2
41. Maryland	0	4
42. Virginia	0	5
43. North Carolina	0	3
44. South Carolina	0	2
45. Georgia	0	5
46. Florida	0	5
47. Alabama	0	2
48. Hawaii	0	1
49. Illinois	0	10
50. New Jersey	0	2
51. Wisconsin	0	3
Total	8	183

Observationally, this results in there only being public pension funds that support the TCFD in the states of California and New York. All the other states do not have public pension funds that support the TCFD. Of the 15 public pension funds in California, 4 support the TCFD and 11 do not. By assets under management, the 4 public pension funds that support the TCFD in California represent 75.7% of the public pension assets under management in the state. Of the 7 public pension funds in New York, 4 of them support the TCFD and 3 of them do not support the TCFD. By assets under management, the 4 public pension funds in New York that support the TCFD represent 70.1% of the public pension assets under management in the state.

A binary variable for whether a fund exists in California or New York (1=Yes; 0=No) was created to input into a logistic regression and test whether it is a significant predictor of TCFD support. The California and New York variable was not identified as a significant predictor of TCFD support in a logistic regression with only one predictor variable. The California and New York variable was also not identified as a significant predictor variable of TCFD support in a logistic regression using two predictor variables, including assets under management.

Third, the group of public pension funds that support the TCFD was analyzed further to identify what stage of implementation of the TCFD recommendations they are at. A scoring system was developed for identifying and ranking stage of TCFD implementation (Figure 2). The scoring strategy is described in the Methods section.

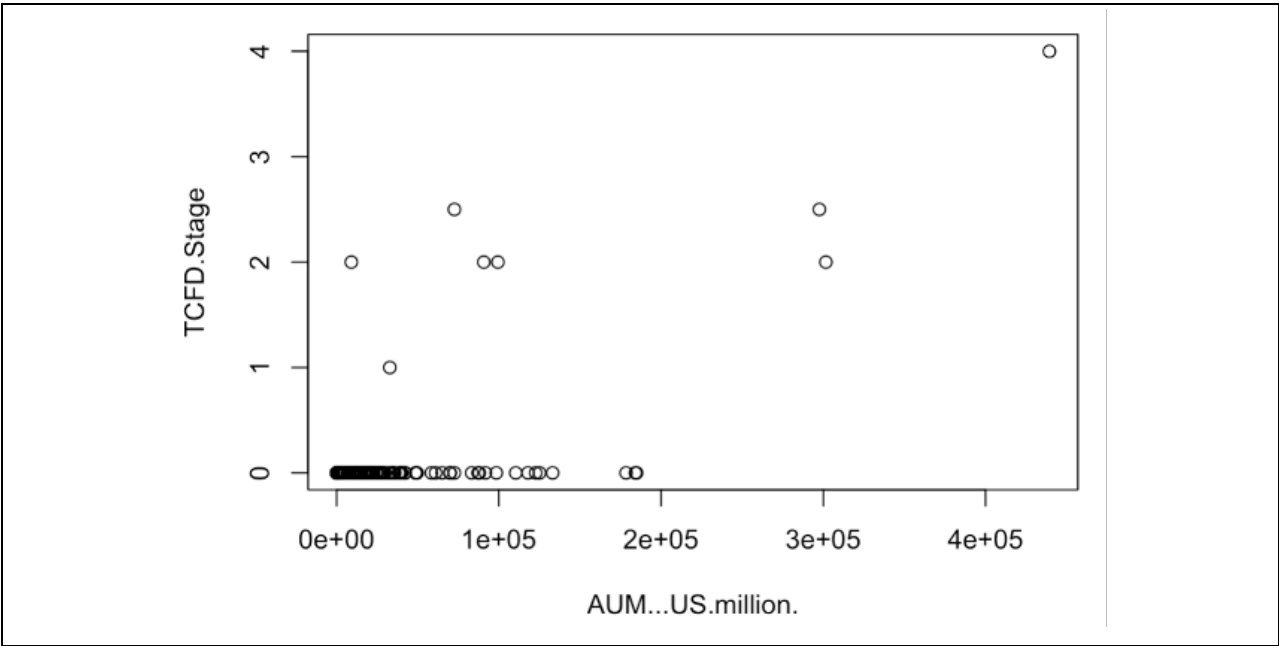
CalPERS received the highest score of 4; LACERA and NYSLRS received the second highest scores of 2.5; CalSTRS, NYC Employees RS; NYC Teachers RS, and NYC Education RS received the third highest scores of 2; and SFERS received the lowest score of 1 (Table 3). Funds that did not support the TCFD received a score of 0. These results demonstrate that the funds that support the TCFD are at various stages of implementation of the recommendations.

Table 3: Stage of TCFD Implementation Scoring Results

Public Pension Fund	Stage of TCFD Implementation Score
1. California Public Employees Retirement System (CalPERS)	4
2. Los Angeles City Employees Retirement Association (LACERA)	2.5
3. New York State and Local Retirement System (NYSLRS)	2.5
4. California State Teachers Retirement System (CalSTERS)	2
5. New York City Employees Retirement System (NYCERS)	2
6. New York City Teachers Retirement System (NYCTRS)	2
7. New York City Educational Retirement System (NYCERS)	2
8. San Francisco Employees Retirement System (SFERS)	1

Next, it was analyzed whether fund size and location influence the stage of TCFD implementation. A scatter plot was created to descriptively explore the relationship between stage of TCFD implementation and fund size (Figure 5).

Figure 5: Scatter Plot of Stage of TCFD Implementation and Fund Size (AUM in \$US millions)



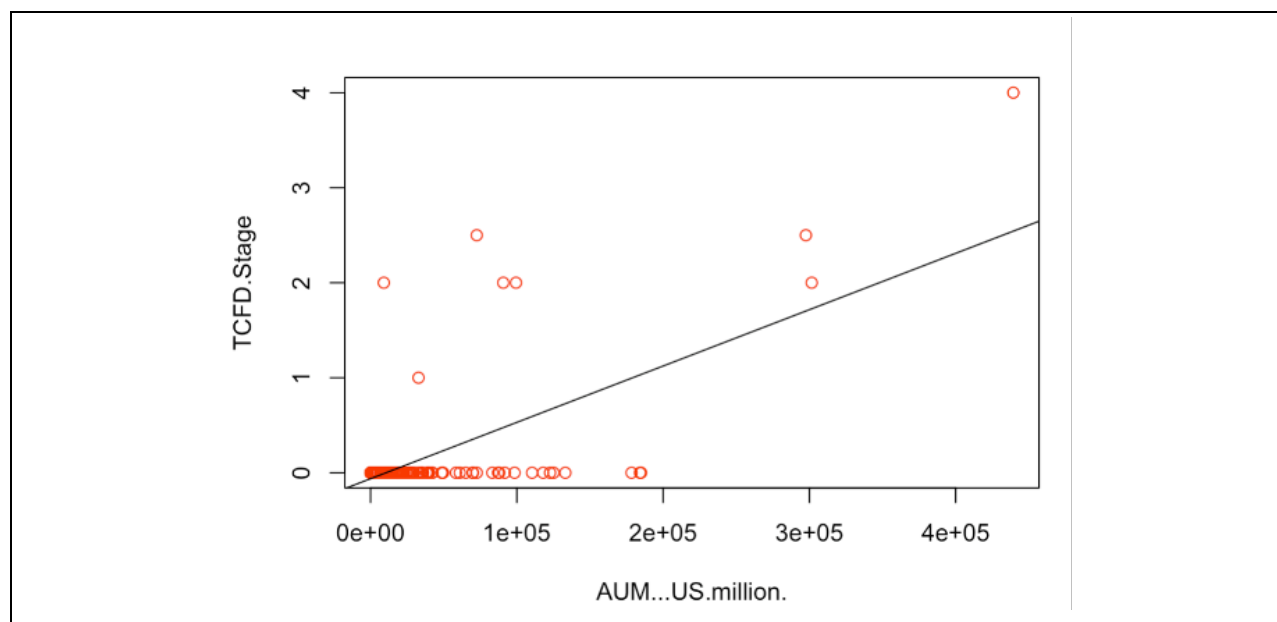
This highlights again that the TCFD non-supporters are small to medium sized funds. It also highlights that the three largest funds in the sample are further ahead in implementing the TCFD recommendations and the largest fund received the highest score. There are also some small to medium-sized funds that received a moderate score in the TCFD implementation assessment.

A linear regression was used to analyze whether fund size significantly predicts the stage of TCFD implementation. The fitted regression model was: TCFD Stage of Implementation = $5.930e-06 * (AUM) - 6.246e-02$ (Table 4, Figure 6).

Table 4: Linear Regression Analysis of Stage of TCFD Implementation and Fund Size (AUM in \$US millions)

Predictor Variable	Coefficient (b)	Standard error	p-value
Fund size (AUM in \$US millions)	5.930e-06	4.878e-07	<2e-16

Figure 6: Plot Linear Regression Analysis of Stage of TCFD Implementation and Fund Size (AUM in \$US millions)



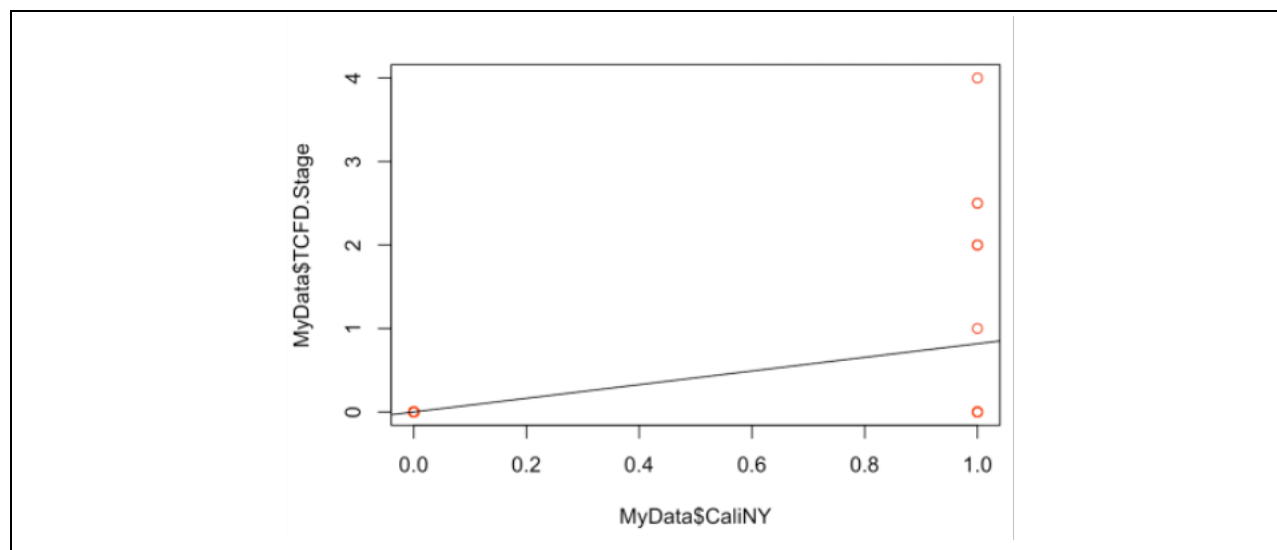
The overall regression was statistically significant, $R^2 = .438$, $F(1,189) = 147.8$, $p < 2.2e-16$. It was found that fund size significantly predicted the stage of TCFD implementation, $b=5.930e-06$, $p= 2e-16$. For every US\$ 1 million increase in fund size, the stage of TCFD implementation score is expected to increase by 0.00000593.

A linear regression was also used to analyze whether a fund being present in California or New York significantly predicts the stage of TCFD implementation. The fitted regression model was: TCFD Stage of Implementation = $8.182e-01 * (CaliNY) + 6.748e-16$ (Table 5, Figure 7).

Table 5: Linear Regression Analysis of Stage of TCFD Implementation and Location of Fund in California or New York

Predictor Variable	Coefficient (b)	Standard error	p-value
California or New York	8.182e-01	9.146e-02	3.39e-16

Figure 7: Plot Linear Regression Analysis of Stage of TCFD Implementation and Location of Fund in California or New York



The overall regression was statistically significant, $R^2 = .2975$, $F(1,189) = 80.03$, $p = 3.39e-16$. It was found that whether a fund is present in California or New York is a significant predictor of stage of TCFD implementation, $b=8.182e-01$, $p=3.39e-16$. If a fund is present in California or New York, the stage of TCFD implementation score is expected to increase by 0.8182.

A multiple linear regression was used to test if fund size and presence in California or New York predicted stage of TCFD implementation. The fitted regression model was: TCFD Stage of Implementation = $4.759e-06 * (AUM) + 5.137e-01 * (CaliNY) - 9.072e-02$ (Table 6).

Table 6: Multiple Linear Regression Analysis of Stage of TCFD Implementation, Fund Size, and Location of Fund in California or New York

Predictor Variable	Coefficient (b)	Standard error	p-value
Fund size (AUM in \$US million)	4.759e-06	4.796e-07	<2e-16
California or New York	5.137e-01	8.037e-02	1.26e-09

The overall regression was statistically significant, $R^2=.539$, $F(2,188) = 109.9$, $p<2.2e-16$. It was found that fund size ($b=4.759e-06$, $p<2e-16$) and whether a fund is in California or New York ($b=5.137e-01$, $p= 1.26e-09$) are significant predictors of stage of TCFD implementation. The R^2 of the multiple linear regression is higher than that of the simple linear regressions, suggesting that the stage of TCFD implementation is more accurately predicted with both fund size and whether a fund is present in California and New York as predictor variables.

Fourth, whether the difference in average non-renewable energy sector exposure pre- and post-TCFD recommendations being released is significantly different if a fund is a TCFD supporter or not was analyzed. A two-sample t-test assuming equal variances was used (Table 7, 8).

Table 7: Difference in Average Non-Renewable Energy Sector Exposure Before and After 2017 of TCFD Supporters and Non-Supporters Data

TCFD Supporters	Non-Supporters
-0.23	-0.03
-0.03	-0.04
0.08	-0.04
0	-0.04
	0.68
	-0.04
	-0.01
	-0.03
	-0.03
	0
	0.35
	-0.03
	-0.05
	-0.04
	-0.01
	-0.03
	-0.03
	0
	-0.04
	-0.19
	-0.19
	0.03
	-0.04
	0
	0
	0.06
	0
	0
	0.03
	0.05

Table 8: T-Test Analysis of Difference in Average Non-Renewable Energy Sector Exposure for TCFD Supporters and Non-Supporters

Groups	Observations	Mean	Variance	t	df	p two-tail
TCFD Supporters	4	-0.045	0.01737	-0.67830	32	0.50246
Non-Supporters	30	0.00967	0.0235			

The results of our statistical analysis does not allow us to reject our null hypothesis. Therefore, it was found that the difference in average public equity non-renewable energy sector exposure does not change significantly pre- and post-TCFD recommendations being released whether a fund is a TCFD supporter or not ($t(32) = -.68$, $p = 0.50$). This result suggests that a fund’s support of the TCFD recommendations does not translate into a significant difference in average non-renewable energy sector exposure pre- and post-2017 that differs from non-TCFD supporters.

Lastly, whether the difference in ratios of average non-renewable energy sector exposure pre- and post-TCFD recommendations being released is significantly different between TCFD supporters and non-supporters was analyzed. A two-sample t-test assuming unequal variances was used (Table 9, 10).

Table 9: Ratio of Average Non-Renewable Energy Sector Exposure Before and After 2017 for TCFD Supporters and Non-Supporters Data

TCFD Supporters	Non-Supporters
7.83	1.75
1.84	1.97
0	1.96
0	2.08
	0.13
	1.95
	0
	1.71
	1.66
	0
	0.13
	1.81
	2.58
	1.94
	1.24
	1.74
	1.78
	0
	1.91
	1.95
	0
	0
	2.27
	0
	0
	0.62
	0
	0
	0
	0

Table 10: T-Test Analysis of Ratio of Average Non-Renewable Energy Sector Exposure for TCFD Supporters and Non-Supporters

Groups	Observations	Mean	Variance	t	df	p two-tail
TCFD Supporters	4	2.4175	13.77243	0.73944	3	0.51324
Non-Supporters	30	1.03933	0.91857			

It was found that the ratio does not change significantly if a fund is a TCFD supporter or not ($t(3) = .74, p = 0.51$). This suggests that a fund’s support of the TCFD recommendations does not result in a significant difference in the ratio of average non-renewable energy sector exposure pre- and post-TCFD recommendations being released than non-TCFD supporters.

Summary of Results

Overall, a large proportion of public pension funds in the United States do not support the recommendations of the TCFD, 183/191 or 95.8%. The funds that do support the recommendations of the TCFD include the three largest public pension funds, CalPERS, CalSTRS, and NYSLRS, as well as a subset of small to medium-sized funds. The TCFD supporting funds represent 26.6% of total public pension fund assets under management. Fund size was identified as a significant predictor of TCFD support, with the larger funds more likely to support. Additionally, only funds in California or New York supported the TCFD.

Further analyzing the TCFD supporting funds to assess their stage of implementation of the recommendations resulted in the identification of the 3 largest funds being among the 4 funds with the highest stage of implementation ranking. Fund size was also identified as a significant predictor of TCFD stage of implementation, with larger funds being more advanced in implementation. Additionally, location, more specifically whether a fund was in California or New York, was also identified as a significant predictor of the TCFD stage of implementation, with funds in these states being more advanced in implementation.

Lastly, impacts of the recommendations of the TCFD, as defined by significant changes in public equity non-renewable energy sector exposure before and after the TCFD recommendations were released in 2017, were not identified. These findings contribute to institutional theory by applying the theory in a new context. In the context of this study, normative pressures on public pension funds from voluntarily supporting the TCFD did not result in significant changes in investment decision-making within the non-renewable energy sector.

Discussion

This study aimed to address several research gaps identified in the current literature on TCFD reporting. It was found that limited research had been conducted to understand the level of support and implementation of the TCFD's recommendations in institutional investors, despite their potential to play a pivotal role in the transition to a climate target-aligned economy. Additionally, it was identified that no studies employed institutional theory to analyze how TCFD support was translating into shifts in investments in sectors facing high climate-related risks like the non-renewable energy sector. This study sought to address these gaps and enhance understanding of the capacity of the TCFD recommendations to facilitate the transition to a climate target-aligned economy.

One of the objectives of this study was to analyze the level of support and implementation stage of the TCFD's recommendations in public pension funds in the United States. This included assessing whether fund size and location influence TCFD support and implementation. It was found that 8 of 191 sampled public pension funds support the TCFD. This is a relatively low proportion of the public pension funds in the United States. Low TCFD support among public pension funds may be a result of the political controversy that unfolded following the SEC's climate-related disclosures proposal (Dial et al., 2022). A potential reason for low TCFD support may be public pension funds trying to avoid political or legal backlash. Another potential reason for low TCFD support may be that public pension funds are already engaged with responsible investment practices due to the normative pressures they already face (Hoepner et al., 2021), so stating their support for the TCFD is redundant. In relation to the implementation stage, it was found that the 8 public pension funds that support the TCFD were at various stages of implementation of the recommendations. Some of the funds have been issuing a TCFD report for multiple years. Whereas others have stated their support but have not yet issued a report. The level of fund alignment with the TCFD's 11 recommendations was not analyzed in detail. Future research could pursue developing a compliance scoring methodology like Demaria and Rigot (2021) to provide more detailed results and identify which recommendations the funds are having the most trouble complying with.

The analysis on the influence of fund size on TCFD support and implementation stage revealed that size is a significant predictor for both TCFD support and the stage of implementation. Large public pension funds were more likely to support the TCFD and be more advanced in implementation. This aligns with previous research that found larger firms disclose more corporate sustainability information (Adams et al., 1998; Cowen et al., 1987; Gallo & Christensen, 2011). Gallo and Christensen (2011) proposed that this phenomenon may be due to larger firms facing greater pressures from stakeholders to disclose sustainability-related information. Additionally, larger firms may be equipped with more resources to respond to these stakeholder pressures (Gallo & Christensen, 2011). These findings contribute to literature on the influence of firm size on engagement with corporate sustainability disclosures.

The analysis on the influence of location on TCFD revealed that only funds located in the states of California and New York support the TCFD. Additionally, whether a fund was in California and New York was identified as a significant predictor of the TCFD implementation stage, with funds in these two states being more advanced in implementation. These findings align with previous research that demonstrated that investors in countries with stewardship codes, climate-conscious norms, and beliefs in the importance of environmental and social issues were more engaged with corporate sustainability disclosures and seeking environmental and social performance improvements (Dyck et al., 2019; Ilhan et al., 2023). Both the states of California and New York have a history of engagement with the issue of climate change (Berkeley, 2023; City of New York, 2013). Therefore, public pension funds located in these states are likely to face more pressures through stewardship codes, climate-conscious norms, and stakeholder beliefs in the importance of environmental and social issues to engage with and disclose in alignment with the TCFD. These findings contribute to literature on the influence of location on investor engagement with sustainability disclosures.

The primary objective of the study was to apply the lens of institutional theory to analyze how TCFD support influences public pension fund investments in the non-renewable energy sector. This involved two research questions. The first question asked whether the difference in average public equity non-renewable energy sector exposure changed significantly before and after the TCFD recommendations were released in 2017 whether a fund is a TCFD supporter or not. The

second question was identical but analyzed the ratio of average non-renewable energy sector exposure pre- and post-TCFD recommendations being released. Our results demonstrated that there were no statistically significant differences in average non-renewable energy sector exposure pre- and post-TCFD recommendations being released whether a fund was a TCFD supporter or not. Additionally, there were no statistically significant differences in the ratios of average non-renewable energy sector exposure pre- and post-TCFD recommendations being released whether a fund was a TCFD supporter or not. These findings suggest that public pension funds that support the TCFD do not have significantly different investment decisions within the non-renewable energy sector compared to funds that do not support the TCFD. These findings are counter to our expectation that normative pressures resulting from TCFD support would lead to reduced investments in the non-renewable energy sector compared to non-TCFD supporting firms.

There are two potential explanations for our results that have implications about the capacity of the TCFD recommendations to contribute to the climate target-aligned economy. First, our results demonstrate that, in the short-term, normative pressures from voluntary TCFD support are not resulting in a significant shift in institutional investment decisions in the non-renewable energy sector. This leads us to conclude that, in our sample of United States public pension funds, the TCFD is not resulting in a significant reallocation of capital from firms facing high climate-related risks to those facing lower risks and engaging in opportunities. This study's findings demonstrate that the TCFD framework may not have the capacity to significantly contribute to the transition to a climate target-aligned economy. These findings would align with a study published by Di Marco et al. in 2022, which argued that instead of facilitating the transition to a more environmentally sustainable economy, TCFD reporting is prone to become a 'ceremonial' practice that lacks substance. Ameli et al. (2020) also stated that while TCFD disclosures enhance transparency, on their own, they are insufficient to tackle the challenge of aligning finance toward a climate target-aligned economy. For policymakers, this challenges previous rhetoric on the transformative potential of the TCFD and suggests that other tools and regulative pressures may be required to shift to a climate target-aligned economy.

Additionally, historical leaders have cautioned against overemphasizing market values and placing excessive belief in the capacity of the market to solve grand challenges like climate change. In 1944, Karl Polanyi stated, “to allow the market mechanism to be sole director of the fate of human beings and their natural environment...would result in the demolition of society” (Polanyi, 1944, p. 76). This warning from Polanyi rings loudly in the 21st century as we consider the role of the TCFD recommendations in addressing the climate challenge. In the 1940s, Polanyi argued that the values of the market such as rationality and utility were eroding values of society such as reciprocity and solidarity (Bansal & Song, 2017). More recently, Carney (2021) brought attention to a similar concern when he discussed how when markets are left unattended, they can devour the societal values that are essential to the long-term functioning of markets themselves. Carney (2021) also emphasized that markets alone will not solve our largest challenges and that we require political processes and citizen values to define our goals and objectives. The need for citizen engagement was also highlighted by Nobel Laureate, Elinor Ostrom (Rangamani, 2012). Despite the potential of the TCFD framework to contribute to improved climate-related disclosures, it is important to remember that it is only one component among many that are needed to transition to a climate target-aligned economy.

Lastly, there is a potential second explanation to our finding of no significant difference in non-renewable energy sector exposure before and after 2017 in TCFD supporting and non-supporting funds. Public pension funds have been identified to already face normative pressures to invest responsibly (Hoepner et al., 2021). Therefore, there is a chance that the sampled public pension funds may already be more advanced in managing their non-renewable energy sector investment decisions than other investor types such as corporate pension funds. This may explain why TCFD supporters and non-supporters did not differ significantly in their non-renewable energy sector exposure before and after the TCFD recommendations were released.

The first explanation suggests that the TCFD recommendations are not facilitating shifts in capital away from sectors facing high climate-related risks and, therefore, they may not have the capacity to contribute to the climate target-aligned economy. The second explanation would suggest that the TCFD recommendations are redundant when integrated in public pension funds. Further research on the influence of the TCFD’s recommendations on investment decisions

among different categories of institutional investors is required to delineate between these two explanations.

Limitations

The results of this study should be considered alongside an understanding of its limitations. First, our analysis of TCFD stage of implementation was limited by what funds self-report in their public disclosures and the measurement instrument that we developed. The information disclosed by funds about their alignment with the TCFD was self-reported, which means it was not audited by an external third-party. Therefore, the information in fund disclosures that fed into our stage of implementation scoring instrument may not be completely accurate. Additionally, reports from the 8 sampled funds that supported the TCFD often included high-level responses to the TCFD recommendations, which made it challenging to discern how in-depth fund processes were internally. This made it challenging to assess stage of implementation of the TCFD's recommendations and develop a complex scoring instrument to compare funds. As a result, we conducted a relatively high-level assessment of a fund's stage of implementation of the TCFD recommendations but recognize that details were likely missed. Another limitation was that only one researcher used the measurement instrument to code fund TCFD implementation stage. Although the scoring instrument was developed to be relatively straightforward and reliant on objective data points, since the results were not checked by an additional researcher, there is a risk of error and subjectivity in the analysis.

Second, our study relied on fund public equity non-renewable energy sector exposure data. Our study did not have access to fund private equity exposure data. There is a possibility that our sampled funds may be exposed to the non-renewable energy sector through private market investments. Therefore, the analysed funds may have larger exposures to the non-renewable energy sector than what was considered in this analysis. This limitation impacts our ability to conclusively state the impact of the TCFD recommendations on non-renewable energy sector investments by public pension funds in the United States.

Third, of the 191 funds in the study, only 34 funds had 10 years of public equity non-renewable energy sector exposure data available in Capital IQ. This small sample size limited the statistical power of our analysis. It also limited our ability to generalize the results from our sample to the population of United States public pension funds. Additionally, time limited the amount of data

we were able to collect on fund non-renewable energy sector exposure. Since the recommendations were released in 2017, the maximum number of years we were able to collect sector exposure data post-release was five. This limited our ability to assess impacts on investment decisions. In the future, more time may result in more data that demonstrates different impacts on investment decisions than what was found in this study.

Another major limitation of our study is that we used non-renewable energy sector exposure as our dependent variable and assumed the entire sector is facing high climate-related risks. This variable can be critiqued due to its inability to capture the granularities between firms in the non-renewable energy sector. There may be some firms in the sector that are managing their fossil fuel reserves to ensure they do not emit more than is allowed in their carbon budget. Additionally, some may be employing technology that improves their emissions performance. Our non-renewable energy sector exposure variable does not capture whether a fund is exposed to only the “best” sustainability performers in the sector.

Additionally, our study was limited in understanding the investment strategy employed by the public pension funds studied. There is a possibility that some of the pension funds employ a passive index investing strategy for their public equity investments. Public pension funds require high liquidity, which is the ability to convert assets into cash quickly to support their beneficiaries (Cumbo, 2022). This requires these funds to invest in assets with high liquidity. If funds are invested in highly liquid assets that mimic broad market indices, these funds may be exposed to the non-renewable energy sector due to its presence in broad market indices. If the funds are not employing an active investment strategy, it may make sense that we did not observe a major shift in non-renewable energy sector exposure after the TCFD recommendations were released.

Lastly, there are several potential confounding variables that were not directly considered in the analysis of this study but are likely to influence public pension fund TCFD support, implementation, and investment decision-making. These may include fund legal requirements, financial performance, market performance, internal governance structure, internal culture, and stakeholder pressures. The study’s lack of integration of these variables is another limitation.

Conclusion

Climate-related financial disclosures have been identified to have an important role to play in the transition to a climate target-aligned economy. In this paper, we provide evidence from publicly available data on the level of support and implementation stage of the TCFD's recommendations in public pension funds in the United States. We also provide evidence of whether fund size and location influence TCFD support and implementation. Lastly, through the lens of institutional theory, we provide an analysis of whether exposure to the non-renewable energy sector varies significantly before and after the TCFD recommendations are released if a public pension fund is a TCFD supporter or not. Our findings contribute to the literature in three ways.

First, they contribute to the limited literature on TCFD reporting and its uptake among institutional investors who hold the potential to contribute significantly to the transition to a climate target-aligned economy. Our study identified that approximately five years after the release of the TCFD recommendations, support for the TCFD framework is very low among public pension funds in the United States.

Second, this study contributes evidence to the literature on the variables that influence sustainability disclosures. This study finds that fund size is a significant predictor of TCFD support and implementation stage, with larger funds more likely to support the TCFD and be further ahead in implementation. This study also identifies that the TCFD is only supported by funds located in California and New York. Our results highlight that whether a fund is in either California or New York is a significant predictor of a fund's TCFD implementation stage. These findings contribute to the literature on the influence of location and size on sustainability disclosures.

Third, this study contributes to institutional theory literature by applying the theory in a new context, analyzing the influence of a normative pressure, TCFD support, on public pension fund investments in a sector facing high climate-related risks like the non-renewable energy sector. The results of this study demonstrate that TCFD supporting funds do not have significantly different investment decision making behavior in the non-renewable energy sector than non-

supporting funds. These results demonstrate that normative pressures resulting from TCFD support are not resulting in a shift in investment away from the non-renewable energy sector, despite its high climate-related risks. This highlights that the TCFD framework is not having the expected impact of facilitating capital allocation away from firms facing high climate-related risks to those facing lower risks. These findings raise doubts about the capacity of the TCFD framework to contribute significantly to a climate target-aligned economy, which may be of interest to policymakers and practitioners.

Further research is required to advance the understanding of the capacity of the TCFD framework to contribute to a climate target-aligned economy. Future research could conduct a similar study again in a few years to see if TCFD implementation is increasing in United States public pension funds and if exposure to the non-renewable energy sector is changing. Since the TCFD recommendations were released in 2017, it may be too soon to identify significant changes in investment decisions. Future research could also look to understand TCFD support and implementation in regions outside of the United States as well as its impact on the investment decisions of different investor types such as corporate pension funds. Lastly, future research could look more deeply into the TCFD adopting funds and develop a more detailed assessment of their stage of implementation and level of compliance with the recommendations. Overall, the TCFD framework represents a potentially important component in facilitating the transition to a climate target-aligned economy, but other features such as strong government leadership and citizen engagement should not be overlooked or underestimated.

Table 11: Sample of United States Public Pension Funds and Descriptions

Public Pension Funds Headquartered in the United States	State	Description
1. Arizona Public Safety Personnel Retirement System (APSPRS)	Arizona	In 1968, the APSPRS was established to provide a consistent and equitable statewide retirement program for Arizona’s public safety personnel. APSPRS provides retirement benefits and programs to approx. 60,000 active members, retired members, and surviving beneficiaries, and more than 300 employer groups in the state (PSPRS, 2023).
2. Arizona State Retirement System (ASRS)	Arizona	In 1953, the ASRS was established to provide retirement and other benefits to Arizona’s public servants, including teachers, municipal workers, and other government employees. Today, the ASRS serves more than 500,000 members, including 100,000 retired members (ASRS, 2023).
3. City of Phoenix Employees' Retirement System (COPERS)	Arizona	In the 1940s, COPERS was established to provide retirement, survivor, and disability benefits to the City of Phoenix general employees (COPERS, 2022).
4. Tucson Supplemental Retirement System (TSRS)	Arizona	In 1953, TSRS was established to provide a monthly retirement supplement to the social security benefits and personal retirement savings of its members (TSRS, 2022).
5. Washington Department of Retirement Systems (WDRS)	Washington	In 1976, the WDRS was established. Today it serves a diverse population of more than 330,000 Washington public employees, including firefighters, teachers, and police officers (WSDRS, 2023).
6. Seattle City Employees Retirement System (SCERS)	Washington	In 1929, SCERS was established. Today SCERS serves 9300 active employee members, 7500 retired employee members, and 3500 deferred members (SCERS, 2023).

7. Oregon Public Employees Retirement System (OPERS)	Oregon	In 1946, OPERS was established. OPERS provides retirement benefits for public employees in Oregon including state agencies, public schools, community colleges, and local governments (OPERS, 2023).
8. California Public Employees Retirement System (CalPERS)	California	In 1932, CalPERS was established. CalPERS serves more than 2 million members and administers benefits for more than 1.5 million members and their families. CalPERS is the largest United States public pension fund (CalPERS, 2023).
9. California State Teachers Retirement System (CalSTRS)	California	In 1913, CalSTRS was established. CalSTRS serves 1 million members and beneficiaries. It is the largest educator-only pension fund in the world and the second largest public pension fund in the United States (CalSTRS, 2023).
10. Contra Costa County Employees' Retirement Association (CCCERA)	California	In 1945, CCCERA was established. CCCERA to provide service retirement, disability, death, and survivor benefits for county employees and other participating agencies (CCCERA, 2023).
11. Los Angeles County Employees Retirement Association (LACERA)	California	In 1938, LACERA was established. LACERA provides retirement and benefits to eligible County employees (LACERA, 2023).
12. San Francisco Employees Retirement System (SFERS)/San Francisco City and County Retirement System	California	In 1921, SFERS was established. SFERS serves more than 74,000 active, vested, and retired employees of the City and County of San Francisco and their survivors (SFERS, 2023).
13. San Diego County Employees Retirement Association (SDCERA)	California	In 1939, SDCERA was established. SDCERA administers retirement, disability, and survivor benefits for more than 49,000 members who are active, retired, or former employees of the County (SDCERA, 2023).
14. University of California Retirement System (UCRS)	California	In 1961, UCRS was established. UCRS provides retirement income and benefits for University of California employees (UCRS, 2022).

15. Alameda County Employees' Retirement Association (ACERA)	California	In 1948, ACERA was established. ACERA provides retirement, disability, and death benefits to Alameda County and member district employees (ACERA, 2023).
16. Kern County Employees Retirement Association (KCERA)	California	In 1937, KCERA was established. KCERA administers service retirements, disability retirements, and survivorship benefits on behalf of 22,106 active, deferred, and retired members and their beneficiaries (KCERA, 2023).
17. Los Angeles City Employees Retirement System (LACERS)	California	In 1937, LACERS was established. LACERS provides the civilian employees of the City of Los Angeles with service retirements, disability retirements, and survivor benefits (LACERS, 2023).
18. Los Angeles Fire and Police Pension (LAFPP)	California	In 1899, LAFPP was established. LAFPP provides retirement services and benefits to 12,800 active members and 13,800 retirees and beneficiaries (LAFPP, 2021).
19. Los Angeles Water and Power (LAWPER)	California	In 1938, LAWPER was established to provide retirement benefits for Department employees and their families (LAWPER, 2023).
20. Orange County ERS (OCERS)	California	In 1945, OCERS was established. OCERS provides retirement, death, disability, and cost-of-living benefits to employees of the County and certain districts. OCERS now has more than 29,000 active and deferred members and more than 19,800 retired members and beneficiaries (OCERS, 2023).
21. Sacramento County ERS (SCERS)	California	In 1941, SCERS was established. SCERS provides retirement, disability, and survivors' benefits to eligible participants (SCERS, 2023).
22. San Diego City ERS (SDCERS)	California	In 1926, SDCERS was established. SDCERS provides a range of member services to its 25,000 active, retired, and deferred members and their beneficiaries, including the administration of retirement, disability, and death benefits (SDCERS, 2018).

23. Alaska Public Employees Retirement System (APERS)	Alaska	In the 1960s, the state government developed and offered the APERS to all political subdivisions whose employees participated in Social Security. Today, the State of Alaska evaluates and adapts the government retirement plans available to both the state and political subdivision employers (APERS, 2023).
24. Alaska Teachers Retirement System (ATRS)	Alaska	In the 1940s, the first Alaska retirement system, ATRS, was established. ATRS provides retirement benefits for teachers (APERS, 2023).
25. Anchorage Police and Fire Retirement System (APFRS)	Alaska	In 1968, the Municipality of APFRS was established. APFRS is a public pension fund that provides retirement benefits to eligible employees (Pitchbook, 2023).
26. Public Employee Retirement System of Idaho (PERSI)	Idaho	In 1963, PERSI was established. PERSI administers retirement benefits, education, and services to Idaho's public employees (PERSI, 2022).
27. Nevada Public Employees Retirement System (NPERS)	Nevada	In 1947, NVPERS was established. NVPERS now has 105,000 active members and over 64,000 benefit recipients (NVPERS, 2022).
28. Montana Public Employees Retirement Board (MPERS)	Montana	In 1945, MPERS was established. MPERS provides benefits and services to 32,000 active members and almost 21,000 retirees (MPERS, 2023).
29. Montana Teachers Retirement Board (MTRS)	Montana	In 1937, MTRS was established. MTRS now provides benefits and service to approximately 50,000 active, inactive, and retired members (MTRS, 2023).
30. Wyoming Retirement System (WRS)	Wyoming	In 1953, WRS was established. WRS now provides expert administration and responsible investment of Wyoming's public retirement and supplements savings programs (WRS, 2023).
31. Utah Retirement Systems (URS)	Utah	In 1963, URS was established. URS is responsible for administering retirement and defined contribution benefits for state, local government, and public education employees in the State of Utah (Oaks, 2020).

32. Colorado Public Employees Retirement Association (CoPERA)	Colorado	In 1931, CoPERA was established by state law. CoPERA provides retirement and other benefits to employees of more than 500 government agencies and public entities in the state of Colorado (COPERA, 2023).
33. Denver Employees Retirement Plan (DERP)	Colorado	In 1963, DERP was established. DERP now provides monthly benefit payments for approximately 10,800 retirees and beneficiaries and supports the future financial security of 10,000 active members (DERP, 2023).
34. New Mexico Public Employees Retirement Association (NMPERA)	New Mexico	In 1947, NMPERA was established. NMPERA now manages 31 retirement and benefits for state, municipal, and county employees (NMPERA, 2023).
35. New Mexico Educational Retirement Board (NMERB)	New Mexico	In 1944, NMERB was established. NMERB now provides retirement benefits to active and retired employees of New Mexico public schools, institutions of higher learning, and certain employees at state agencies who work in educational programs (NMERB, 2023).
36. North Dakota Public Employees Retirement System (NDPERS)	North Dakota	In 1966, NDPERS was established. NDPERS administers an employee benefits program for employers in the upper Midwest (NDPERS, 2021).
37. North Dakota Teachers Fund for Retirement (NDTFFR)	North Dakota	In 1913, NDTFFR was established. NDTFFR administers a retirement program that provides public educators in North Dakota with a retirement security foundation (NDTFFR, 2019).
38. Bismarck Employees' Pension Plan (BEPP)	North Dakota	In 1966, BEPP was established. BEPP provides pension services to local employees (Public Plans Data, 2022a).
39. Bismarck Police Plan (BPP)	North Dakota	In 1972, BPP was established. BPP provides pension services to police and fire employees (Public Plans Data, 2022b).
40. South Dakota Retirement System (SDRS)	South Dakota	In 1974, SDRS was established. SDRS provides retirement, disability, and survivor benefits for employees of the state of South Dakota (SDRS, 2022).

41. Sioux Falls ERS (SFERS)	South Dakota	In 1957, SFERS was established. SFERS administers retirement services to local employees (Public Plans Data, 2022c)
42. Sioux Falls Fire	South Dakota	SFFRS administers retirement services for police and fire employees (Public Plans Data, 2022d).
43. Nebraska Public Employees Retirement Systems (NPERS)	Nebraska	In 1945, NPERS was established. NPERS administers several statewide retirement systems (NPERS, 2023).
44. Omaha School Employee Retirement System (OSERS)	Nebraska	In 1951, OSERS was established. OSERS manages retirement benefits for all full-time school employees (OSERS, 2022).
45. Omaha Police and Fire Pension Fund (OPFPF)	Nebraska	In 1961, OPFPF was established. OPFPF manages retirement benefits for police and fire employees in the state (Public Plans Data, 2022e).
46. Omaha ERS (OERS)	Nebraska	In 1949, OERS was established. OERS provides pension, retirement, death, and disability benefits for public employees and retirees of Omaha (Public Plans Data, 2022f).
47. Kansas Public Employees Retirement System (KPERS)	Kansas	In 1962, KPERS was established. KPERS provides retirement, disability and death benefits for Kansas state and local public employees (KPERS, 2023).
48. Wichita Employees Retirement System (WERS)	Kansas	In 1948, WERS was established. WERS provides pension, retirement plans, and other benefits to public employees and retirees of Wichita (Public Plans Data, 2022g).
49. Oklahoma Public Employees Retirement System (OPERS)	Oklahoma	In 1964, OPERS was established. OPERS provides retirement services to Oklahoma’s public servants (OPERS, 2023).
50. Oklahoma Teachers Retirement System (OTRS)	Oklahoma	In 1943, OTRS was established. OTRS provides retirement income for public education employees (OTRS, 2023).
51. Oklahoma Police Pension and Retirement System (OPPRS)	Oklahoma	In 1981, OPPRS was established. OPPRS provides retirement benefits for state and local members and beneficiaries (OPPRS, 2023).

52. Oklahoma City Employee Retirement System (OCERS)	Oklahoma	In 1958, OCERS was established. OCERS provides pension and survivors benefits to full-time civilian employees of the City of Oklahoma (OCERS, 2020).
53. Oklahoma Municipal Employees Retirement Fund (OkMRF)	Oklahoma	In 1966, OkMRF was established. OkMRF provides retirement plans for municipal employers (OkMRF, 2022).
54. Oklahoma Fire (OF)	Oklahoma	In 1981, OF was established. OF provides retirement benefits to firefighters of Oklahoma (OF, 2023).
55. Austin Employees' Retirement System (AERS)	Texas	In 1941, AERS was established. AERS provides retirement benefits to eligible City of Austin employees (AERS, 2021).
56. Houston Firefighters Relief and Retirement Fund (HFRRF)	Texas	In 1937, HFRRF was established. HFRRF provides retirement, disability, and death benefits for firefighters and their beneficiaries (HFRRF, 2022).
57. Texas County & District Retirement System (TCDRS)	Texas	In 1967, TCDRS was established. TCDRS administers pension and other benefits for employees of counties in Texas (TCDRS, 2023).
58. Texas Employees Retirement System (TERS)	Texas	In 1947, TERS was established. TERS manages benefits for employees and retirees of State of Texas agencies and some higher education institutions (TERS, 2023).
59. Texas Municipal Retirement System (TMRS)	Texas	In 1947, TMRS was established. TMRS provides retirement, disability, and survivor benefits to active members, retirees, and their beneficiaries (TMRS, 2023).
60. Teachers Retirement System of Texas (TRST)	Texas	In 1937, TRST was established. TRST administers pension, disability, health care, and survivors benefits for school teachers and other employees of more than 1300 educational institutions (Public Pension Data, 2022h).
61. Dallas Police and Fire Pension System (DPFP)	Texas	In 1916, DPFP was established. DPFP serves to provide retirement, death, and disability benefits to police officers and firefighters employed by the City (Public Plans Data, 2022i).

62. Dallas ERS (DERS)	Texas	In 1943, DERS was established. DERS provides retirement benefits and service for City of Dallas' non-uniformed permanent employees (DERS, 2023).
63. Houston Municipal Employees Pension System (HMEPS)	Texas	In 1943, HMEPS was established. HMEPS is a governmental pension plan that provides retirement, disability, and survivor benefits for eligible employees of the City of Houston (HMEPS, 2018).
64. Houston Police Officers' Pension System (HPOPS)	Texas	In 1947, HPOPS was established. HPOPS provides retirement, survivor, and disability benefits to Houston police officers (HPOPS, 2022).
65. Austin Fire Relief and Retirement Fund (AFRRF)	Texas	In 1937, AFRRF was established. AFRRF protects and manages the fund for the plan participants and beneficiaries (AFRRF, 2022).
66. Austin Police Retirement System (APRS)	Texas	In 1991, APRS was established. APRS was established to provide retirement, death, and disability benefits to members of the System (APRS, 2022).
67. Minnesota Public Employees Retirement Association (MPERA)	Minnesota	In 1931, MPERA was established. MPERS and is a retirement plan for Minnesota public employees that serves 440,000 current and former public employees and pays monthly benefits to more than 120,000 retirees, disabled members, and survivors of deceased members (MPERA, 2023).
68. Minnesota State Retirement System (MSRS)	Minnesota	In 1929, MSRS was established. MSRS administers retirement plans that provide retirement, survivor, and disability benefit coverage for Minnesota state employees, the Metropolitan Council, and many non-faculty employees at the University of Minnesota and Minnesota State university system. MSRS covers over 56,000 active employees and pays monthly benefits to over 44,000 retirees and survivors (MSRS, 2020).
69. Minnesota Teachers Retirement Association (MTRA)	Minnesota	In 1931, MTRA was established. MTRA provides retirement, disability, and survivor benefits to Minnesota's public educators (MTRA, 2023).

70. St. Paul Teachers' Retirement Fund Association (SPTRFA)	Minnesota	In 1909, SPTRFA was established. SPTRFA provides retirement, survivor, and disability benefits for members and beneficiaries (SPTRFA, 2021).
71. Iowa Public Employees Retirement System (IPERS)	Iowa	In 1953, IPERS was established. IPERS administers a retirement plan for public employees (IPERS, 2022).
72. Municipal Fire and Police Retirement System of Iowa (MFPRSI)	Iowa	In 1992, MFPRSI was established. MFPRSI is a public retirement system that delivers retirement and disability benefits to police officers and fire fighters (MFPRSI, 2022).
73. MoDOT & Patrol Employees Retirement System (MPERS)	Missouri	In 1955, MPERS was established. MPERS provides retirement, survivor, and disability benefits to over 18,000 members (MPERS, 2023).
74. Missouri Local Government Employees Retirement System (MLGRS)	Missouri	In 1967, MLGERS was established. MLGERS provides pension and other benefits for employees dedicated to serving Missouri's local communities (MLGRS, 2022).
75. Missouri Public Schools Retirement System (MPSRS)	Missouri	In 1945, MPSRS was established. MPSRS provides retirement, disability, and survivor benefits to Missouri's public-school teachers, school employees and their families (MPSRS, 2022).
76. Missouri State Employees Retirement System (MOSERS)	Missouri	In 1957, MOSERS was established. MOSERS administers retirement and other benefits for most state employees, including members of the state general assembly, state elected officials and judges (MOSERS, 2023).
77. St. Louis Public School Retirement System (PSRSSTL)	Missouri	In 1944, PSRSSTL was established. PSRSSTL provides retirement, disability, death, and survivor benefits for members and beneficiaries (PSRSSTL, 2023).
78. Kansas City Missouri Employees' Retirement System (KCMO)	Missouri	In 1962, KCMO was established. KCMO administers the Employees' Retirement System and Firefighters' Pension System in the City (KCMO, 2023).

79. St. Louis Employees Retirement System (SLERS)	Missouri	In 1960, SLERS was established. SLERS provides retirement and social security benefits for employees of St. Louis (SLERS, 2023).
80. Kansas City Public School Retirement System (KCPSRS)	Missouri	In 1944, KCPSRS was established. KCPSRS administers retirement, disability, and survivor benefits for the employees of Kansas City, Missouri School District, Kansas City Public Library, the charter schools within the boundaries of the Kansas City Missouri School District, and the Retirement System (KCPSRS, 2023).
81. St. Louis Police Retirement System (SLPRS)	Missouri	In 1957, SLPRS was established. SLPRS administers retirement benefits for police of the City (SLPRS, 2023).
82. St. Louis Firemen Retirement System (SLFRS)	Missouri	In 1944, SLFRS was established. SLFRS provides retirement, disability, death, and survivor benefits to nearly 2000 active and retired participants and their beneficiaries (SLFRS, 2015).
83. Kansas City Police Employees Retirement System (KCPERS)	Missouri	In 1946, KCPERS was established. KCPERS provides retirement, disability, and death benefits for the Kansas City, Missouri Police Department's 3000 police officers, civilian employees, retirees, and their beneficiaries (KCPERS, 2023).
84. Kansas City Fire Retirement System (KCFRS)	Missouri	In 1953, KCFRS was established. KCFRS provides retirement, disability, survivor, and death benefits to its members and beneficiaries (Public Plans Data, 2022j).
85. Arkansas Public Employees Retirement System (APERS)	Arkansas	In 1957, APERS was established. APERS provides income to retired members, survivors, and disabled members of the system (APERS, 2021).
86. Arkansas Police and Fire (APF)	Arkansas	In 1981, APF was established. APF is a statewide retirement plan for police officers and firefighters (APF, 2021).
87. Arkansas Teachers Retirement System (ARTRS)	Arkansas	In 1937, ARTRS was established. ARTRS provides retirement benefits to Arkansas's public school and education employees (ARTRS, 2022).

88. Louisiana State Employees Retirement System (LSERS)	Louisiana	In 1947, LSERS was established. LSERS administers pension benefits for state employees (LSERS, 2022).
89. Louisiana Teachers Retirement System (TRSL)	Louisiana	In 1936, TRSL was established. TRSL provides services and benefits to more than 160,000 individuals (TRSL, 2023).
90. Louisiana Municipal Police Retirement System (LMPRS)	Louisiana	In 1973, LMPRS was established. LMPRS provides retirement allowances and other benefits for municipal policemen in the state of Louisiana and their beneficiaries (LMPRS, 2022).
91. Louisiana Schools Employees Retirement System (LSERS)	Louisiana	In 1946, LSERS was established. LSERS administers retirement benefits for school support personnel (LSERS, 2023).
92. Louisiana State Parochial Employees (LSPE)	Louisiana	In 1953, LSPE was established. LSPE provides retirement benefits to all employees of any parish in the state of Louisiana (Pitchbook, 2023a).
93. Baton Rouge City Parish Retirement System (BRCPRS)	Louisiana	In 1953, BRCPRS was established. BRCPRS is a public pension fund that provides benefit payments for its eligible members, beneficiaries, and survivors (Pitchbook, 2023b).
94. New Orleans Employees' Retirement System (NOMERS)	Louisiana	In 1947, NOERS was established. NOERS provides retirement allowances and death benefits for all officers and employees of the city and the parochial and judicial officers and employees of Orleans parish (NOMERS, 2023).
95. New Orleans Firefighters (NOF)	Louisiana	NOF provides retirement benefits for firefighters of the City of New Orleans (NOF, 2021).
96. Louisiana Municipal Employees Retirement System (LMERS)	Louisiana	In 1955, LMERS was established. LMERS provides retirement benefits for the employees of the municipalities of the state (LMERS, 2022).
97. Municipal Employees' Retirement System of Michigan (MERSM)	Michigan	In 1945, MERSM was established. MERSM is an independent, professional retirement services company that was created to administer the retirement plans for Michigan's local units of government on a not-for-profit basis (MERSM, 2023).

98. Michigan Public School Employees Retirement System (MPSERS)	Michigan	In 1945, MPSERS was established. MPSERS administers pension, disability, health insurance, and survivors benefits for employees of public-school districts, colleges, and universities in the state (Public Plans Data, 2022k).
99. Michigan State Employees Retirement System (MSERS)	Michigan	In 1943, MSERS was established. MSERS administers pension, disability, health insurance, and survivors benefits for state employees (Public Plans Data, 2022l).
100. Detroit Police and Fire Retirement System (DPFRS)	Michigan	In 1941, DPFRS was established. DPFRS administers pension benefits for police and fire employees (Public Plans Data, 2022m).
101. Detroit Employees General Retirement System (DEGRS)	Michigan	In 1918, DEGRS was established. DEGRS administers the benefits of members and beneficiaries of the system. DEGRS is part of the Retirement System of the City of Detroit (RSCD, 2019).
102. Indiana Public Retirement System (INPRS)	Indiana	In 2011, Indiana’s Public Employees’ Retirement Fund and the Teacher’s Retirement Fund merged to form the INPRS. INPRS administers and manages retirement plans in the state (INPRS, 2023).
103. Kentucky County Employees RS (KCERS)	Kentucky	KCERS is administered by a 9-member board of trustees separate from KRS (KPPA, 2023).
104. Kentucky Employees RS (KERS)	Kentucky	KERS is administered by KRS (KPPA, 2023).
105. Kentucky State Police Retirement System (KSPRS)	Kentucky	KSPRS is administered by KRS (KPPA, 2023).
106. Kentucky Retirement Systems (KRS)	Kentucky	KRS administers pension and other benefits for public employees in the state except teachers. KRS oversees the Kentucky Employees Retirement System and State Police Retirement System. The administrative entity comprising the office of counselors and professional staff that has traditionally been known as KRS has changed its name to the Kentucky Public Pensions Authority (KPPA) (KPPA, 2023).

107. Kentucky Teachers Retirement System (KTRS)	Kentucky	In 1940, KTRS was established. KTRS and administers pension and other benefits for professional educators of the Commonwealth of Kentucky (KTRS, 2022).
108. Lexington-Fayette County Policemen's and Firefighters' Retirement Fund (LFPFRF)	Kentucky	In 1974, LFPFRF was established. LFPFRF provides retirement benefits for members of the Divisions of Police and Fire and Emergency Services (LFPFRF, 2023).
109. Tennessee Consolidated Retirement System (TCRS)	Tennessee	In 1972, TCRS was established. TCRS administers pension and other benefits for public employees in the state (TCRS, 2023).
110. Nashville-Davidson Metropolitan Employees Benefit Trust Fund (NMEBTF)	Tennessee	In 1963, NMEBTF was established. NMEBTF provides death, disability, and retirement benefits to employees of the county (Pitchbook, 2023c).
111. Mississippi Public Employees Retirement System (MPERS)	Mississippi	In 1952, MPERS was established. MPERS provides retirement benefits for individuals working in state government, public schools, universities, community colleges, municipalities, counties, the Legislature, highway patrol, and other public entities (MPERS, 2022).
112. Ohio Public Employees Retirement System (OPERS)	Ohio	In 1935, OPERS was established. OPERS provides retirement, disability, and survivor benefits to Ohio's public employees (Public Plans Data, 2022n).
113. Ohio Police and Fire Pension Fund (OPFPF)	Ohio	In 1965, OPFPF was established. OPFPF provides pension and disability benefits to the state's full-time police officers and firefighters (OPFPF, 2022).
114. Ohio School Employees Retirement System (OSERS)	Ohio	In 1937, OSERS was established. OSERS provides retirement allowances, disability, survivor benefits and access to health care coverage for school employees (OSERS, 2023).
115. Ohio State Teachers Retirement System (OSTRS)	Ohio	In 1920, OSTRS was established. OSTRS provides Ohio's public educators a foundation for their financial security (OSTRS, 2023).
116. Cincinnati Employees Retirement System (CERS)	Ohio	In 1931, CERS was established. CERS provides retirement benefits to local employees (Public Plans Data, 2022o).

117. West Virginia Consolidated Public Retirement Board (WVCRB)	West Virginia	In 1991, WVCPRB was established. WVCRB is responsible for the administration of all State retirement plans (WVCRB, 2023).
118. Charleston (CWVP) Police Pension	West Virginia	CWVP administers retirement benefits for policemen in Charleston, West Virginia. Established date unclear (Public Plans Data, 2022p).
119. Charleston, WV Firemen's Pension (CWVF)	West Virginia	CWVF administers retirement benefits to firemen in Charleston, West Virginia. Established date unclear (Public Plans Data, 2022q).
120. Maine Public Employees Retirement System (MPERS)	Maine	In 1942, MPERS was established. MPERS helps public employees prepare for retirement (MPERS, 2023).
121. New Hampshire Retirement System (NHRS)	New Hampshire	In 1967, NHRS was established. NHRS administers pension and other benefits for public employees in the state (Public Plans Data, 2022r).
122. Manchester Employees' Contributory Retirement System (MECRS)	New Hampshire	In 1974, MECRS was established. MECRS provides service and disability retirement benefits to City of Manchester employees (MECRS, 2021).
123. Vermont State Employees Retirement System (VSERS)	Vermont	In 1944, VSERS was established. VSERS administers pension benefits to employees of the state (VSERS, 2023).
124. Vermont Teachers Retirement System (VSTRS)	Vermont	In 1947, VSTRS was established. VSTRS provides pension benefits for teachers in the state (VSTRS, 2023).
125. Burlington ERS (BERS)	Vermont	In 1954, BERS was established. BERS administers pension benefits to employees of the state (Public Plans Data, 2022bb).
126. Vermont Municipal Employees (VMERS)	Vermont	In 1975, VMERS was established. VMERS provides pension benefits for municipal employees of the state (VMERS, 2023).
127. Massachusetts State Employees' Retirement System (MSERS)	Massachusetts	In 1911, MSERS was established. MSERS provides retirement benefits to state employees (Public Plans Data, 2022s).
128. Massachusetts Teachers Retirement Board (MTRB)	Massachusetts	In 1914, MTRB was established. MTRB administers pension benefits for public school teachers in the state (Public Plans Data, 2022t).

129. Boston Retirement System (BRS)	Massachusetts	In 1911, BRS was established. BRS administers retirement benefits to local employees (Public Plans Data, 2022u).
130. Rhode Island Employees Retirement System (ERSRI)	Rhode Island	In 1936, ERSRI was established. ERSRI provides retirement, disability, and survivor benefits to state employees, public school teachers, judges, state police, participating municipal police and fire employees, and general employees of participating municipalities (ERSRI, 2022).
131. Providence Employees Retirement System (PERS)	Rhode Island	In 1923, PERS was established. PERS administers pension plan benefits to local employees (Public Plans Data, 2022v).
132. Connecticut State Employees Retirement System (CSERS)	Connecticut	In 1939, CSERS was established. CSERS administers retirement benefits for state employees (Public Plans Data, 2022w).
133. Connecticut Teachers Retirement Board (CTRB)	Connecticut	In 1939, CTRB was established. CTRB administers pension and other benefits for public school teachers in Connecticut (Public Plans Data, 2022x).
134. Connecticut Municipal Employees Retirement System (CMERS)	Connecticut	In 1947, CMERS was established. CMERS administers retirement benefits for municipal employees (CMERS, 2023).
135. Hartford Municipal Employee Retirement Fund (HMERF)	Connecticut	In 1947, HMERF was established. HMERF provides retirement benefits for employees of the city (Public Plans Data, 2022y).
136. New York City Employees Retirement System (NYCERS)	New York	In 1920, NYCERS was established. NYCERS provides retirement benefits to municipal public employees (NYCERS, 2020).
137. New York City Teachers Retirement System (NYCTRS)	New York	In 1918, NYCTRS was established. NYCTRS provides retirement benefits to teachers in the city (Public Plans Data, 2022z).
138. New York State Teachers Retirement System (NYSTRS)	New York	In 1921, NYSTRS was established. NYSTRS provides retirement, disability, and death benefits to public school teachers and administrators (NYSTRS, 2023).

139. New York State and Local Retirement System (NYSLRS)	New York	In 1921, NYSLRS was established. NYSLRS administers two distinct systems – employees retirement system and police and fire retirement system. These systems provide retirement, disability, and death benefits to public employees, police officers, and firefighters (NYSLRS, 2023).
140. New York City Fire (NYCF)	New York	In 1941, NYCF was established. NYCF provides retirement benefits for firefighters in the city (Public Plans Data, 2022ab).
141. New York City Police (NYCP)	New York	In 1940, NYCP was established. NYCP provides retirement benefits for city police (Public Plans Data, 2022ac).
142. New York City Educational (NYC BERS)	New York	In 1921, NYC BERS was established. NYC BERS provides retirement benefits for civil service employees employed by the City and School District of New York and employees of the Department of Education (NYC BERS, 2022).
143. Pennsylvania Public School Employees Retirement System (PPSERS)	Pennsylvania	In 1917, PPSERS was established. PSERS services the public-school employees of the Commonwealth of Pennsylvania (PPSERS, 2023).
144. Pennsylvania State Employees Retirement System (PSERS)	Pennsylvania	In 1923, PSERS was established. PSERS provides retirement benefits for public employees (PSERS, 2023).
145. Pennsylvania Municipal Retirement System (PMRS)	Pennsylvania	In 1974, PMRS was established. PMRS administers retirement benefits to local government organizations (PMRS, 2023).
146. Philadelphia Municipal Retirement System (PMRS)	Pennsylvania	In 1915, PMRS was established. PMRS administers retirement benefits for municipal employees (Public Plans Data, 2022ad).
147. City of Pittsburgh Combined Pension Trust Funds (PPTF)	Pennsylvania	The city has three pension funds (municipal, policemen, and firemen) and the funds are held by the Combined Trust Fund. The municipal pension fund was established in 1915. The policemen’s fund was established in 1935. The firemen’s fund was established in 1933 (PPTF, 2018).

148. District of Columbia Retirement Board	District of Columbia	In 1979, DCRB was established. DCRB administers and manages the police officers, firefighters, and teachers' retirement funds (DCRB, 2020).
149. Delaware Public Employees Retirement System (DPERS)	Delaware	In 1970, DPERS was established. DPERS administers retirement benefits for public employees (DPERS, 2022).
150. New Castle County Pension Program (NCCPP)	Delaware	In 1947, NCCPP was established. NCCPP provides retirement benefits for local employees (Public Plans Data, 2022ae).
151. Maryland State Retirement and Pension System (MSRPS)	Maryland	In 1941, MSRPS was established. MSRPS administers death, disability, and retirement benefits for state employees, teachers, state police, judges, law enforcement (MSRPS, 2022).
152. Baltimore Fire and Police Employees Retirement System (BFPERS)	Maryland	In 1962, BFPERS was established. BFPERS administers retirement benefits for fire and police employees (BFPERS, 2023).
153. Montgomery County Employees Retirement System (MCERS)	Maryland	In 1965, MCERS was established. MCERS administers retirement benefits for local employees (Public Plans Data, 2022af).
154. Baltimore City Employees Retirement System (BCE)	Maryland	In 1926, BCE was established. BCE administers retirement benefits for city employees (Public Plans Data, 2022ag).
155. Educational Employees' Supplementary Retirement System of Fairfax County (ERFC)	Virginia	In 1973, EERFC was established. EERFC administers retirement benefits for educational employees (ERFC, 2023).
156. Virginia Retirement System (VRS)	Virginia	In 1942, VRS was established. VRS delivers retirement and other benefits to covered Virginia public sector employees (VRS, 2023).
157. Fairfax County Employees' Retirement System (FCERS)	Virginia	In 1955, FCERS was established. FCERS provides retirement benefits for local employees (Public Plans Data, 2022ah).
158. Fairfax County Police (FCP)	Virginia	In 1944, FCP was established. FCP provides retirement benefits for police in the county (Public Plans Data, 2022ai).

159. Fairfax County Uniformed (FCURS)	Virginia	In 1974, FCURS was established. FCURS provides retirement benefits for uniformed employees in the county (Public Plans Data, 2022aj).
160. North Carolina Local Governmental Employees' Retirement System (NCLGERS)	North Carolina	In 1941, NCLGERS was established. It administers the pension benefits for local government employees (Public Plans Data, 2022ak).
161. North Carolina Teachers' and State Employees' Retirement System	North Carolina	In 1945, NCTSERS was established. NCSTERS provides retirement benefits for state and local employees (Public Plans Data, 2022al).
162. Charlotte Firefighters' Retirement System (CFRS)	North Carolina	In 1947, CFRS was established. CFRS provides retirement and disability benefits to the uniformed employees of the Charlotte Fire Department (Public Plans Data, 2022am).
163. South Carolina Retirement Systems (SCRS)	South Carolina	In 1945, SCRS was established. SCRS provides retirement plan for employees of state agencies, public and charter school districts, public higher education institutions, and other local subdivisions of government (SCRS, 2022).
164. Greenville Fire Pension Plan (GFPP)	South Carolina	In 1964, GFPP was established. GFPP administers retirement benefits to firefighters (Public Plans Data, 2022an).
165. Georgia Employees Retirement System (ERSGA)	Georgia	In 1949, ERSGA was established. ERSGA administers five separate and distinct pension plans for employer agencies across the state of Georgia (ERSGA, 2023)
166. Georgia Teachers Retirement System (GTRS)	Georgia	In 1943, GTRS was established. GTRS administers retirement security to citizens who dedicate their lives to educating the children and adults of Georgia (GTRS, 2023).
167. Atlanta General Employees' Pension Fund (AGEPF)	Georgia	In 1927, AGEPF was established. AGEPF provides retirement benefits to employees of the city of Atlanta (Public Plans Data, 2022ao).
168. Atlanta Police Fund (APF)	Georgia	In 1924, APF was established. APF provides retirement benefits to police officers employed by the city (Public Plans Data, 2022ap).

169. Atlanta Fire (AF)	Georgia	In 1978, AF was established. AF offers pension benefits to firefighter employees (Public Plans Data, 2022aq).
170. Florida Retirement System (FRS)	Florida	In 1970, FRS was established. FRS provides retirement, disability, and survivor benefits for participating public employees (FRS, 2023).
171. Jacksonville General Employee Pension Plan (JGEPP)	Florida	In 1951, JGEPP was established. JGEPP provides death, disability, and retirement benefits to employees of the city (Public Plans Data, 2022ar).
172. City of Miami Firefighters and Police Officers Retirement Trust (MFPORT)	Florida	In 1931, MFPORT was established. MFPORT provides retirement benefits for the firefighters and police officers of Miami (MFPORT, 2023).
173. Jacksonville Fire and Police (JFP)	Florida	In 1937, JFP was established. JFP provides retirement benefits for police officers and firefighters in Jacksonville (Public Plans Data, 2022as).
174. Miami General and Sanitation Employees (MGSE)	Florida	In 1956, MGSE was established. MGSE provides retirement benefits for local employees (Public Plans Data, 2022at).
175. Alabama Teachers Retirement System (ATRS)	Alabama	In 1939, ATRS was established. ATRS provides disability, retirement, and survivor benefits for teachers in the state (Public Plans Data, 2022au).
176. Alabama ERS (AERS)	Alabama	In 1945, AERS was established. AERS provides benefits to state employees, state police, and other elected persons (AERS, 2011).
177. Hawaii Employees Retirement System (HERS)	Hawaii	In 1926, HERS was established. HERS provides retirement allowances to State and county government employees (HERS, 2023).
178. Chicago Public School Teachers Pension and Retirement Fund (CTPF)	Illinois	In 1895, CTPF was established. CTPF provides retirement, survivor, and disability benefits for teachers and employees of Chicago Public Schools (CTPF, 2023).
179. Illinois Municipal Retirement Fund (IMRF)	Illinois	In 1941, IMRF was established. IMRF provides retirement, survivor, disability, and death benefits to employees of local governments and school districts in Illinois (IMRF, 2023).

180. Illinois State Employees Retirement System (ISERS)	Illinois	In 1944, ISERS was established. ISERS provides retirement, survivor, disability, and death benefits to state employees (Public Plans Data, 2022av).
181. Illinois Teachers Retirement System (ITRS)	Illinois	In 1939, ITRS was established. ITRS administers retirement, disability, and survivor benefits for licensed public-school teachers and administrators employed outside the City of Chicago (ITRS, 2023).
182. Illinois State Universities Retirement System (ISURS)	Illinois	In 1941, ISURS was established. ISURS provides retirement benefits to employees in public higher education in the State of Illinois (ISURS, 2023).
183. Chicago Municipal Employees (CMEABF)	Illinois	In 1921, CMEABF was established. CMEABF provides disability and retirement benefits to qualified employees of the City of Chicago and Chicago Board of Education (CMEABF, 2023).
184. Chicago Police (CPABF)	Illinois	In 1922, CPABF was established. CPABF provides retirement, survivors, and disability benefits to members of the Chicago Police Department, their spouses, and children (CPABF, 2023).
185. Cook County Employees Pension Fund (CCPF)	Illinois	In 1915, CCPF was established. CCPF provides pension, disability, and other benefits to employees of both Cook County and the Forest Preserve District (CCPF, 2023).
186. Chicago Fire Annuity and Benefit Fund (CFABF)	Illinois	In 1931, CFABF was established. CFABF provides retirement, survivors, and disability benefits to firefighters in the city (Public Plans Data, 2022aw).
187. Chicago Laborers and Retirement Board Annuity and Benefit Fund (CLABF)	Illinois	In 1935, CLABF was established. CLABF provides retirement and disability benefits to its members (CLABF, 2013).
188. New Jersey Division of Pension and Benefits (NJDPB)	New Jersey	In the 1950s, NJDPB was established. NJDPB administers pension benefits for public employees in the state, including teachers, police, and firemen (Public Plans Data, 2022ax).

189. Jersey City Municipal Employees Pension Fund (JCMEPF)	New Jersey	In 1965, JCMEPF was established. JCMEPF administers pension benefits for municipal employees (Public Plans Data, 2022ay).
190. Wisconsin Retirement System (WRS)	Wisconsin	In 1982, WRS was established. WRS administers pension and other benefits for public employees in the state (Public Plans Data, 2022az).
191. Milwaukee City ERS (McERS)	Wisconsin	In 1937, McERS was established. McERS provides retirement benefits for city employees (McERS, 2023).
192. Milwaukee County Employees Retirement System (MCERS)	Wisconsin	In 1937, MCERS was established. MCERS and provides retirement benefits to county employees (Public Plans Data, 2022ba).

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